COMPARISON OF TREATMENT MODES IN
THE MANAGEMENT OF MYOFASCIAL
PAIN DYSFUNCTION SYNDROME

by

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ABSTRACT

Reviews of treatment studies dealing with TMJ syndromes and myofascial pain dysfunction (MPD) typically point out the lack of controlled comparative research. The purpose of this study was to provide such research, comparing three treatment modes for the management of MPD: dental splints and physiotherapy; relaxation training, biofeedback, and stress management; and transcutaneous electrical nerve stimulation. Also of interest was the analysis of variables which may be related to treatment outcome.

Twenty-one females ranging in age from 19 to 45 years ($M=27.2; \, SD=7.1$), assessed as meeting specific criteria for MPD and consenting to participate in a research project on treatment issues, were randomly assigned, over blocks of 3, to one of the three treatment conditions. Pre-treatment assessment included dental assessment of pain and jaw mobility, self-report measures of pain, EMG assessment of masseter muscle activity under baseline and task conditions, and psychometric questionnaires. The pre-treatment assessment was replicated post-treatment, and daily symptoms self-monitoring over the course of treatment was also included for treatment evaluation. The groups formed were assessed and found equivalent with respect to age, duration of pain history, measure of mouth opening, baseline masseter EMG, adjectival pain rating index, and expectations for treatment success by multivariate analysis of variance (MANOVA). The treatment programs were balanced with
respect to total duration (8 weekly sessions) and at-home programs. Post-treatment follow-up was limited to 3 months, and assessment was limited to whether or not further treatment was sought within that time.

Analyses by 2-way MANOVA across groups pre- to post-treatment revealed no differences between groups with respect to dental assessment of pain remission or increased jaw mobility, or reduction of EMG activity, but overall effects pre- to post-treatment were significant for these variables (dental assessment: approx. $F(3,16) = 9.22, p = .0009$; EMG assessment: approx. $F(4,15) = 10.38, p = .0003$). Self-report measures were significant overall pre- to post-treatment (approx $F(4,15) = 3.27, p = .036$) and indicated group differences (approx. $F(10,28) = 2.47, p = .029$), suggesting superiority of the relaxation/stress group in the reduction of daily self-monitored pain ratings and the incidence of reported pain.

From the overall pattern of results, however, it was concluded that the principal response to treatment derived from "non-specific effects" — the provision of an explanation for the problem and treatment ostensibly specifically oriented to symptom relief.

Diagnostic and assessment issues, and psychometric interests with this chronic pain population are also discussed.
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INTRODUCTION

The problem of interest in this study is treatment outcomes with a pain syndrome associated with temporomandibular joint (TMJ) dysfunction: a musculoskeletal disorder arising from hyperactivity of the muscles of mastication (Bell, 1969; Rugh & Solberg, 1976; Yemm, 1976) and manifested in the clinical population primarily by the complaint of chronic pain (Carlsson, Gale, & Ohman, 1975; Clark & Solberg, 1977). As a syndrome, the disorder has been essentially defined by the presenting symptoms as including one or more of:

1. pain and tenderness in the masticatory muscles and the TMJ(s);
2. sounds such as clicking or crepitation during condylar movements (the pivot point of the joint); and
3. limitation of range of motion of the jaw, such as restricted opening and/or lateral excursion (cf. Rugh & Solberg, 1976).

(See Figure 1 for schematics of joint and muscles.)

Laskin (1969) proposed the distinction of myofascial pain dysfunction (MPD) syndrome as distinguishing a muscle problem rather than a skeletal or organic problem of the joint with the additional criteria:

4. absence of organic change in the joint, and
5. absence of tenderness of the TM joint when palpated via the external auditory meatus.

As presented by Guralnick, Kaban, and Merrill (1978), TMJ
Figure 1

Temporomandibular joint and muscles of mastication

a) The medial and lateral pterygoid muscles.
The zygomatic arch has been removed.

b) The temporalis muscle.
The masseter muscle and zygomatic arch have been removed.

c) The masseter and temporalis muscles.

(Source: Hylander, 1979)
dysfunction and MPD have been used as essentially synonymous references in much of the literature (see also Carlsson, 1976). The distinction of non-organicity is apparently consistent both with the fact that only a small percentage of TMJ patients have organic problems (as trauma or disease) and with the underlying history of the development of criteria defining the disorder. The role of tenderness of the TM joint is not consistently emphasized in the literature, however, suggesting a possible confound when attempting to compare studies. It has been suggested (Blasberg, 1981, Reference note 1) that tenderness of the joint itself may indicate unidentified organic problems to which muscle tenderness is secondary. It may also be assumed that tenderness of the joint may arise as a result of increased pressure on the joint structures created by spasms of the masticatory muscles (Blasberg, 1982; Laskin, 1979). For a comparison of symptoms used in thirteen studies selecting subjects for TMJ pain and dysfunction, see Table I. From further review of the literature it would appear that some clarification of the significance of symptoms and symptom patterns needs to be adopted for consistency of usage. The studies outlined in Table I relate to various purposes ranging from descriptive correlational studies (e.g., Franks, 1964; Lupton, 1966) to treatment studies e.g., Gessel, 1972; Laskin & Greene, 1972). Only 1 of the 13 studies excluded patients exhibiting joint sounds only, and joint pain was a symptom used in 7 but not in 6 of the studies. Similarly, evidence of no organic pathology was not consistently represented. Table II provides more detailed summaries of 8.
Table I

Comparison of symptoms employed in 13 studies to select subjects with temporomandibular pain and dysfunction

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<td>Muscular pain or tenderness</td>
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<td>Joint sounds</td>
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<td>Limited mandibular function</td>
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<td>Excluded patients with joint sounds only</td>
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<td>Evidence of no organic pathology</td>
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(Source: Rugh & Solberg, 1976)
Table II

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<td>Personality correlates</td>
<td>56 females</td>
<td>Referred by family dentist for a dysfunction of the TMJ with subsequent confirmation of functional disorder</td>
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<td>Lupton, 1969</td>
<td>Personality correlates</td>
<td>37 females</td>
<td>Exhibiting craniofacial pain or limitation of jaw movement or one of above with crepitation or clicking</td>
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<tr>
<td>Marbach &amp; Lipton, 1978</td>
<td>Personality correlates</td>
<td>170 &quot;consecutive patients&quot; (135 female)</td>
<td>Referred to TMJ clinic</td>
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<td>Solberg, Flint, &amp; Brantner, 1972</td>
<td>Personality correlates</td>
<td>29 (20 female) (selected over period of 23 months)</td>
<td>Exhibit: pain in TMJ or muscles of mastication or associated structures and/or limitation of opening</td>
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<td>Stenn, Mothersill, &amp; Brooke, 1979</td>
<td>Treatment evaluation (biofeedback)</td>
<td>274 patients yield 194 diagnosed as MPD, 22 meet study criteria, 11 complete study (9 female)</td>
<td>1. TMJ pain 1 year. 2. previous treatment failure. 3. no radiologic evidence of trauma or disease. 4. 16 to 55 years old. 5. no history of physical trauma to head or neck</td>
</tr>
<tr>
<td>Thomas, Tiber, &amp; Schireson, 1973</td>
<td>EMG characterization</td>
<td>10 dental patients (6 female)</td>
<td>&quot;Professionally diagnosed as TMJ syndrome&quot;</td>
</tr>
<tr>
<td>Zarb &amp; Thompson, 1975</td>
<td>Dental treatment review (compiled cases)</td>
<td>93 patients (82 female)</td>
<td>One or more of pain in TMJ, altered function of TMJ, joint sounds</td>
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studies (2 of which appear in Table I) with respect to their purpose and the description and diagnostic criteria provided for subject selection. It may be seen that there is considerable room for confusion. In addition to inconsistent usage, the heterogeneity of the subject populations selected by a disjunctive diagnostic scheme (i.e., the presence of any one or more symptoms) will hamper clarification of other characteristics of subjects which may contribute to differential treatment outcome. Widely-ranging subject characteristics may serve to limit treatment effectiveness due to the inclusion of a reasonably large proportion of subjects for whom any particular treatment is essentially inappropriate.

In screening patients for the present research, it became apparent that only a relatively small proportion (approximately 20%) of the people complaining of discomfort associated with the TM joints could be diagnosed as MPD. In contrast, a large proportion (55-60%) of people complaining of limitation of movement, joint sounds, and only occasional discomfort were diagnosed as having displaced the articular disc. How this condition arises is not clear. It is not, apparently, the result of a previous history involving chronic pain, but could be the result of protracted muscle tension drawing the condyle off the disc. Considering this condition a physical problem of the joint itself excludes the group from diagnosis as MPD. This raises two points that seem to counter the literature: 1) a large proportion of TMJ patients may have an organic (physical) problem of the joint (internal derangements); and 2) as a chronic pain syndrome, MPD
is a less common complaint than the more general rubric of TMJ
dysfunction would imply. These points suggest the need for
better specificity of terms for differential diagnosis, and
amplify the necessity for accurate reporting of the criteria used
in studies involving treatment for "TMJ dysfunction" or "MPD
syndrome."

In a 1979 review, Laskin reiterates the criteria for MPD
as most commonly involving unilateral pain, tenderness to muscle
palpation, joint sounds such as clicking or popping (but not if
primary complaint), limitation of mandibular mobility, and
usually no radiographic or biochemical evidence of changes in the
TM joint (as would result, for example, from arthritis). Laskin
(1979) points out that degenerative changes of the TM joint and
occlusal misalignment may develop as secondary to the muscle
problem.

For the purposes of this study, the diagnostic criteria
are essentially consistent with Laskin's outline as pain and
tenderness in the masticatory muscles, limitation of mandibular
range of motion, and absence of organic change in the temporo-
mandibular joint as identified by radiography. Sounds, such as
clicking or crepitation during movement of the jaw, may or may
not be present, but are an exclusionary criterion if the primary
complaint. Similarly, tenderness of the TM joint to palpation
also may or may not be present but is exclusionary if it is the
primary complaint or is associated with evidenced organic
problems of the joint. A criterion for chronicity of pain of
six months' minimum duration was also used.
Having defined the problem, the interest becomes treatment. As will be developed further in the ensuing review of the literature, treatments and results with TMJ problems raise more questions than are readily answered. The interest here is to provide a relatively well-controlled comparison of three treatment modalities for the defined MPD syndrome and, secondarily, to attempt to further identify psychological variables which may take a role in the manifestation of the disorder and in response to treatment. The following review of the literature will provide a summary of issues involved in the specification of the disorder and come to focus on treatment and psychological issues.
Actual specification of the TMJ syndrome began with Costen in the 1930s, who listed various symptoms assumed to be associated with dysfunction of the TM joint (Guralnick et al., 1978; Moss, Garrett, & Chiodo, 1982; Rugh & Solberg, 1976). Subsequent demonstrations of the improbability of the association of some of these symptoms with disorders of the TM joint, both anatomically and physiologically (Yemm, 1976), resulted in the narrowing of the definition of the syndrome and the growing emphasis on predisposing psychological factors. At present, etiological models consider grinding and clenching of the teeth as the primary mechanism in hyperactivity of the jaw muscles (Rugh & Solberg, 1976; Weinberg, 1974; Yemm, 1976), and are represented by two orientations: dental interests emphasizing the role of structural characteristics, primarily occlusal alignment (e.g., Nally & Moore, 1975; Zarb & Thompson, 1975); and psychological interests emphasizing personality characteristics (e.g., Gross & Vacchiano, 1973; Lupton, 1969) and the role of anxiety and reactivity to stress (e.g., Thomas, Tiber, & Schireson, 1973; Yemm, 1976). Each orientation proposes to explain the initiation and/or maintenance of grinding and clenching, and endorses treatment approaches accordingly.

A psychophysiological approach to the TMJ syndrome, i.e., the influence of both structural and psychological propensities to the disorder, may serve to integrate the orientations taken to the problem. Furthermore, expansion of this approach may allow
for the consideration of a spectrum of interactions of the influences of both factors in the etiology and maintenance of the disorder (or disorders). This spectrum extends from occlusal problems being primary in the etiology of the syndrome for some individuals, to psychological factors being primary to the creation of the problem in individuals with (or without) perfect occlusion. Laskin (1969) has reported evidence from five areas which may substantiate such an approach:

1. epidemiological studies of symptom incidence,
2. radiologic studies pointing to the absence of significant pathologic conditions,
3. psychological studies of personality profiles and treatment results with placebo interventions,
4. biochemical studies of assumed stress indicants, and
5. physiological studies of induced muscle fatigue and pain.


Each of these areas of research has been further pursued since the work reviewed by Laskin, and the more recent work will be outlined briefly here. As the psychological studies are of particular interest, they will be considered last and in greater detail.

EPIDEMIOLOGY

Helkimo (1976) presents data derived from epidemiological studies in Sweden and Finland, and also a review of previous studies conducted in Europe and the United States between 1949
and 1975. The populations investigated ranged from the entire population of a Finnish village to American university undergraduate samples. The symptoms investigated were: click or crepitation in the joint, pain in the TM joint, headache, facial pain, pain or tenderness of the masticatory muscles, impaired mobility of the mandible, and irregular path or jerky movement of the mandible. Helkimo concluded from the available data that the symptoms of dysfunction are very common, appearing in 20% to 79% of the individuals in the populations studied; and that the incidence of symptoms may be seen in all age groups and in essentially equal proportions between men and women (Helkimo, 1976). Interestingly, Helkimo (1976) points out that, on average, approximately four times as many women as men appear for treatment of TMJ dysfunction and, overall, the number of people seen clinically is fewer than would be expected on the basis of the symptom population.

Franks (1964) also noted that the ratio of women to men in studies reviewed by him averaged approximately 4 to 1. His analysis of the "social character" of TMJ dysfunction suggested the modal patient to be a housewife between the ages of 20 and 40 years. Anatomical and physiological reasons for such a discrepant representation of the sexes were pursued by Franks (1964), but no biological, skeletal, or hormonal factors appear to explain the preponderance of females. An explanation often called upon, and which may fit here as well, is the assumption of a greater tendency of females to seek professional attention for symptoms that may be suffered by males in keeping with sex role expectations.
Radiologic evidence provides an exclusionary criterion for diagnosis of MPD. The absence of organic damage, such as deformation due to trauma or disease, as could be identified by radiography, is a defined criterion of the disorder and thus subscribed to by most investigators. Laskin's (1969) review of corrected laminigraphic data—a series of parallel section views generally taken in planes perpendicular to the long axis of the joint—obtained for 277 patients showed less than 5% to have evidence of pathologic changes in the structure of the TM joints. Markovic and Rosenberg (1973) utilized this radiographic technique with 100 MPD patients and found only 9% to exhibit "frank bony changes." Thus, the conclusion is that a large proportion of individuals appearing with symptoms of TMJ disorders do not have structural problems with the TM joint itself, but rather some functional problem of the musculature. However, as previously mentioned, an apparent complication, not mentioned in the literature but evidenced in screening subjects for the present research, is the prevalence of internal derangements of the articular disc. Internal derangements of the disc were diagnosed in approximately 55% to 60% of subjects complaining of pain associated with "clicking" and crepitus of the joint and were consequently considered inappropriate for identification as MPD. The implication for treatment from this distinction is that some physical manipulation of the joint itself would appear called for as opposed to treatment attempting to reduce masseter activity in the absence of an associated complaint of pain.
BIOCHEMICAL EVIDENCE

Biochemical evidence supporting a psychophysiological conception of MPD derives primarily from the identification of substances in the urine associated as metabolic correlates of physiological arousal or emotional response to stress. In consideration of studies by Elmadjian, Hope, and Lamson (1958) and Miller (1968) suggesting emotional stress to be related to increased concentrations of catecholamines and 17-hydroxy-steroids in the urine, Evaskus and Laskin (1972) investigated the concentrations of these compounds in urine samples obtained from 32 MPD patients and 34 "control individuals." On the basis of their finding significantly higher concentrations of these compounds in the urine of MPD patients, Evaskus and Laskin (1972) concluded that MPD patients are typically under greater emotional stress than normal individuals. Laskin (1979) notes that increased muscle activity alone may increase urine concentrations of catecholamine; however, such an observation is still consistent with a psychophysiological orientation. Grinding of the teeth has also been identified as a correlate of chronic amphetamine use (Ashcroft, Eccleston, & Waddell, 1965) and as a side-effect of fenfluramine, an anorexiant (Lewis, Oswald, and Dunleavy, 1971). Similarly, the DSM III (1980) identifies increased frequency of masseter muscle contractions as a symptom of tobacco withdrawal. Such evidence may be taken as an implication of the central mediation of oral habits rather than a local reflex stemming from the relationship of the teeth.
PHYSIOLOGY

Physiological studies have been reviewed by Thomas et al. (1973), Yemm (1976), and Scott and Gregg (1980). The interest here has primarily been the demonstration of both increased masseter activity (i.e., clenching and grinding) in response to stressors, and the development of pain dysfunction symptoms as a result of increased masseter activity. Thomas et al. (1973) demonstrated TMJ patients to manifest significantly higher masticatory EMG in response to anxiety-provoking and frustrating situations than normal control subjects matched for age and sex. Yemm (1976) provides a review of neurophysiologic studies of TMJ dysfunction, including his own studies involving EMG monitoring of the masseter muscles while subjects are involved in stressful tasks. His primary conclusions are that the influence of stress can increase jaw muscle activity and that differences exist between normals and TMJ patients in the response characteristics to stressors, i.e., TMJ patients do not habituate in response to repeated exposures to tension-provoking tasks. Vestergaard-Christensen (1975) presents evidence that prolonged clenching or grinding of the teeth (periods of three to thirty minutes) can result in symptoms representative of TMJ dysfunction. Scott and Gregg (1980) attempted to improve upon Vestergaard-Christensen's work to demonstrate greater specificity of the muscles involved and the resulting pain symptoms with those of MPD. On the basis of investigation with 30 "healthy volunteer subjects," Scott and Gregg arrived at the same conclusion, i.e., "muscle hyperactivity
causes pain" (Scott & Gregg, 1980, p. 234), but suggest the lateral pterygoid muscles to be primarily involved rather than the masseters. This distinction may arise artificially as a result of different jaw maneuvers being used: Vestergaard-Christensen (1975) having subjects clench or grind the teeth, whereas Scott and Gregg (1980) had subjects thrust the jaw forward. The implications of muscle specificity and particular oral habits have apparently yet to be investigated.

Other physiologic investigations include the study of clenching and grinding during sleep (Fuchs, 1975; Satoh & Harada, 1973); correlation of the perception and reaction to stressful stimuli with increased masseter activity through monitoring of masseter EMG in the natural environment (Rugh & Solberg, 1974); histologic and infra-red scanning studies pointing to microtraumatic lesions and inflammation of the muscles due to hyperactivity (Awad, 1971; Yemm, 1976); and characterization of abnormal mandibular movement (Nakazawa & Takahashi, 1974) and EMG profiles (e.g., Bessette, Bishop, & Mohl, 1971) suggestive of dysfunctional integration of structure, muscles, and neuronal control.

The demonstration of a relationship between muscle hyperactivity and pain, and the characterization of TMJ patients' tendency to increased masticatory muscle activity in response to stressors have served to substantiate further the role of central mediation in the manifestation of oral habits and pain and the appropriateness of a psychophysiological view of the syndrome.
PSYCHOLOGICAL FACTORS

Investigation of psychological factors in TMJ dysfunction has reflected the changing emphasis of various theoretical perspectives taken toward characterization of the presenting population. The interest of identifying personality characteristics in the TMJ population is maintained by consideration of the epidemiology of the symptoms. It has been repeatedly demonstrated that the incidence of persons manifesting the symptoms and oral habits associated with TMJ disorders found in surveys of the general population over-represents the clinical population (cf. Helkimo, 1976; Moss et al., 1982; Rugh & Solberg, 1976). Given the apparent similarity of the base rates of TMJ symptoms in patient and non-patient populations, the implication of patient status with a chronic problem may be taken as differential perception of the nature and means of management of the symptoms (i.e., "this is a dental problem"), or as the "adaptive ability" of the individual in response to the initial manifestations of the symptoms. Such perception may contribute to the development of chronic pain as opposed to a less severe or more transient nature of the symptoms in individuals not considering treatment necessary. The clarification of psychological variables involved in TMJ disorders may be of considerable interest to the development of more efficacious intervention and treatment strategies.

Psychological factors in the TMJ population are categorized by Rugh and Solberg (1976) as representing three "models": personality traits; emotional states such as anxiety, fear, and
depression; and physiological reactions to stress. As Rugh and Solberg have pointed out, clear distinctions among these three models are not easily maintained; for example, physiological reactions may parallel, to various extents, emotional states, particularly anxiety and fear. Further, it may be postulated that personality "traits," in the interactionalist sense of "organismic variables" which affect the perception of situations or events, have some bearing upon an individual's emotional state and physiological reaction. Individuals seen as typically tense, anxious, or prone to worry as stable or "trait" characteristics may be expected to manifest elevated and protracted emotional arousal to stressful stimuli. Such individuals would be expected to be less responsive to conservative physical interventions than individuals in whom emotional reactivity is more transient or "state" dependent. It may be concluded that the assessment of personality characteristics that demonstrate correlation with aspects of the presenting population may serve to summarize various "interactive styles" of some individuals with their symptoms and allow prediction of treatment choice and outcome. As such, identification of psychological factors taking a role in predisposition to or maintenance of TMJ dysfunction is of interest for purposes of differential assessment and treatment assignment. A brief review of earlier attempts to characterize the TMJ population will be presented.

As outlined by various reviews (e.g., Guralnick et al., 1978; Lupton, 1969; Moss et al., 1982; Rugh & Solberg, 1976), the pursuit of personality characteristics of TMJ patients began
from a psychoanalytic perspective. A most commonly cited source is Moulton, who, in the 1940s and 1950s, attempted a compilation of case studies. Moulton (1955) presents conclusions based on a psychiatric interview of approximately one hour's duration with each of 35 patients. However, she notes that the sample may have been non-representative, comprising "a higher percentage of the more recalcitrant patients" (p. 409) as "many patients could see no reasons for psychiatric consultation and refused it" (Moulton, 1955, p. 408). The individuals seen were characterized as "not only unusually anxious, but also tended to express their anxieties with physical symptoms" (Moulton, 1955, p. 410). She further characterized the patients as "hostile, angry people" and others as "exact ing, perfectionistic, obsessive people who tended to dominate and were secretly hostile" (Moulton, 1955, p. 412). Despite the apparent methodological shortcomings of this work, the results have been taken as suggestive of personality characteristics or traits, and have formed the basis for later psychometric assessments.

Rugh and Solberg (1976) provide an extensive review of studies prior to 1976 which investigated personality correlates and proposed profiles of TMJ patients based on interviews and/or psychometric assessments. A summary of these studies and their conclusions is given in Table III. As reported by Rugh and Solberg (1976): ". . . it is difficult to maintain that patients with TMJ disorders represent a homogeneous group with respect to personality characteristics" (p. 9).
<table>
<thead>
<tr>
<th>AUTHOR(S)</th>
<th>SUBJECTS</th>
<th>METHOD(S)</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engle (1951)</td>
<td>20 Atypical Facial Neuralgia</td>
<td>Psychiatric Interview</td>
<td>Patients were sexually masochistic, depressed, self-destructive, dependent, unhappy and unsatisfied.</td>
</tr>
<tr>
<td>Moulton (1955b)</td>
<td>35 TMJ patients</td>
<td>Psychiatric Interview</td>
<td>20 of 35 patients were anxious and tense. 11 of 35 were psychotic or pre-psychotic. Noted two groups: one was hostile, angry, and dependent; another was perfectionistic, obsessive, demanding and highly efficient.</td>
</tr>
<tr>
<td>Lesse (1956)</td>
<td>18 Atypical facial pain patients</td>
<td>Psychiatric Interview</td>
<td>Described patients as rigid, perfectionistic, domineering, and obsessive-compulsive.</td>
</tr>
<tr>
<td>Kydd (1959)</td>
<td>30 TMJ patients</td>
<td>Cornell Medical Index, MMPI, Edwards Personality Profile</td>
<td>23 of 30 patients were described as significantly disturbed emotionally. Described patients as anxious, tense, apprehensive, and overreacting to pain.</td>
</tr>
<tr>
<td>McCall et al.</td>
<td>70 TMJ patients and 2 control groups</td>
<td>MMPI</td>
<td>TMJ patients responded differently on 48 of 566 inventory items. These items included somatic complaints, nervousness, anxiety, and worry. No specific personality characteristics noted.</td>
</tr>
<tr>
<td>Lefer (1966)</td>
<td>30 TMJ patients</td>
<td>Psychiatric Interview</td>
<td>TMJ patients had poor ego boundaries and utilized bodily reactions to diminish the level of anxiety aroused by the threatened awareness of oral sadistic, extractive, and incorporative needs.</td>
</tr>
<tr>
<td>Lupton (1966)</td>
<td>37 TMJ patients and control group</td>
<td>MMPI, Interpersonal Adjective Checklist, TAT, Interview</td>
<td>TMJ patients described as over-generous, autocratic, narcissistic, sadistic, dominant, hypernormal, responsible, and managerial.</td>
</tr>
<tr>
<td>AUTHOR(S)</td>
<td>SUBJECTS</td>
<td>METHOD(S)</td>
<td>RESULTS</td>
</tr>
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<tr>
<td>Schuler</td>
<td>63 TMJ patients and control group</td>
<td>Psychiatric Examination</td>
<td>The incidence of a pathological personality structure was not found to be greater between groups.</td>
</tr>
<tr>
<td>(1966)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greider</td>
<td>100 TMJ patients</td>
<td>Personality assessment</td>
<td>Patients internalized stress, had conflicts between feelings of dependency and desire for dominance and aggression; denied and suppressed true emotions; were domineering, responsible, generous and obsessive-compulsive.</td>
</tr>
<tr>
<td>(1973)</td>
<td></td>
<td>not specified</td>
<td></td>
</tr>
<tr>
<td>Solberg et al.</td>
<td>29 TMJ patients and controls</td>
<td>MMPI and Clinical Interview</td>
<td>No common personality traits or patterns reported. A subgroup of patients showed greater anxiety; however, it was considered within the context of a normal personality profile.</td>
</tr>
<tr>
<td>(1972)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gessel</td>
<td>23 TMJ patients</td>
<td>Clinical Interview</td>
<td>TMJ patients set high standards and had few indications of covert or overt depression and little social disability.</td>
</tr>
<tr>
<td>(1973)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross and</td>
<td>56 TMJ patients</td>
<td>Clinical Interview</td>
<td>TMJ patients described as emotional, proper, imaginative, apprehensive, tense, anxious, neurotic; they drive the ego and restrain the id.</td>
</tr>
<tr>
<td>Vacchiano</td>
<td>(1973)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molin et al.</td>
<td>27 MDS patients and control</td>
<td>MNTI, Eysenck Personality</td>
<td>Patients were higher in psychic and somatic anxiety, muscular tension, aggression, super ego strength. Higher rating on SUSI. Described as emotionally unstable, insecure, hostile, and frequently worried.</td>
</tr>
<tr>
<td>(1973)</td>
<td></td>
<td>Inv., Somatic &amp; Psychic Inv., BDAI, Cattell, 16PF Inv., SUSI</td>
<td></td>
</tr>
<tr>
<td>Shipman</td>
<td>176 MPD patients</td>
<td>MMPI</td>
<td>Patients scored high on conversion hysteria, hypochondriasis, depression, and psychopathic deviate scales.</td>
</tr>
<tr>
<td>(1973)</td>
<td></td>
<td></td>
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<tr>
<td>Schwartz</td>
<td>42 unsuccessfully treated MPD patients</td>
<td>MMPI</td>
<td>Elevated scores on neurotic triad-scales. (Hypochondriasis, depression, and hysteria). Excessive somatic concern, agitation, and depression.</td>
</tr>
<tr>
<td>(1974)</td>
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</table>
Although attempts to characterize the TMJ population as a whole have not been consistent, what has emerged from these studies is the possibility of the identification of subgroups within the TMJ population which may demonstrate more consistent personality profiles. Lupton (1969) suggests the identification of three subgroups with distinguishable personality characteristics when discriminated on the basis of tolerance to experimentally-induced pain as high, middle, or low. Unfortunately, Lupton provides no description of the individuals seen for this study in terms of demographics or problem history and suggests no implications for the discrimination of these groups other than the demonstration of more homogeneous sets of characteristics. As reported by Lupton (1969), the low tolerance group

... was characterized by willingness to acknowledge the presence of emotional stress in their lives, was manifestly apprehensive and dependent, and often experienced conflict over impulse control and oral gratification. The high tolerance or stoical group was characterized by high degrees of defensiveness, with concomitant emotional problems and psychosomatic profiles on the MMPI, that is, elevated hysteria and hypochondriacal scores accompanied by relatively low depression scores (p. 135).

This particular MMPI profile, the "conversion V," was also identified by Schwartz (1974) in the context of TMJ patients and response to treatment. Non-responders to treatment were identified as presenting a "more pronounced" conversion-V profile. As the MMPI is considered too time-consuming for the purposes of this study, it will be of interest to see if discrimination of treatment outcome can be obtained with a shorter scale.
The identification of emotional states, such as anxiety, fear, depression, or anger, as more transient factors contributing to TMJ disorders, has also been researched. Anxiety elevations in TMJ patients have been the most common report (cf. Rugh & Solberg, 1976). However, there is some confusion with respect to the conceptualization and assessment of anxiety used in different studies. The evidence for the role of anxiety in the manifestation of TMJ dysfunction is most strongly presented in studies relating physiological reactions as muscle tension, fatigue, and TMJ-like pain symptoms in response to emotional states produced experimentally. The primary studies basic to this interest have already been cited in relation to physiological and biochemical aspects of TMJ dysfunction: demonstrations that anxiety-inducing or otherwise stressful tasks can induce muscle tension (Yemm, 1976), that prolonged muscle tension can induce pain symptoms similar to reported TMJ symptoms (Scott & Gregg, 1980; Vestergaard-Christensen, 1975), and that biochemical indicants of stress are found in higher concentration in TMJ patients (Evaskus & Laskin, 1972). The biochemical data plus demonstrations of greater muscle tension in response to stressors in TMJ patients versus non-TMJ patients (Thomas et al., 1973; Yemm, 1976) and the high incidence of dysfunctional oral habits as bruxing and clenching (reports ranging from 77% to 95%) in the TMJ population (cf. Rugh & Solberg, 1976) may be taken as evidence of a causal link between emotionally-induced tension and TMJ symptoms. To provide some understanding of the possible development of oral habits and provide a link to the
intervention strategy of interest in this study, a psychological perspective based on learning theory may now be taken under consideration—a consideration which may serve to integrate some of the foregoing observations.

Fordyce (1974) points out the potential involvement of secondary gains as attention or compensation in the maintenance of complaints of pain. Increases in muscular tension in response to stress or anxiety found in TMJ patients are proposed by Yates (1958) to represent a "conditioned avoidance response," tension having been paired at some point with a reduction in anxiety. Also suggested are the influences of modelling and imitation in the development of such oral habits as teeth clenching or lip biting and the contraction of the masseter as being a learned form of non-verbal expression of emotion (Rugh & Solberg, 1976). Whatmore and Kohli (1968) suggest that dysfunctional habits such as bruxism may be learned as adaptive responses to noxious stimuli such as social situations or emotional arousal. Marbach and Lipton (1978) investigated "aspects of illness behaviour" in people seeking treatment for TMJ disorders, and point out the possibility that individuals "from sociocultural backgrounds where the expression of psychological or emotional distress and physical symptoms are encouraged will be more likely to do so, particularly under stressful circumstances" (p. 636). Similarly, individuals less content with their life status may be more likely to seek treatment as an excuse to "escape from stress" (Marbach & Lipton, 1978). The foregoing list of hypothetical relations
suggests a number of ways in which dysfunctional oral habits may be learned as a response to stress. The implication of this perspective is that such habits should be amenable to behavioural interventions. In fact, treatment based on learning theory may comprise the bulk of psychological intervention strategies currently employed. However, as will be seen, there is no consensus as to what treatment orientation may be considered to be the most appropriate or effective.

TREATMENT

An amazing variety of treatments has been pursued in the management of TMJ disorders. As pointed out by Green (1979), the controversies surrounding advocated treatment approaches have been maintained in large part by the absence of controlled comparative research and the plethora of apparently successful clinical reports, suggesting that it is "possible to obtain success either because of, irrespective of, or despite the treatment provided" (p. 315). As outlined by Rugh and Solberg (1976), treatments have included:

. . . hypnosis, TMJ joint surgery, muscular exercises, counselling, electrical stimulation, biofeedback, tranquilizing drugs, corticosteroids, muscle relaxants, placebo drugs, psychoanalysis, group psychotherapy, occlusal adjustment, and a variety of occlusal splints (p. 24).

Rugh and Solberg (1976) note that poor experimental design and the unstable nature of TMJ symptoms may account in part for the apparent success of many of these treatments. There were few studies found in review of the literature which may be regarded
as methodologically rigorous. Some of the better studies involve the evaluation of biofeedback training; however, these also vary considerably in design and execution.

Budzynski and Stoyva (1973) demonstrated that normal individuals provided with EMG feedback from the masseter muscle could achieve greater relaxation (reduced EMG activity) in one twenty-minute session than normal individuals not provided with feedback. They concluded that this demonstration suggested a useful treatment mode for dental patients with bruxism or MPD. Carlsson and Gale (1973) investigated the effectiveness of masseter EMG feedback with 11 TMJ patients and concluded the treatment to be effective, demonstrating reduction or elimination of symptoms by self-report of 8 of the 11; however, no comparison group was utilized. Kardachi and Clarke (1977) utilized EMG feedback during sleep in the treatment of bruxism with 9 individuals monitored for "usually" 7 nights. Using a multiple baseline technique, it was concluded that the feedback from masseter and temporalis muscles provided a "highly significant reduction in bruxism"; however, no statistical analysis was offered and no comparison group was utilized.

Dohrmann and Laskin (1978) provided a better controlled evaluation of EMG feedback for the treatment of MPD; however, their results point out the difficulties of assessing outcome with this clinical group. Twenty-four subjects were admitted to the study, 16 being assigned to the experimental group and 8 forming a placebo treatment control group. Treatment success was evaluated on the basis of subjective reports of pain at
each session, pre- and post-treatment measure of limitation of opening with and without discomfort, subjective report of muscle tenderness to palpation, subjective report of presence of joint sounds, and subject's evaluation of treatment success at the conclusion of treatment. Differences of mean EMG activity were not utilized in assessment due to high variability of the control subjects (e.g., experimental group: $M = 6.31, SD = 3.28$; control group: $M = 11.7, SD = 8.27$), which contributed to non-significant comparison on the basis of unequal sample variances.

Changes in the other proposed dependent variables were followed over 9 treatment sessions and results were obtained as follows:

1. Pain Self-Report: 13 of 16 subjects in the experimental group and 8 of 8 control subjects complained of "some degree of pain" at the beginning of treatment; at the ninth session 2 experimental subjects and 4 controls still complained of pain — no statistical analysis was offered (however, on the basis of z-score approximation of the difference of two sample proportions at pre-treatment, the groups' proportions differ at $p = .095$, and differ at post-treatment at $p = .021$);

2. Limitation of Opening: showed no significant differences either between groups or over sessions within groups;

3. Tenderness to Palpation: percentage of patients complaining changed from 81% to 43% over sessions with the treatment, and 80% to 75% in the control group (z-score approximation of the difference of the proportions changing suggests the groups to differ at $p = .043$);
4. Joint Sounds: showed no change;
5. Patients' Ratings of Treatment Success: differed as 10/16 of the treatment group rated treatment successful and 6/16 as partially successful, whereas in the control group 3/8 rated their treatment as successful and 5/8 as partially successful. No patients in either group considered treatment to have failed.

(cf. Dohrmann & Laskin, 1978; emphasis added).

Thus, this study by Dohrmann and Laskin provides only marginal support for the superiority of biofeedback over placebo treatment and demonstrates the difficulty of arranging adequate assessment of treatment; objective assessment as EMG being victim to high variability, and subjective reports being vulnerable to demand characteristics of the treatment situation.

Stenn, Mothersill, and Brooke (1979) provided 11 MPD patients with combinations of EMG feedback from the masseter; progressive relaxation training (Jacobson, 1975); and cognitive behaviour therapy focussing upon situational analysis of the pain response and utilizing different aspects of assertive training, rational-emotive therapy, or stress inoculation which varied from patient to patient. All 11 patients received relaxation training and cognitive therapy, 6 of the 11 also receiving masseter EMG feedback while the remaining 5 had EMG monitoring without feedback. Pre- to post-treatment assessment showed significant improvement for all subjects with regard to self-report pain ratings and "symptoms and signs" of MPD. Differences were noted at the post-treatment assessment between
the biofeedback and non-biofeedback groups, in that the biofeedback group reported lower pain ratings and fewer signs and symptoms, although no differences existed between the groups for reduction of masseter EMG. It was not reported whether the EMG comparison was compromised by the high variability of the data obtained. Stenn et al. (1979) concluded that biofeedback, relaxation training, and cognitive therapies can be effective in the treatment of MPD. There is also the suggestion that biofeedback may enhance the effectiveness of relaxation training and cognitive therapies. There is no means afforded by their study to evaluate the individual contribution of cognitive therapies to the treatment of MPD. Scott and Gregg (1980), in a review of behavioural relaxation therapies for TMJ (some of which have been reviewed here), conclude that research has indicated relaxation treatments to be helpful clinical interventions. As suggested in the other literature, this result is not surprising.

We will now turn to a brief discussion of conservative dental interventions utilized with TMJ disorders. Basic dental intervention focuses upon malocclusion, poor alignment, or interrelationship of the upper and lower teeth, as the primary etiologic factor in TMJ pain and dysfunction (Carlsson, 1976; Shore, 1959, 1970). Malocclusion is proposed to create oral habits such as clenching and grinding through local proprioceptive reflexes and also to strain the jaw muscles and TM joint by forcing the mandible into an irregular path when closing. In keeping with this orientation, treatment has centred around the correction of the malocclusion through either "equilibration"—
the grinding down of tooth surfaces making premature contact; realignment of the teeth with orthodontics; or by adjusting the bite through the use of splints — plastic appliances mounted on the teeth to effect equilibration (Carlsson, 1976; Nally & Moore, 1975; Shore, 1959; Zarb & Thompson, 1975). Occlusal correction is generally supplemented by other treatments aimed to facilitate muscle relaxation, such as application of hot or cold packs or, occasionally, local anaesthetics; the use of sedatives and muscle relaxants; and the employment of exercises and restrictions of jaw movement, including the avoidance of chewy foods (Nally & Moore, 1975; Shore, 1970; Zarb & Thompson, 1975). There is often attention also to the role of psychological factors in the TMJ population, and hence recommendation of the inclusion of counselling or emphasis on the "general management" of the patient and the doctor-patient relationship (Nally & Moore, 1975; Weinberg, 1974; Zarb & Thompson, 1975).

Evaluation of conservative dental treatments has relied primarily upon compiled case studies. Zarb and Thompson (1975) present a summary of 93 individuals seen over a period of several years. Their treatment approach focussed on "eliminating occlusal and TMJ disharmony" through the use of splints, equilibration, exercises, or immobilization of the jaw, and controlling pain with the use of analgesics and local anaesthetics. However, attention was also given to "lowering psychic tension through counselling and a compassionate, tolerant attitude, combined occasionally with administration of sedatives and muscle relaxants" (Zarb & Thompson, 1975, p. 413). They report
success with 61% of the patients remaining asymptomatic over follow-up ranging from 2 to 7 years. Further treatment was required for 26 individuals who evidenced "frank recurrences," and 10 patients did not respond at all to conservative treatment. Zarb and Thompson (1975) concluded that this study supported the hypothesis that "functional occlusal therapy, coupled with patient counselling, ameliorates TMJ dysfunction" (p. 416), and point out that the study allowed no comparison between the efficacy of counselling and physical modalities alone. Table IV provides a summary of the measures and results for the three principal treatment studies just reviewed.
<table>
<thead>
<tr>
<th>AUTHORS</th>
<th>MEASURES</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dohrmann &amp; Laskin, 1978</td>
<td>patient pain ratings: none (0), mild (2),</td>
<td>experimental group (biofeedback)</td>
</tr>
<tr>
<td></td>
<td>moderate (3), severe (4)</td>
<td>pre-tx: mean pain rating approx. = 3 (13 of 16 reporting)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.4 overall)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>post-tx: mean = 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2 of 16 reporting)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.5 overall)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>control group (placebo)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pre-tx: mean pain 2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>post-tx: mean pain 1.25</td>
</tr>
<tr>
<td></td>
<td>measure of opening</td>
<td>no change, no differences</td>
</tr>
<tr>
<td></td>
<td>patient report of pain to palpation</td>
<td>exp. pre: 81% post: 43%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>control pre: 80% post: 75%</td>
</tr>
<tr>
<td></td>
<td>patient report of joint sounds</td>
<td>no change, no differences</td>
</tr>
<tr>
<td></td>
<td>patient report of treatment success</td>
<td>exp: 10/16 rate as successful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6/16 rate as partial success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>control: 3/8 rate as successful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5/8 as partial success</td>
</tr>
<tr>
<td></td>
<td>EMG measures</td>
<td>no change over treatment</td>
</tr>
<tr>
<td>Stenn, Mothersill, &amp; Brooke,</td>
<td>patient pain ratings</td>
<td>sig. reduction (&lt;.05) over treatment, sig. diff. (&lt;.05) biofeedback vs.</td>
</tr>
<tr>
<td>1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>number of &quot;signs &amp; symptoms&quot; presence of</td>
<td>sig. reduction (&lt;.05) over treatment, sig. fewer (&lt;.05) biofeedback vs.</td>
</tr>
<tr>
<td></td>
<td>limitation of opening</td>
<td></td>
</tr>
<tr>
<td></td>
<td>joint sounds, tenderness in muscles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EMG measures</td>
<td>no change, no differences</td>
</tr>
<tr>
<td>Zarb &amp; Thompson, 1975</td>
<td>2 to 7-year follow-ups for symptom recurrence</td>
<td>61% successful, minor symptom recurrence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28% &quot;frank recurrences,&quot; seek further treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11% no response to treatment</td>
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</tbody>
</table>
IMPLICATIONS FOR RESEARCH

From the literature reviewed, it is apparent that treatment research has proceeded with little formal cooperation or comparison between dental and psychological (reacting to stress) orientations. However, some overlap is evident within conservative dental treatment. Controlled treatment comparisons providing distinction of physical and psychological treatment would be of considerable interest as an attempt to isolate the relative importance of these orientations. Yemm (1976) asserts that there is no experimental evidence to suggest that malocclusion alone can initiate or maintain the habits of clenching or grinding, which are thought to be primary in the development of the TMJ pain syndrome. Green (1979) points to the absence of any statistical correlation of occlusal problems with MPD complaint, and Zarb and Thompson (1975) note that 41% of their patients had "excellent dentition." Furthermore, Laskin (1979) proposes that degenerative changes of the TM joint and occlusal misalignment may develop as secondary to the hyperactivity of the jaw muscles which may arise in response to stress. The attention to psychological management of the patient and the implications of response to placebo treatment (e.g., Dohrmann & Laskin, 1978) emphasize the role of psychological factors in the manifestations of MPD. The identification of psychological characteristics which may contribute to response to treatment is also an area requiring further research.
PROPOSAL

The primary interest of this research is to evaluate the relative efficacy of 3 treatment programs (and 2 treatment orientations) in the management of MPD: conservative dental treatment restricted to the physical aspects of such treatment (e.g., dental splints and physiotherapy); psychologically oriented treatment utilizing biofeedback, relaxation training, and stress management; and a minimal treatment comparison utilizing transcutaneous electrical nerve stimulation (TENS). The treatment programs were balanced for total duration and patient involvement (therapy sessions and "homework"), and patients were assigned randomly to the treatment conditions. The treatment programs will be elaborated upon shortly, and the treatment manuals are provided in Appendices 1, 2, and 3.

Treatment evaluation is based upon pre- to post-treatment changes of measures derived from dental assessment, questionnaires, and EMG assessment. Of supplementary interest is the potential identification of psychological characteristics that may influence response to treatment. This information has been gathered from questionnaires incorporated into the pre- and post-treatment assessment.

The details of assessment and the treatment programs may be most easily elaborated by following the sequence of events as they would unfold for the subject. This section will provide the introduction to the measures and aspects of treatment, and further detail will follow in the Method section.

Initially, the subject must meet the criteria of MPD as
all of a, b, c, and d below, as assessed by dentists of the UBC Department of Oral Medicine:

- a) complaint of facial pain and chronicity of at least 6 months,
- b) limitation or deviations of mandibular movement,
- c) no apparent organic association as evidenced by X-ray or by pain complaint restricted solely to TM joints, and
- d) tenderness of muscles to palpation.

In addition, for the purposes of this study, the subject must be over 19 years of age, report no physical trauma to jaw within the last 6 months prior to assessment, not be considered ineligible as a Dental Clinic patient due to psychological instability (e.g., clinically depressed), and must be able to read English (to complete questionnaires). Information gathered from this initial diagnostic assessment includes symptom and treatment history, and rating of occlusal characteristics as well as measures of mandibular movements and dentists' ratings of pain to palpation used in treatment evaluation. Those individuals meeting the criteria of MPD as defined above, and consenting to participate in the research program, then received the balance of the pre-treatment assessment: completion of questionnaires, structured interview, and masticatory muscle EMG assessment under task conditions. The complete pre-treatment assessment was replicated post-treatment.

The questionnaires completed by the subject were the SCL-90-R (Derogatis, Rickels, & Rock, 1976) and the Internal-
External Locus of Control (Phares, 1974; Rotter, 1966). The SCL-90-R is a brief (90 items) multidimensional self-report inventory proposed to quantify psychopathology in terms of 9 symptom constructs: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism (Derogatis & Cleary, 1977). This inventory was used in the interest of assessing somatization, obsessive-compulsive tendencies, anxiety, depression, and hostility, as constructs postulated to have roles in the manifestation of TMJ disorders and to obtain this assessment with a minimum of subjects' inconvenience. Also, as moderate correlations have been shown between the dimensions of the SCL-90-R and the clinical scales of the MMPI (Derogatis, Rickels, & Rock, 1976), the possibility exists of testing the identification of non-responders to treatment with an alternative to the conversion-V profile proposed by Schwartz (1974). It is thus hypothesized that differential scale elevations may be found on the Somaticism, Obsessive-Compulsive, Anxiety, Depression, and Hostility scales of the SCL-90-R, with non-responders to treatment evidencing higher scores. It is also hypothesized that these scales will show a decrease in scores from pre- to post-treatment in individuals responding to treatment. The I-E Locus of Control Scale is included with the hypotheses that, as a group, TMJ subjects will tend to high external scores in the assumption that TMJ patients perceive themselves not to be in control of their environment (i.e., subject to external sources of reinforcement and stress), and that these scores will show a
decrease from pre- to post-treatment, and may also serve to
differentiate treatment responders from non-responders. It is
postulated here also that the I-E scales may differ pre- to post-
among the treatment conditions, in that psychologically oriented
treatments, in requiring both participation and introspection on
the part of the client with respect to symptoms and the relation­
ship of external sources of stress and perceptions of them, may
serve to alter the subjects' perception of "locus of control."
If the subjects perceive the orientation of the other treatment
programs to be more as further external sources of intervention,
these differences may be expected to be reflected at post-treat­
ment as lesser change in locus of control. In anticipation of
the I-E scale being insensitive to changes of a more circum­
scribed nature, as one's locus of control with respect to health,
a scale purporting to be more specifically focussed on this
hypothesis (The Multidimensional Health Locus of Control scale—
Wallston, 1978) was included for part of the sample. This is a
recently developed scale, the utility of which in assessment
with small samples remains to be seen.

A structured interview was conducted utilizing an adapted
format of the McGill Pain Questionnaire (MPQ) (Melzack, 1975).
Information obtained from this interview included analgesic use
for the management of pain, diet restrictions as a result of
pain, and quantifiable self-report pain ratings obtained from
response to the pain adjective check list (Melzack, 1975). As
well, standardized enquiry was made of specific aspects relevant
to oral habits and pain as awareness of clenching or grinding of
the teeth, avoidance of chewy or crunchy foods, use of diet aids, smoking, lip or cheek biting, problems swallowing, or awareness of clenched teeth when speaking in situations when angry, tense or stressed. Information involving habit awareness, diet restrictions, and awareness of mediating stressors will be used as descriptive data, whereas information involving self-report pain ratings will be used in treatment evaluation with the hypothesis that pain rating will decrease pre- to post-treatment.

The other major component of assessment involved EMG monitoring of the muscles of the jaw at rest and under task conditions. Task conditions have been included with the aims of demonstrating elevated EMG activity relative to resting baseline and improving the utility of the EMG measures for treatment evaluation by diminishing inter-subject variability with an anticipated "ceiling" effect resulting from the EMG elevations. The hypotheses with respect to these measures are that:

1. as a group, the subjects will show EMG elevations under task conditions relative to resting baseline, and
2. across treatment conditions, the relaxation-biofeedback group will show greater reduction of EMG activity under tasks pre- to post-treatment.

The task conditions were the static steadiness and maze coordination tests of the Klove-Mathews Motor Steadiness Battery (Reitan & Davison, 1974) and a hand dynamometer. Subjects' perception of frustration, anxiety, or "tension" due to task difficulty was assessed by enquiry at the conclusion of this
phase of testing. The EMG equipment used for this assessment was a battery-powered EMG instrument providing peak-to-peak RMS output (J & J, model M-51) and a digital integrating score-keeper (J & J, model LGS-150).

At the conclusion of assessment, the subject was informed of assignment (random in blocks of 3) to one of the three treatment conditions: dental/physiotherapy (DPT), relaxation training/biofeedback/stress management (RBS), or transcutaneous electrical nerve stimulation (TENS) — programs A, B, and C, respectively. Treatment generally commenced in the week following assessment. At the conclusion of the introduction to the particular treatment program in the first session, the subjects provided a rating of expected treatment success based on their understanding of the prescribed treatment rationale. This rating was provided by the selection of an integer value from 0 to 10, where 0 signifies no change and 10 indicates complete relief. This rating was taken as a measure of treatment credibility, and it is hypothesized that the means will be equal across treatment groups.

Program A — dental splint and physiotherapy — provided physically oriented treatment with specific exclusion of references to the implications of tension or psychological stress. The dental splint was a heat-cured acrylic appliance constructed to neutralize the effects of any occlusal abnormalities or interferences that may be associated with the subject's symptoms (Blasberg, 1981). Physiotherapy provided physical treatments and exercises designed to recondition the muscles of
the jaw. These approaches may be seen as active treatments provided to the subject as a passive recipient.

Program B—relaxation training, biofeedback, and stress management—emphasized the role of psychological stress, tension, and resulting pain, with the intention of enhancing the subject's awareness of potentially stressful situations and their reactions to these situations, and providing the subject with specific relaxation strategies to counteract tension. (Standardized audio tapes were produced for the home practice of relaxation exercises.) This approach may be seen as the provision of essentially passive treatments of which the subject is an active recipient.

Program C—TENS—was utilized as a minimal treatment comparison. This treatment consisted of the application of a mild electrical current which has been shown to reduce the perception of pain; however, the exact mechanism by which pain relief is achieved is not known (Lampe, 1978; Wolf, 1978). The pain gate theory of Melzack and Wall is considered feasible (Wolf, 1978); however, other suggestions such as the potentiation of endorphin release or improved blood flow are also postulated (Wolf, 1978). The primary function is seen to be pain relief, and there is no apparent direct effect on muscle tension. Pain relief is seen to be transient, and dependent upon the frequency of application for sustained relief (Health Devices, 1981; Lampe, 1978; Wolf, 1978). As such, this treatment modality applied for approximately half an hour weekly may be seen to approximate a placebo condition, or, at best, to
provide minimal active therapeutic results.

The three treatment programs each involved one-hour sessions provided weekly over a period of 8 weeks. All subjects completed daily symptom monitoring of pain, providing incidence information and rating of pain on a scale of 0 to 10, where 0 indicates no pain and 10 denotes extreme pain. These symptom reports were turned in and discussed with the respective therapist at the beginning of the weekly treatment session. Also, the programs were balanced with respect to the "at home" aspects of treatment for the subjects: exercise programs with physiotherapy, practice of relaxation skills with relaxation training, and "rest periods" with no specific instruction for those receiving TENS. The weekly self-report pain rating forms were used to tabulate daily occurrence of pain and weekly mean pain rating as a further assessment of treatment.

The hypothesis with respect to these data is that the average weekly incidence and/or pain ratings will decrease from the first 3 weeks of treatment to the last 3 weeks of treatment. At the conclusion of the treatment programs, all subjects completed a confidential (with respect to their particular therapist) evaluation of treatment success and of the therapist. The treatment rating is a replication of the expectation scale — the selection of an integer value from 0 to 10, where 0 is no change and 10 is complete relief — based on their perception of results. The therapist evaluation was provided as a check of differential therapist-client relationships contributing to treatment response. It is apparent that therapists are nested
within the respective treatment programs as a natural consequence of the differing fields of expertise.

The overall hypothesis with respect to differing treatment effectiveness is that the psychologically oriented program will demonstrate the best results through the development of awareness of the role of stress and tension and providing the subject with an active means of intervening in the pain cycle.
METHOD

Subjects:

Subjects were obtained from individuals presenting for treatment of complaint of chronic pain to the UBC Department of Oral Medicine Clinic, and screened through dental assessment as meeting the previously-outlined criteria of MPD. Individuals meeting these criteria were then asked if they were willing to participate in a research program concerning treatment approaches to TMJ disorders. Those individuals agreeing to participate then signed consent forms informing them of their right to withdraw from the program at any time they may choose, and of the need to have them complete questionnaires, the results of which were to be strictly confidential. Subjects then completed the pre-treatment assessment and received assignment to one of the three treatment conditions.

Of 128 subjects screened from the Oral Medicine Clinic, 33 were found to meet the diagnostic criteria of MPD as outlined for this study. From those 33, 29 agreed to take part in the research program; the 4 refusing (2 of whom were male and 2 female) did so primarily in response to time and travel considerations in attending treatment. From the 29 subjects agreeing to take part in this research, 21 completed the entire program and their data were used for the purposes of this report. Of the 8 persons not used, 1 did not appear for treatment, 1 refused registration with a psychiatric facility, 1 was re-referred for treatment of depression, 3 discontinued treatment, and 2 completed treatment but were not used in order to maintain equal
group sizes across treatments. Of 10 subjects assigned to the Dental/Physiotherapy program, 2 discontinued treatment (1 for reasons unknown, the other for time constraints) and 1 was not used; of 10 assigned to the Stress/Relaxation program, 1 refused registration, 1 was re-referred, and 1 discontinued (required surgery for another problem); of 9 assigned to the TENS program, 1 did not appear for treatment, and 1 was not used. All of the 21 individuals completing the program were female; of the 8 entering the program but not contributing to the data, 7 were female and 1 male.

The 21 subjects providing data for this study ranged in age from 19 to 45 years (M=27.2; SD=7.1). From pre-treatment assessment, the treatment groups formed by random assignment did not differ with respect to the subjects' age, duration of pain history, measure of mouth opening, masseter EMG baseline measure, adjectival pain rating index, or expectations for success with their respective treatments (MANOVA likelihood ratio, approx. F(12,26) = 0.599, p=.82) (see Table V). From the total sample correlation matrix for the foregoing variables, it was noted that a high inverse relation existed between duration of pain history and expectation for treatment success (r = -.67, p < .01). No other correlation in the matrix was significant (see Table VI). At post-treatment, this negative expectation was apparently overcome, there being no significant relationship between duration of pain history and ratings of treatment success (r = -.35, p > .10). There does not appear to be an effect attributable to experiences with previous treatment
TABLE V

Means (and standard deviations) of variables assessed for comparison of equivalence of groups at pre-treatment

<table>
<thead>
<tr>
<th></th>
<th>Dental/ Physio (n=7)</th>
<th>Relaxation/ Stress (n=7)</th>
<th>TENS (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>29.0(7.4)</td>
<td>27.0(5.0)</td>
<td>25.6(8.9)</td>
</tr>
<tr>
<td>Duration of pain (years)</td>
<td>2.98(2.06)</td>
<td>2.76(1.97)</td>
<td>4.21(3.28)</td>
</tr>
<tr>
<td>Mouth opening (mm)</td>
<td>41.0(10.2)</td>
<td>39.4(9.5)</td>
<td>38.3(8.7)</td>
</tr>
<tr>
<td>Masseter EMG baseline (µV)</td>
<td>5.54(2.79)</td>
<td>4.71(1.38)</td>
<td>4.85(2.06)</td>
</tr>
<tr>
<td>Adjective pain rating index (max = 5)</td>
<td>2.38(.41)</td>
<td>2.48(.81)</td>
<td>2.28(.57)</td>
</tr>
<tr>
<td>Expectation of treatment success (max = 10)</td>
<td>8.0(.6)</td>
<td>7.3(2.56)</td>
<td>6.3(2.0)</td>
</tr>
</tbody>
</table>
TABLE VI

Total sample correlation matrix for variables assessed with respect to pre-treatment status

<table>
<thead>
<tr>
<th>Age</th>
<th>Duration of Pain</th>
<th>Mouth Opening</th>
<th>Masseter EMG Index</th>
<th>Pain Rating Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of pain</td>
<td>.065</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouth opening</td>
<td>-.091</td>
<td>-.249</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masseter EMG baseline</td>
<td>-.255</td>
<td>-.160</td>
<td>.221</td>
<td></td>
</tr>
<tr>
<td>Pain rating index</td>
<td>-.013</td>
<td>-.223</td>
<td>.211</td>
<td>-.199</td>
</tr>
<tr>
<td>Treatment expectation</td>
<td>.216</td>
<td>-.675*</td>
<td>.297</td>
<td>.229</td>
</tr>
</tbody>
</table>

*p < .01; all other probabilities > .10
(compared with critical values with n - 2 = 19 degrees of freedom)
within the longer pain histories which may affect treatment expectation; previous treatment did not correlate with treatment expectation (point-biserial correlation = .18, p > .10).

Table VII provides a summary of descriptive variables taken from the problem history, and Table VIII summarizes the occlusal characteristics of subjects within each group. Occupational categories are summarized in Table IX.

From these tables, some discrepancies are apparent in the composition of groups; however, the differences seen do not consistently contribute to possible differential effects across the treatment groups with respect to treatment outcome. For example, the higher incidence of previous treatment seen in Table VII for the Stress/Relaxation group may be expected to mitigate against expectations for treatment success if the previous treatments were unsuccessful; however, as may be seen from Table V, no such difference was obtained. The higher incidence of analgesic use in the Stress/Relaxation group at pre-treatment is essentially irrelevant, as all subjects were asked to refrain from, or minimize, analgesic use over the course of treatment, and compliance with this directive was good. These issues will be returned to in the Discussion.

Pre-Treatment Assessment:

Pre-treatment assessment provided dependent measures from the dental assessment, psychometric tests, symptom report and pain ratings, EMG activity, and descriptive data from the history outline (see Table X). Ratings of expectation for change were obtained once introduced to treatment. The dental
### TABLE VII

Summary of descriptive variables associated with symptom history

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dental/Physio. (n=7)</th>
<th>Stress/Relaxation (n=7)</th>
<th>TENS* (n=7)</th>
<th>Overall (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Had had previous treatment more than 6 months prior to current program</td>
<td>42.9% (3)</td>
<td>85.7% (6)</td>
<td>42.9% (3)</td>
<td>57.1% (12)</td>
</tr>
<tr>
<td>2. Aware of oral habits of clenching and/or grinding</td>
<td>100% (7)</td>
<td>85.7% (6)</td>
<td>85.7% (6)</td>
<td>90.5% (19)</td>
</tr>
<tr>
<td>3. Pain resulting in change of diet, i.e., avoidance of chewy or crunchy foods</td>
<td>85.7% (6)</td>
<td>57.1% (4)</td>
<td>57.1% (4)</td>
<td>66.7% (14)</td>
</tr>
<tr>
<td>4. Aware of some association of &quot;tension&quot; or &quot;stress&quot; with manifestation of pain</td>
<td>100% (7)</td>
<td>85.7% (6)</td>
<td>85.7% (6)</td>
<td>90.5% (19)</td>
</tr>
<tr>
<td>5. Use of analgesics for pain</td>
<td>42.9% (3)</td>
<td>71.4% (5)</td>
<td>42.9% (3)</td>
<td>52.4% (11)</td>
</tr>
</tbody>
</table>

*TENS = Transcutaneous Electrical Nerve Stimulation
### TABLE VIII

Summary of occlusal characteristics of subjects within each group

<table>
<thead>
<tr>
<th>Occlusal Rating</th>
<th>Characteristics</th>
<th>Dental/Physio. (n=7)</th>
<th>Stress/Relaxation (n=7)</th>
<th>TENS (n=7)</th>
<th>Overall (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (good)</td>
<td>Full natural dentition or less than 3 missing teeth with fixed replacement; maximum intercuspal position stable; class I molar relationship; no non-working or protrusive interferences</td>
<td>14.3% (1)</td>
<td>14.3% (1)</td>
<td>28.6% (2)</td>
<td>19.1% (4)</td>
</tr>
<tr>
<td>3 (fair)</td>
<td>Full natural dentition or less than 3 missing teeth with fixed replacement; class II molar relationship; no non-working or protrusive interferences</td>
<td>42.9% (3)</td>
<td>0% (0)</td>
<td>14.3% (1)</td>
<td>19.1% (4)</td>
</tr>
<tr>
<td>5 (poor)</td>
<td>3 or more missing teeth; maximum intercuspal position unstable; loss of vertical dimension; drifting of teeth; non-working and protrusive interferences present.</td>
<td>42.9% (3)</td>
<td>85.7% (6)</td>
<td>57.1% (4)</td>
<td>61.9% (13)</td>
</tr>
</tbody>
</table>
TABLE IX

Summary of occupational status of subjects by groups and overall

<table>
<thead>
<tr>
<th></th>
<th>Dental/Physio. (n=7)</th>
<th>Relaxation/Stress (n=7)</th>
<th>TENS (n=7)</th>
<th>Overall (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>14.3% (1)</td>
<td>14.3% (1)</td>
<td>0. %</td>
<td>(2) 9.5%</td>
</tr>
<tr>
<td>Skilled</td>
<td>42.9% (3)</td>
<td>71.4% (5)</td>
<td>71.4% (5)</td>
<td>(13) 61.9%</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0. %</td>
<td>0. %</td>
<td>0. %</td>
<td>0. %</td>
</tr>
<tr>
<td>Unskilled</td>
<td>14.3% (1)</td>
<td>0. %</td>
<td>0. %</td>
<td>(1) 4.8%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0. %</td>
<td>0. %</td>
<td>0. %</td>
<td>0. %</td>
</tr>
<tr>
<td>Housewife</td>
<td>28.6% (2)</td>
<td>0. %</td>
<td>14.3% (1)</td>
<td>(3) 14.3%</td>
</tr>
<tr>
<td>Student</td>
<td>0. %</td>
<td>14.3% (1)</td>
<td>14.3% (1)</td>
<td>(2) 9.5%</td>
</tr>
</tbody>
</table>
### TABLE X

Descriptive variables and dependent measures

**DESCRIPTORS:**

Demographics: Sex, age, occupation

Problem history: Duration of pain history

  Previous treatment

  Oral habit awareness

  Diet change

  Association of stress effects

  Occlusal rating

**DEPENDENT MEASURES:**

Dental assessment: Pain to palpation

  Jaw mobility (opening and lateral movement)

Subject assessment: Treatment expectations

  Pain rating index

  Worst pain rating

  Mean weekly pain rating

  Mean weekly pain incidence

  Treatment evaluation

  Therapist rating

EMG assessment: Baseline measure

  Task conditions (static steadiness, maze coordination, dynamometer)
assessment provided history and symptom information; description of occlusal characteristics; and objective measures of limitations of jaw maneuverability such as opening and lateral movements. These data were utilized for characterization of the treatment population, e.g., as duration of problem and presence or absence of malocclusion; and for outcome assessment, i.e., relief of symptoms and improvement of jaw maneuverability. Ratings of pain to palpation were obtained by having two dentists independently provide ratings from 0 to 4 of the subjects' response to manual pressure over various muscle groups. As it is not feasible to expect exact duplication of pressure and subjective rating, the ratings obtained were averaged for the two dentists, one of whom was always blind to the subjects' treatment assignment. (Note: neither dentist was aware of the subject's treatment assignment at the pre-treatment assessment, but one would not be blind at post-treatment.) The pain to palpation ratings were averaged for the two dentists as a means of systematically incorporating potential error arising from ratings taken from one or the other. Neither of the dentists was consistently blind to the subject's treatment assignment, and differences of ratings (subjective assessment by the dentist of the subject's responsiveness to manual pressure on the muscles) were expected to exist between the dentists. Thus, as a standardized assessment pre- and post-treatment, both dentists rated pain to palpation for each subject and their ratings were averaged. The issues of reliability and the potential influence of bias will be addressed in
the Results. All measures of jaw manoeuvrability were taken by one dentist using a millimeter scale to assess interincisal opening and lateral excursion from the centre of the front teeth.

Subjects then completed the SCL-90-R and I-E Locus of Control scales. Subjects were directed to complete the SCL-90-R as a summary of symptoms they perceived over the previous 3 to 4 weeks. When the questionnaires were completed, a structured interview was then conducted using an adapted format of the McGill Pain Questionnaire. Pain ratings were taken with respect to pain perceived in the previous 3 to 4 weeks. At the conclusion of the interview, the subject was then assessed for EMG activity.

For EMG assessment, electrodes were placed bilaterally over the masseter muscle located on the muscle bulge created by clenching of the teeth. The ground electrode was positioned on the forehead centred approximately 1 inch above the eyebrows. Resistance levels were checked with a built-in electrode test circuit on the EMG instrument (J & J, model M-51) and limited to a maximum of 9,500 ohms or the electrodes were reapplied. Following hook-up, baseline measures were taken over three one-minute intervals using a digital integrating scorekeeper (J & J, model LGS-150) while the subject sat quietly. Measures were averaged μvolt activity. The subject was then instructed to complete the Static Steadiness test, using the standard format of holding a stylus without supporting the hand for 15 seconds in each of 9 holes of decreasing diameter. EMG activity was
monitored for the corresponding 15-second intervals. The subject completed the task with each hand. The task is seen to have increasing difficulty with the diminishing diameter of the holes as the subject proceeds through the test. At the completion of this task, the subject then completed the Maze coordination test. In order to create increasing difficulty of this task, the subject first moved the stylus through the maze with the instructions to take as much time as desired, only attempting not to contact the sides of the maze. The EMG activity was monitored for consecutive 15-second intervals until task completion. The subject was then instructed to repeat the task with the intention of travelling as far as possible in 60 seconds and attempting to minimize contact with the sides of the maze. The subject was then instructed to repeat the above task with a 30-second time limit. EMG activity was monitored for consecutive 15-second intervals, and the subject completed all tasks with each hand. Total number of contacts was recorded for each hand in each task condition. The third task in the EMG assessment required the subject to generate maximum pressure with a hand dynamometer and attempt to maintain that pressure for 15 seconds. This task was repeated twice with each hand. For treatment assessment, mean baseline EMG, and mean EMG activity for each of the three task conditions were compared as pre- versus post-treatment. At the completion of assessment, the subject was informed of the treatment program to which they were assigned.
Treatment Programs:

Program A — occlusal splints and physiotherapy — was provided by two dentists on faculty with the Department of Oral Medicine, UBC, utilizing the facilities of the Oral Medicine Clinic; and three physiotherapists on staff with the Rehabilitation Services of the HSC Acute Care Hospital and using those facilities. At Week 1 of treatment, occlusal splints made from dental casts taken at pre-treatment assignment were fitted to the subject so as to neutralize or correct the effects of any occlusal abnormalities, and introduction was made to physiotherapy. Treatment expectancy rating forms were completed after the program had been explained to the subject. The subject was provided with a symptom report form to self-monitor and to rate pain symptoms (see Appendix 4 — Forms and Questionnaires) daily for the week between treatment sessions. Weeks 2 and 3 involved physiotherapy providing applications of hot and cold packs, exercises for bodily posture and jaw muscles, and explanation of physical aspects of problems such as sleeping positions, eating, and swallowing. The subject was given "at home" exercises to complete daily between treatment sessions. At Week 4, the subject was seen in dentistry for adjustments to the splint, and then reported to physiotherapy to complete a one-hour session in total. Weeks 5, 6, and 7 were spent with physiotherapy, with further splint adjustment at Week 6. At Week 8, the subject reported for the conclusion of treatment with physiotherapy, and then made arrangements for post-treatment assessment at the first opportunity to be seen through the Department of Oral
Medicine. At the conclusion of session 8, the treatment and therapist rating forms were completed by the subject and inserted into an envelope by the subject to be mailed to an individual not directly associated with treatment. (See Appendix 1 for the treatment manual detailing Program A.)

Program B—relaxation training, masseter EMG biofeedback, and stress management—was provided by three Master's level students in clinical psychology at UBC, utilizing the facilities of the Behaviour Therapy Services of the Division of Psychology in the HSC Psychiatric Unit. At Week 1 of treatment, introduction was made to the treatment program and assessment made of the problem history. At the conclusion of this session, the treatment expectancy rating forms were completed by the subject. The subject was provided a symptom report form to self-monitor and to rate pain symptoms daily for the week between treatment sessions. At Week 2, the symptom report form was reviewed with respect to symptom occurrence and perceptions of stress, and introduction was made to progressive relaxation training (see Appendix 2 for program), with the therapist guiding the subject through the first set of exercises and providing a standardized audio tape of the exercise script for at-home practice daily. At Week 3, the symptom report and completion of exercises were reviewed and introduction was made to EMG biofeedback of the muscles of the jaw. Weeks 4 through 8 continued with biofeedback and symptom/stress review. Audio tapes for the second and third shortened exercise scripts were provided at Weeks 5 and 7 respectively. (See Appendix 2 for the detailed
treatment manual for Program B.) At the conclusion of Week 8, the subject completed the treatment-success and therapist-rating form and inserted it in an envelope for mailing to another individual not associated directly with treatment. The subject was instructed to make an appointment with the Department of Oral Medicine for post-treatment assessment at the earliest opportunity.

Program C — TENS — was provided by three physiotherapists on staff with the Rehabilitation Services of the HSC Acute Care Hospital and utilizing those facilities. At Week 1, the subject was introduced to the treatment program, completed the treatment expectancy rating form, and was provided the first application of TENS. The instrument used for the transcutaneous nerve stimulation (Joanco, model 4) was battery-powered (9-volt) and provided spike-wave alternating current at approximately 100 Hertz and a current flow of approximately 50 microamperes. Stimulation was adjusted so as to be just perceptible by the subject and was left at that setting for one half hour. The subject was also directed to take approximately half an hour daily at home to sit comfortably and "rest," with no further instruction, in order to balance for time spent in at-home exercises with the other treatment programs. A symptom report form was provided for self-monitoring and rating of pain symptoms daily for the week between treatment sessions. At Week 2, the symptom report was reviewed with respect to incidence and severity and completion of rest periods, TENS was applied for half an hour, and the subject was provided another symptom
report form. Weeks 3 through 7 proceeded as Week 2. At Week 8, the subject received the final treatment session, completed the treatment-success and therapist-rating form and inserted it in an envelope for mailing to an individual not directly associated with the treatment, and was instructed to make an appointment for post-treatment assessment with the Department of Oral Medicine at the earliest opportunity. (See Appendix 3 for the detailed treatment manual for Program C.)

Post-Treatment Assessment:

At post-treatment assessment, all measures taken of pre-treatment assessment were replicated. Subjects were then asked if they felt that relief had been adequate or if they felt that further treatment was necessary for relief. If the subject did not request further treatment, arrangements were made for follow-up evaluation in three months' time, and explanation was made that, if they should feel the need for further treatment within that time, arrangements could be made through the Department of Oral Medicine. As a measure of treatment effectiveness, it was of interest only whether or not subjects elected further treatment. No further systematic assessment was conducted after the post-treatment assessment.

Evaluation and Analysis:

The contrasts to be used in treatment evaluation are outlined in Table XI. Analysis of the results was conducted by multivariate techniques (MANOVA) with respect to clusters of data as outlined below:
TABLE XI

Contrasts for treatment evaluation and hypotheses for tests

Dental assessment: Pain to palpation — Pre-Post

Jaw mobility — Pre-Post

DPT & RBS > TENS — As relation of groups for effects of treatment on dental measures

Subjective assessment: Pain rating index) Pre-Post

Worst pain rating)

Mean weekly pain rating (Weeks 1, 2, 3 vs Weeks 5, 6, 7)

Mean weekly pain incidence)

Treatment expectations)

DPT = RBS = TENS

Therapist ratings

Treatment evaluation — DPT & RBS > TENS

DPT & RBS > TENS — As relation of groups for effects of treatment on pain ratings

EMG assessment: Baseline) Pre-Post

Tasks)

RBS > DPT > TENS — As relation of groups for effects of treatment on EMG reduction
1. Dental assessment — pain to palpation and jaw maneuverability;
2. Subjective assessment — pain rating index (MPQ), "worst pain" rating, pain incidence and rating (symptom report), and rating of treatment success; and
3. EMG assessment — baseline, static steadiness, mazes, and dynamometer.

This format for analysis allowed assessment of any group differences and also allowed comparison of any differential effects of treatment among these areas of data.

Results of the psychometric assessment were analyzed by MANOVA for differences pre-versus post-treatment and by discriminant analysis with respect to groups as good versus poor treatment outcome over variables of interest from the pre-treatment assessment.

Six subjects (2 from each group) rated treatment outcome as 5 or less out of 10, and they comprised the "poor" response group. This group was compared with 6 randomly-selected subjects (2 from each group) who rated treatment outcome as 8 or more — the "good" response group.

As previously outlined, pre-treatment differences of subject populations among the treatment groups were assessed by MANOVA, with respect to age, symptom history (duration), interincisal opening, EMG baseline, pain rating index from pain questionnaire, and treatment expectancy. These measures provide some assessment of background, jaw limitation, EMG baseline activity, pain perception, and treatment expectations,
which may be seen to be a relatively broad sampling of variables of relevance to equivalent pre-treatment status. With respect to treatment perception, the equivalence of therapist ratings at post-treatment was assessed by a univariate analysis of variance. As reported, randomization of groups was found to be effective with respect to the above-mentioned variables.
RESULTS

The dental data revealed a significant overall treatment effect (Likelihood Ratio, approx. $F(3,16) = 9.22$, $p = .0009$), with increased opening ($F(1,18) = 6.53$, $p = .019$) and reduction of pain to palpation ($F(1,18) = 18.68$, $p = .0005$), but no differential effects across the treatment groups (LR, approx. $F(6,32) = 1.15$, $p = .358$). These results indicate a generalized effect of all the treatments to reduce muscle pain and sensitivity to palpation and correspondingly to reduce limitation of opening (see Table XII for means and standard deviations of pre- and post-treatment assessments). These results provide some physical or relatively objective evidence of general treatment effects.

Possible differential perceptions of treatment credibility and of therapist warmth and regard are of general importance to the assessment of treatment differences and of particular importance to assessment by subjective self-report. Possible differential perceptions of treatments or therapists were each assessed by univariate analysis of variance. From the assessment of expectations for treatment success based on the treatment rationales presented at the beginning of the respective treatments (essentially an assessment of treatment credibility), no differences were found: Dental/Physio (DPT), $M = 8.0$, $SD = 1.0$, Relaxation/Stress (RBS), $M = 7.3$, $SD = 2.6$; TENS, $M = 6.3$, $SD = 2.0$; $F(2,18) = 1.44$, $p > .25$. Similarly, no differences were found for the therapist ratings (expressed here as ratio to the maximum possible score) obtained at the conclusion of treatment: DPT, $M = .98$, $SD = .03$; RBS, $M = .93$
### TABLE XII

Means (and Standard Deviations) of ratings of pain to palpation and measure of mouth opening assessed at pre-treatment (pre-Tx) and post-treatment (post-Tx)

<table>
<thead>
<tr>
<th></th>
<th>Dental/Physio. (DPT)</th>
<th>Relaxation/Stress (RBS)</th>
<th>TENS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Tx</td>
<td>Post-Tx</td>
<td>Pre-Tx</td>
</tr>
<tr>
<td>Pain to Palpation</td>
<td>1.565</td>
<td>.903</td>
<td>1.421</td>
</tr>
<tr>
<td></td>
<td>(.390)</td>
<td>(.468)</td>
<td>(.460)</td>
</tr>
<tr>
<td>Interincisal</td>
<td>41.00</td>
<td>43.00</td>
<td>39.40</td>
</tr>
<tr>
<td>Opening</td>
<td>(10.25)</td>
<td>(7.23)</td>
<td>(9.50)</td>
</tr>
</tbody>
</table>

Notes:  

a. Maximum rating = 4.0

b. Measured in millimeters.
SD = .07; TENS, $M = .96, SD = .05; F(2,18) = 1.45, p > .25$. These results suggest any influence of the perceptions of treatment rationale or of therapist characteristics to be equivalent across groups, and that therefore any differential reports should derive from the perceptions of treatment effectiveness and/or symptom remission.

The self-report data (see Table XIII) concur with the dental data as representing significant overall change pre- to post-treatment (LR, approx. $F(5,14) = 3.27, p = .036$), but also suggest significant differences across groups (LR, approx. $F(10,28) = 2.47, p = .029$) and interaction effects (LR, approx. $F(10,28) = 2.45, p = .030$). Direct multiple comparisons of group differences over the relevant variables are questionable in the absence of a significant greatest root for the multivariate solution (GRC, $p = .0765$); however, less formal analysis provides some insight as to the obtained effects. Univariate analysis of the variables obtained from self-report show only the reported weekly incidence of pain (days per week) to differ across groups ($F(2,18) = 4.61, p = .024$), and only weekly average pain ratings to have a significant interaction effect ($F(2,18) = 10.44, p = .001$). Plotting the group means of the weekly average pain ratings and pain incidence over the course of treatment suggests the sources of the above-mentioned effects (see Figure 2). With respect to weekly incidence, it can be seen that the TENS group experienced no change over treatment, whereas both the DPT group and the RBS group showed a relatively significant average reduction of pain incidence. With respect
TABLE XIII
Means (and Standard Deviations) of self-report data used for treatment evaluation

<table>
<thead>
<tr>
<th></th>
<th>Dental/Physio.</th>
<th>Relaxation/ Stress</th>
<th>TENS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Tx</td>
<td>Post-Tx</td>
<td>Pre-Tx</td>
</tr>
<tr>
<td>&quot;Worst Pain&quot; Rating&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Worst Pain&quot; Rating&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.57</td>
<td>3.14</td>
<td>3.86</td>
</tr>
<tr>
<td></td>
<td>(0.79)</td>
<td>(1.35)</td>
<td>(0.90)</td>
</tr>
<tr>
<td>Pain Rating Index&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Rating Index&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.38</td>
<td>2.05</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>(0.41)</td>
<td>(0.63)</td>
<td>(0.81)</td>
</tr>
<tr>
<td>Average Weekly Report of Pain&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Weekly Report of Pain&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.58</td>
<td>2.87</td>
<td>4.06</td>
</tr>
<tr>
<td></td>
<td>(1.06)</td>
<td>(0.89)</td>
<td>(0.67)</td>
</tr>
<tr>
<td>Average Weekly Incidence of Pain&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Weekly Incidence of Pain&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6.28</td>
<td>3.47</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td>(1.06)</td>
<td>(1.99)</td>
<td>(2.09)</td>
</tr>
<tr>
<td>Treatment Evaluation&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment Evaluation&lt;sup&gt;e&lt;/sup&gt;</td>
<td>6.50</td>
<td>(2.47)</td>
<td>6.86</td>
</tr>
</tbody>
</table>

Notes:  
<sup>a</sup> Obtained as summary of 3 weeks preceding assessment. Max = 5.0  
<sup>b</sup> Adjectival rating adapted from McGill Pain Questionnaire (Melzack, 1975)  
<sup>c</sup> Mean of average weekly pain rating. Max = 10.0  
<sup>d</sup> Mean of pain incidence (occurrence days per week)  
<sup>e</sup> Self-report rating at conclusion of treatment. Max = 10.0
Figure 2: Plots of group means for average weekly pain rating and weekly incidence of pain over the 8 weeks of treatment.
to the average weekly pain ratings, it can be seen that the RBS
group changed from an initially higher mean pain rating at the
beginning of treatment to a relatively much lower mean pain
rating at the conclusion of treatment.

The EMG data for baseline and task measures provide some
objective corroboration for the self-report data, demonstrating
a significant overall change pre- to post-treatment (LR, approx.
$F(4,15) = 10.379$, $p = .0003$) and again showing no differences
between groups (LR, approx. $F(8,30) = 1.000$, $p = .457$). The
univariate tests show the baseline, static steadiness, and maze
measures to be reduced pre- to post-treatment ($F(1,18) = 15.184$,
$p = .0011$; $F(1,18) = 27.637$, $p = .0001$; and $F(1,18) = 7.477$, $p =
.013$, respectively). With the dynamometer task, no reduction
of EMG was evidenced ($F(1,18) = 2.598$, $p = .1210$), suggesting that
the tendency to clench when exerting physical pressure with the
hands is somehow harder to control or become aware of. No
group differences or interactions were evidenced for any of the
conditions (see Table XIV for means and standard deviations).
Analysis using range-corrected scores (Lykken, Rose, Luther,
& Maley, 1966), using maximum and minimum scores obtained for
each individual from the pre- and post-treatment assessments,
was used as an adjustment for individual differences of resting
EMG and range of response. As these results did not differ,
subsequent comparisons were made using the raw score data.

The above results demonstrate a reduction of EMG activity
under baseline and task conditions to accompany self-reported
improvement and dental data results. That the task conditions
TABLE XIV

Raw EMG means (and standard deviations) for treatment groups pre- (pre-Tx) and post-treatment (post-Tx)

<table>
<thead>
<tr>
<th></th>
<th>Dental/Physio. (n=7)</th>
<th>Relaxation/Stress (n=7)</th>
<th>TENS (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Tx</td>
<td>Post-Tx</td>
<td>Pre-Tx</td>
</tr>
<tr>
<td>Baseline</td>
<td>5.546</td>
<td>3.85</td>
<td>4.71</td>
</tr>
<tr>
<td></td>
<td>(2.793)</td>
<td>(0.88)</td>
<td>(1.38)</td>
</tr>
<tr>
<td>Static Steadiness</td>
<td>7.24</td>
<td>5.09</td>
<td>4.97</td>
</tr>
<tr>
<td></td>
<td>(2.374)</td>
<td>(1.71)</td>
<td>(1.67)</td>
</tr>
<tr>
<td>Mazes</td>
<td>6.40</td>
<td>5.54</td>
<td>4.07</td>
</tr>
<tr>
<td></td>
<td>(2.08)</td>
<td>(1.67)</td>
<td>(1.59)</td>
</tr>
<tr>
<td>Dynamometer</td>
<td>14.63</td>
<td>12.82</td>
<td>9.09</td>
</tr>
<tr>
<td></td>
<td>(7.60)</td>
<td>(6.89)</td>
<td>(8.01)</td>
</tr>
</tbody>
</table>

Note: All measures are µvolts integrated over 15-second intervals.
demonstrated a significant general EMG drop over treatment without group differences suggests that specific provision of biofeedback and a stress management emphasis did not yield any unique benefits over the more physically oriented treatments. However, effects attributable to "stress" were evidenced within the EMG assessment with respect to both baseline versus tasks and within-task conditions.

Comparison of the baseline measure to the mean of the three task conditions over all 21 subjects at pre-treatment yields a significant result ($t(20) = 3.035$, $p < .005$), suggesting a tendency to increased masseter activity during manual tasks that require concentration but little physical exertion. Two-way analysis of variance for the difference of the mean task and baseline measures over groups pre- to post-treatment demonstrate no group differences ($F(2,18) = 2.013$, $p = .161$) and no change over treatment ($F(1,18) = 0.163$, $p = .692$). This latter result reflects the general reduction of both baseline and task measures over treatment, but suggests the relative magnitude of the increased EMG of task conditions over baseline to persist post-treatment.

To assess response to increased difficulty and demands within a task condition, measures taken during completion of the static steadiness task were compared for the four largest holes versus the four smallest. This comparison was incorporated within a 3-way analysis of variance with groups and pre- versus post-treatment providing the other dimensions for comparison. The results of this analysis show significance only for the main
effects of hole size as increased EMG with the smaller holes ($F(1,54) = 11.421, p = .0015$), and reduction of overall EMG pre-to post-treatment ($F(1,54) = 26.636, p < .0001$). No group differences nor any interaction effects were evidenced. These results suggest increased demands for concentration and fine motor control tend to contribute to increased masseter activity, but that the overall activity can be reduced as a general result of treatment. Changing the task demands with the mazes test by setting shorter time limits did not result in increased EMG across those in-task conditions ($F(2,90) = .840, p = .438$), possibly because subjects did not substantially alter their rate of movement through the maze in the different conditions. The maze task did show a significant reduction of overall EMG pre-to post-treatment ($F(1,90) = 20.912, p < .0001$), with no group differences and no interactions, again suggesting the EMG reduction to be a general result of treatment (see Table XV for means and standard deviations).

Interestingly, no differences of EMG elevations of relative reductions over treatment were evidenced for the two groups discriminated on the basis of self-reported treatment outcome. Range-corrected scores (used to improve power for the contrast of interest) for the 6 subjects rating treatment outcome as poor ($\leq 5$ out of 10) were compared with a randomly-selected set of 6 subjects rating outcome as good ($\geq 8$ out of 10). These two groups did not differ over the basic set of EMG measures ($LR$, approx. $F(4,7) = 0.644, p = .648$), but demonstrated a significant overall change pre- to post-treatment
TABLE XV

Group means (and standard deviations) for the in-task conditions with static steadiness and mazes pre- (pre-Tx) and post-treatment (post-Tx).

<table>
<thead>
<tr>
<th></th>
<th>Dental/ Physio. (n=7)</th>
<th>Relaxation/ Stress (n=7)</th>
<th>TENS (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Tx</td>
<td>Post-Tx</td>
<td>Pre-Tx</td>
</tr>
<tr>
<td><strong>Static steadiness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large holes</td>
<td>6.59</td>
<td>4.65</td>
<td>4.40</td>
</tr>
<tr>
<td></td>
<td>(3.26)</td>
<td>(1.78)</td>
<td>(1.87)</td>
</tr>
<tr>
<td>Small holes</td>
<td>7.54</td>
<td>5.63</td>
<td>5.49</td>
</tr>
<tr>
<td></td>
<td>(2.30)</td>
<td>(2.08)</td>
<td>(2.17)</td>
</tr>
<tr>
<td><strong>Mazes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No time limit</td>
<td>6.28</td>
<td>5.48</td>
<td>4.17</td>
</tr>
<tr>
<td></td>
<td>(2.28)</td>
<td>(1.55)</td>
<td>(1.56)</td>
</tr>
<tr>
<td>60 sec.</td>
<td>6.49</td>
<td>5.38</td>
<td>4.05</td>
</tr>
<tr>
<td></td>
<td>(2.35)</td>
<td>(1.67)</td>
<td>(1.59)</td>
</tr>
<tr>
<td>30 sec.</td>
<td>6.41</td>
<td>5.78</td>
<td>4.01</td>
</tr>
<tr>
<td></td>
<td>(2.61)</td>
<td>(1.97)</td>
<td>(1.76)</td>
</tr>
</tbody>
</table>
(LR, approx. $F(4,7) = 4.702, p = .0362$) with no interaction effect. This result suggests that although EMG reduction accompanies treatment response in general, it does not appear to accompany any differential perception of (or report of) treatment success. This implies some discrepancy of objective results with subjective evaluation, either good or poor; this will be returned to in the Discussion.

A further assessment of treatment effectiveness was provided by a three-month follow-up period, during which subjects may have elected to seek further treatment. Analysis of the tendency for group membership to aid prediction of the desire to seek further treatment within three months of treatment conclusion suggests no relationship to exist ($X^2(2) = 1.72, p > .25$). However, the result may derive from small numbers. Three of 7 individuals completing the Dental/Physiotherapy program sought further treatment within three months; the same result was obtained for those completing the TENS program; while only 1 of 7 completing the Relaxation/Stress program sought further treatment.

**Assessment Issues:**

Two of the dependent measures utilized in assessing treatment have been seen to be problematic: dental ratings of pain to palpation, and EMG measures. Dental ratings of pain to palpation, used here, achieved a reliability coefficient of .68 when raters were compared on the basis of average ratings over 7 muscle groups assessed. This measure is thus accounting for only some 46% of the possible variance between raters in
assessing pain to palpation (i.e., assuming a linear relation of raters 1 to 2). However, no systematic bias was apparent for the ratings obtained at post-treatment, compared either as one rater versus the other within a total sample of ratings ($z = 0.133, p > .10$) or specifically as blind rater versus the other ($\chi^2(4) = 7.53, p > .10$). These results suggest that there was no systematic contribution to the ratings which would serve to inflate or eliminate group differences. It is still to be considered, however, that the overall weakness of inter-rater reliability makes the measure of questionable utility. If it was of particular interest to follow sensitivity of certain muscle groups to assess change over treatment, some other method or means of standardizing such methods must be found, as the reliability obtained here for muscle-by-muscle pain ratings approximated only .22.

Similarly, EMG measures have been seen to be victim to high variability, both across individuals and within individuals across time. Of interest here was the possibility of reducing the variance of these measures with the introduction of task conditions assumed to elevate masseter activity. In particular, did the tasks elevate activity over baseline, and did this have the effect of reducing the overall variability? As reported, the tasks did have the effect of elevating masseter EMG over baseline levels ($t(20) = 3.035, p < .005$). However, if one may consider relative variability in terms of the proportionate magnitude of the variance to the mean for the measures, it would not be concluded that the tasks contributed to any reduction in variability (baseline: $SD/M = 41.3\%$; tasks: $SD/M = 70.3\%$), but
conversely, appear to elevate it (results based on raw scores at pre-treatment assessment). It may be noted, however, that the variability obtained did not preclude demonstration of differing levels between baseline and task conditions, or reductions with treatment. An advantage here was the use of equal group sizes, although none of the analyses suggested the group variances to be significantly different.

Psychometric Interests:

The inclusion of the SCL-90-R was provided primarily in the interests of assessing its utility in predicting treatment outcome; however, it also affords assessment of some personality variables of interest with the MPD population and assessment of change of these variables over treatment. As outlined previously, the variables of interest are somaticism, obsessive-compulsive features, depression, anxiety, and hostility. At pre-treatment, the mean profile for all subjects suggests this group to demonstrate considerable elevations on these variables relative to the non-patient female population used for standardization of the test. Overall group mean results ranged from the 84.9%ile on depression to the 90.7%ile for somaticism (see Table XVI for summary of group mean results pre- and post-treatment). The treatment group profiles did not differ on these variables (LR, approx. \( F(12,24) = .414, p = .94 \)).

These measures evidenced a significant drop overall from pre- to post-treatment (LR, approx. \( F(6,13) = 3.79, p = .021 \)), with notable reductions on somaticism (\( F(1,18) = 24.0, p = .0001 \)) and depression (\( F(1,18) = 15.26, p = .001 \)) and relatively more
TABLE XVI

<table>
<thead>
<tr>
<th>Groups</th>
<th>Somaticism</th>
<th>Obsessive/Compulsive</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Hostility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Tx</td>
<td>Post-Tx</td>
<td>Pre-Tx</td>
<td>Post-Tx</td>
<td>Pre-Tx</td>
</tr>
<tr>
<td>Dental/Physio.</td>
<td>64.</td>
<td>60.6</td>
<td>63.</td>
<td>55.6</td>
<td>62.1</td>
</tr>
<tr>
<td></td>
<td>(91.9)</td>
<td>(85.5)</td>
<td>(90.3)</td>
<td>(71.2)</td>
<td>(88.6)</td>
</tr>
<tr>
<td>Relax./Stress</td>
<td>60.6</td>
<td>56.2</td>
<td>60.6</td>
<td>54.2</td>
<td>58.8</td>
</tr>
<tr>
<td></td>
<td>(85.5)</td>
<td>(73.2)</td>
<td>(85.5)</td>
<td>(66.3)</td>
<td>(81.1)</td>
</tr>
<tr>
<td>TENS</td>
<td>65.</td>
<td>60.3</td>
<td>60.9</td>
<td>59.6</td>
<td>60.</td>
</tr>
<tr>
<td></td>
<td>(93.3)</td>
<td>(84.9)</td>
<td>(86.2)</td>
<td>(83.2)</td>
<td>(84.1)</td>
</tr>
<tr>
<td>Overall</td>
<td>63.2</td>
<td>59.2</td>
<td>61.5</td>
<td>56.5</td>
<td>60.3</td>
</tr>
<tr>
<td></td>
<td>(90.7)</td>
<td>(82.1)</td>
<td>(87.5)</td>
<td>(74.2)</td>
<td>(84.9)</td>
</tr>
</tbody>
</table>
conservative reductions of the obsessive-compulsive ($p = .017$), anxiety ($p = .0348$), and hostility ($p = .028$) mean scores. These results corroborate the self-report data and reflect symptomatic reduction and reduced depressive preoccupations or concern with pain, as may be inferred from the relative reductions of the Somaticism and Depression scales.

With respect to treatment outcome predictions, mean score results for the 5 variables of interest at pre-treatment were compared for the 2 groups formed on the basis of treatment evaluation ratings at post-treatment categorized as good or poor. As previously outlined, these evaluations were dichotomized as good being a rating of 8 or greater out of 10 (10 being complete relief) and poor being a rating of 5 or less. The variables used provided no discrimination of these groups ($\chi^2(5)$ test of 1st discriminant function, $p = .347$).

This two-group discrimination was also assessed with respect to the set of variables used to determine pre-treatment status of the treatment groups — age, problem duration, jaw limitation, EMG baseline, adjectival pain rating index, and treatment expectation. This analysis yielded a rather anomalous result, which may be of interest for further research. Although the first discriminant function criterion was not significant ($p = .231$), the weighted linear combination of scores provided a non-overlapping classification of the good and poor treatment outcome groups. The anomaly may be assumed to arise from small group sizes ($n's = 6$), but the nature of the effect is not clear. The effect may be insufficient power to obtain a significant
criterion, or the apparently perfect discrimination may be merely a spurious result of the subject to variable ratio.

Assessment of the I.E. locus of control scale yielded no significant results over treatment or with respect to treatment groups, or groups dichotomized on the basis of treatment evaluation. Data obtained for the MHLC scale demonstrated no changes of scores pre- to post-treatment.

Comparison of groups formed on the basis of occlusal status (see Table VIII, p. 48) as those rated either good or fair (n = 8) versus a random selection of 8 subjects rated poor showed no significant differences with respect to outcome as assessed by dental evaluation, self-report indices, or EMG assessment (LR, approx. \( F(2,13) = 2.48, p = .12 \); approx. \( F(4,11) = .84, p = .53 \); approx. \( F(4,11) = 1.49, p = .27 \), respectively). These results are consistent with previous reports (e.g., Green, 1979; Laskin, 1979; Yemm, 1976) proposing that occlusal characteristics appear to show no consistent relationship to the MPD complaint or to treatment method or outcome.
DISCUSSION

The results obtained demonstrate significant overall effects for the 3 treatment programs with respect to the dental assessment of pain and jaw limitation, self-reports of pain remission, and the reduction of masseter EMG in both baseline and task conditions. Differential effects of the treatments were suggested only from the weekly self-report symptom monitoring as a greater reduction of the incidence of pain for both the Dental/Physiotherapy (DPT) and Relaxation/Biofeedback/Stress (RBS) groups as compared with the Transcutaneous Electrical Nerve Stimulation (TENS) group, and a significantly greater relative reduction of mean pain severity ratings over the course of treatment for the RBS group. No other differential effects were evidenced across the treatment groups, suggesting that, in general, all the treatments provided were essentially equally effective in providing symptom relief. As a controlled comparison of 3 different treatments representing 2 orientations to the problem, factors potentially contributing to these results are of particular interest.

The treatment programs were designed with the intentions of both providing representation of typical dental and psychological programs, and attempting to discriminate between physical and psychological orientations. The basis of such discrimination is founded with the relevant areas of expertise; however, some overlap in dental programs with psychological orientations to stress effects and tension, as in the prescription of anxiolytics and attention to "counselling," has been
suggested in the literature reviewed. For this reason attention was paid to the exclusion of specific references to life stress effects or relaxation techniques in the DPT and TENS groups. Thus, the intention was to provide a comparison of treatment oriented to the physical aspects assumed etiologically primary (malocclusion) with treatment oriented to the psychological aspects considered important (stress). After review of the treatment programs and implications of the results and characteristics of the subject population, focus will be brought to this comparison.

The DPT program may be seen to be representative of conservative interventions oriented to the physical aspects of MPD — the provision of a dental splint to offset the effects of any occlusal abnormalities, and physical rehabilitation of the muscles of mastication. Similarly, the RBS program may be seen to be representative of interventions currently emphasized oriented to the psychological aspects of MPD — the provision of relaxation training, masseter biofeedback, and stress management. The TENS program represents a minimal treatment intervention utilized as a baseline for comparison.

The TENS program may be seen as essentially a placebo intervention in the assumption of providing minimal active relief at best (however, the therapeutic parameters of TENS are apparently unclear and would warrant further systematic research). Placebo treatments of various sorts have been utilized as treatment control comparisons and have served to indicate that remission of symptoms can be obtained through
assumed "nonspecific" effects. However, it is not to be assumed that placebo interventions provide a choice for treatment. Service providers in care facilities are hesitant to utilize "inert" treatment programs for patients seeking treatment, particularly with chronic pain. As the interests of this study were to evaluate the relative efficacy of different treatment approaches to the management of MPD, TENS was chosen as a "minimal" treatment intervention serving the purpose of a baseline for comparisons with the more treatment-intensive programs of dental splints/physiotherapy and stress management/relaxation training. The TENS program provided physical treatment in that it may be assumed to have provided at least transient disruption of pain. The at-home "rest" component served to counter at-home assignments provided with the other two treatment programs. The rest component may also have provided for spontaneous relaxation effects as well as time for introspection and consideration of symptom patterns identified by self-monitoring more specifically pursued with the RBS program. It was seen that subjects had equivalent perceptions of all treatment programs in terms of expectations for success and therapist evaluations.

The clusters of data obtained for treatment evaluation afford several contrasts of interest. Comparison of subjective versus objective results can be obtained from the self-report measures and dental and EMG assessments. The apparent absence of differences between the groups distinguished as Good versus Poor treatment response also reflects on the subjective versus
objective comparison. Contradictory results with respect to the effectiveness of the RBS program may be seen in that there is a collection of circumstantial evidence suggesting some superiority of this treatment over the others, whereas, in other respects, particularly the EMG measures, the RBS program is seen to provide no special benefits. Also, within-task stress effects (EMG elevations) and changes of EMG levels over treatment raise other points of interest to the treatment comparisons pursued here.

Overall, there is general concurrence of significant symptom remission by self-report and by dental evaluation and EMG measures across all treatments: pre- to post-treatment, suggesting that self-reported remission of pain is accompanied by reduced limitation of opening of the mouth and sensitivity to palpation, and by a general reduction of masseter EMG activity. There was, however, no apparent systematic relationship of these measures in the overall subjective evaluation of treatment success. In the interests of ascertaining what measures may show differences or differential changes for the two groups formed on the basis of the post-treatment summary evaluation as Good (≥ 8 out of 10) or Poor (≤ 5 out of 10), it became apparent that there were no differences for these two groups on any of the measures assessed. The relative utility (and validity) of global self-report measures, as compared with the more immediate measures provided by daily symptom monitoring, is brought into question by these comparisons. Furthermore, from the self-report data, overall treatment changes were
evidenced from the weekly reports of daily symptom monitoring, but no changes were obtained with the global summary measures of worst pain or the pain rating index taken only at the pre- and post-treatment assessments. These results reflect the value of obtaining systematic symptom reports over the course of treatment in providing more accurate records of symptom status for treatment evaluation.

In following the weekly reports over the course of treatment, it was apparent that most change occurred in the first 3 weeks of treatment. If it is to be argued that the treatment programs were too brief to provide maximal benefits, then it must be assumed that a plateau of effects had been reached and was not overcome in the latter 4 weeks of treatment. It may be of interest for further research to compare the relative efficacy of longer treatment periods.

Implications for the superiority of the RBS program were evidenced in the weekly symptom reports and suggested by relatively better maintenance of effects over the 3-month follow-up. The reported average pain ratings and pain incidence over the course of treatment indicated the RBS group to have had an initially relatively higher rating of pain and to have moved to a relatively lower rating—a significant change over the course of treatment as compared with the ratings for the other two programs. With respect to pain incidence, the RBS and DPT groups evidenced significant reductions, whereas the TENS group showed no change. It is unclear, however, as to what aspects of the RBS program may be considered most important for these
benefits. It would appear that the provision of biofeedback of the masseter EMG provided no particular benefits, as no differential effects across groups were evidenced with respect to overall EMG changes pre- to post-treatment, mean task versus baseline EMG levels, or within-task EMG elevations at pre- or post-treatment. All comparisons, with the exception of the dynamometer, showed generalized EMG reductions pre- to post-treatment, but no group differences. No changes were evidenced with the dynamometer task, suggesting that the tendency to clench the teeth when exerting manual pressure is a habit that is most resistant to change. The RBS program may differ in providing a specific and focussed orientation to the implications of stress effects in the creation of pain as a result of muscle tension, and the provision of relaxation training to offset stress effects by minimizing tension and so preventing pain. This strategy may have served to reduce the incidence and severity of pain and potentiated better maintenance post-treatment as an active strategy engaged by the subject. However, the evidence for differential effects is sparse, and obtained treatment changes need also to be considered in the broader context of the overall effects obtained.

Overall, the results obtained are consistent with the model of muscle hyperactivity as being responsible for pain, but the mechanisms by which hyperactivity and/or the report of pain are being reduced would appear to rely on non-specific effects. No consistent pattern of effects is apparent by which one treatment approach can be seen to be more appropriate or
effective than another. Aspects of the subject population obtained may reflect further on these results, and may contribute toward the development of a coherent body of knowledge for treatment of TMJ and MPD syndromes.

Of interest is the number and nature of persons meeting the criteria of MPD specified in this study. Approximately 25.8% of all new patients screened through the Oral Medicine Clinic between September of 1971 and October of 1982 were seen as appropriate. Relative to initial expectations of available subjects and the presumed incidence of MPD, the proportion obtained is somewhat low. However, the relative return may be seen to be quite favourable in comparison with other reports, as will be explained shortly. The low absolute numbers procured raise two general issues of interest—one statistical, and the other methodological.

In the statistical realm, low numbers of observations (subjects) mean low power for tests. This study was in the unfortunate position of having no real recourse to the recruitment of significantly more subjects than those already obtained, and, as no calculation exists for the determination of power with multivariate analysis of variance, the actual power of these analyses with respect to the demonstration of differential treatment effects can only remain in doubt. It can only be argued that, given that the number of subjects exceeds the number of variables for any given analysis, where significant effects are obtained, such results are not trivial. It remains debatable, however, as to whether a fair test of treatment
differences has been achieved in consideration of the fact that the probability of failing to identify differences where differences actually exist may indeed be quite high.

With respect to methodology, the issue is diagnostic assessment. From the literature reviewed, there is a conspicuous absence of comparative information as to the relative proportions of subjects screened meeting MPD diagnostic criteria, and an apparent inconsistency in how those criteria are described (refer back to Table II). Stenn, Mothersill, and Brooke (1979) provided the most detailed information and reflect the difficulty of obtaining subjects for study, their relative return being approximately 4% of 274 subjects screened, although approximately 70% met their criteria of MPD. Moss et al. (1982), in a review of the literature, reported the incidence of facial pain obtained from two studies reporting that information to be about 5% of the symptom populations screened.

Inconsistent diagnostic criteria and inadequate specification of subject populations have obvious implications for the development of accurate comparative data across studies. As suggested by Moss et al. (1982), clarification of issues regarding MPD and TMJ dysfunction may be facilitated by more consistent use of a specific classification scheme incorporating conjunctive sets of criteria rather than the commonly-used disjunctive scheme requiring only the presence of some one or more of the basic criteria. Such disjunctive schemes may provide more subjects, but serve to obscure variables of interest across studies. The use of better discriminative labels based
on the presence of specific symptoms appearing alone or in specific combinations would allow for more clear comparisons to be made between studies. Such clarification would contribute to the identification of subgroups within TMJ dysfunctions for which better directed treatment recommendations could be made, based on the understanding of symptom patterns and subject characteristics which may be more or less problematic to particular treatment orientations. The representativeness of subjects obtained with respect to the problem population presumed to be identified must be made clear. Further research is required in order to discern whether specific treatments can be expected to be more effective in the long run with more narrowly defined populations as compared with more comprehensive programs treating broader groups.

In consideration of the foregoing, it is of interest to review the characteristics of the subjects obtained for this study. The ratio of females to males for all subjects considered appropriate for this study was 10:1. Of the 3 males seen, 2 refused to enter the program on the basis of time constraints and the third did not appear for treatment. Thus, all the subjects completing the program were female. Given that there was no particular intention to restrict males from this research, the obtained representation of the sexes is notable in far exceeding the 4:1 ratio of females commonly referred to in the literature. The significance of this discrepancy is unclear, but may be of interest to subsequent research. The implications of stress effects and the possibility of differential impact on
the sexes is an area of apparent conjecture; however, it is clear that there is an increased tendency for females to seek treatment in general (cf. Weissman & Klerman, 1977, pp. 101-102).

With respect to age and occupation, the subjects fall within profiles obtained in other studies, with predominance of the 20 to 40 years age group and a marked tendency to professional and skilled work pursuits (see Table IX). Background variables obtained from assessment suggest a general awareness of dysfunctional oral habits (90.5%) and a frequent acknowledgment of an exacerbating role of tension and stress (90.5%) (see Table VII). It may be assumed that these variables would contribute to the facilitation of treatment success, particularly with psychologically oriented treatment emphasizing stress management. Occlusal characteristics of the sample show approximately 38% to have good or fair dentition and occlusion, while 62% demonstrate some abnormality. The distribution of these characteristics among the treatment groups mitigates against the importance of occlusion in MPD. The large proportion of subjects with poor occlusion in the Stress/Relaxation program would be expected to reduce the likelihood of successful treatment; however, no such reduction of effect was evidenced. Similarly, the relatively high proportion of subjects in the Dental/Physiotherapy program with good or fair occlusion would be expected to benefit less from an occlusal splint; however, there was no apparent decrement to evaluations of treatment success. It may be argued that these two effects operated in parallel to bring both treatments to a common level of
mediocrity, but the overall assessment of treatment effects would appear to counter this line of reasoning.

Another factor at work is the duration of the pain problem, which was seen to range from 6 months to 10 years, with a mean duration of 3.3 years. Longer pain histories were seen to correlate with low expectations for treatment success. It does not appear to be that longer problem durations necessarily include more experiences of failure with previous treatments; previous treatment did not correlate with treatment expectations; moreover, problem duration did not correlate with subjects' final evaluations of treatment success. Thus, although problem duration would appear a likely candidate mitigating against treatment response, it does not appear to play a significant role.

From the foregoing relationships of subject characteristics, the results obtained from psychometric assessment are of interest. The average profiles from assessment with the SCL-90-R suggest, in comparison with the non-patient female standardization sample, the identified MPD population obtained here to experience considerable psychological distress arising from the perception of bodily dysfunction; have recurrent unpleasant thoughts; express loss of interest, hopelessness, and tendencies to self-blame and worry; experience nervousness, fearfulness, tenseness, and autonomic arousal; and express tendencies to irritability and hostile urges. This profile is in accord with previous suggestions characterizing the TMJ population as tending to somatic complaints, anxiety,
nervousness, and worry. Inconsistency in previous literature may result from inconsistency in defining the populations; however, it remains to be seen whether the profile obtained here may be replicated with a similarly defined group.

The profile obtained here is consistent with impressions of MPD patients as preoccupied with and distressed by their pain symptoms and may suggest that it is this interactive style that contributes to the generation of a chronic problem. A cyclic mechanism may be envisioned whereby clenching and pain are initiated and maintained through a tendency to be hyperreactive to environmental stressors, clenching the teeth in response to stress (arousal, concentration, goal-oriented activity), and being further stressed and hyperreactive to pain resulting from the excessive activity of the jaw muscles.

The average profiles showed a significant reduction overall from pre- to post-treatment with no group differences, suggesting that, in general, remission of pain symptoms was accompanied by reductions of these various psychological concerns. This result further implicates the role of pain as contributing to psychological distress and a possible reciprocating relationship. However, at post-treatment, the relative scale profiles still suggest moderate elevations as compared with the standardizing sample, implying a relatively stable nature of the aforementioned characteristics in the sample population.

Changes pre- to post-treatment for the two groups formed as Good or Poor outcome showed no differential effects, so
rather than providing some explanation of differential perceptions of treatment as identifiable characterological differences, this result merely concurs with the absence of any other differences for the two groups so defined. Furthermore, comparison of the Good versus Poor outcome groups for the pre-treatment profiles on the SCL-90-R suggested no discrimination for prediction. It does not appear that the SCL-90-R as used here provides a discrimination of outcome as was obtained by Schwartz (1974) with the MMPI. Unfortunately, too few subjects were obtained to allow pooling of variables to assess more systematically what measures may contribute most to good response to and evaluation of treatment. Similarly, it would be of interest to assess differential measures for good versus poor response within each treatment and across treatments in order to develop a pre-treatment assessment allowing differential treatment assignments which may improve overall rates of success.

With respect to the comparison of physically versus psychologically oriented treatments, it would appear that no particular advantages were afforded by the treatment programs used here, but that the basis of treatment response may be seen to be psychological and most appropriately summarized as due to "non-specific effects." Overall, it may be considered that the largest contribution to treatment effects derives from providing subjects with a specific diagnosis and a treatment program presumably specifically designed to provide relief. Essentially, labelling what was a disturbing problem of uncertain origins (e.g., it is not some degenerative disease such as cancer or
arthritis) and obtaining even transient relief through treatment may provide sufficient psychological relief to interrupt a self-maintaining pain cycle, i.e., removing a straw and saving the camel's back. Any insights gained through treatment toward self-management of the problem as from symptom monitoring or specific exercises either from physiotherapy, relaxation training, or mere rest periods, serve to potentiate continued relief.

The results of this study suggest it is not reasonable to pursue irreversible and potentially damaging physical interventions, such as grinding of the teeth to effect equilibration of the bite. Similarly, other more radical interventions should not be entertained before attempting basic conservative manipulations. It would appear that a short-term treatment program educating the patient as to the nature of the problem and strategies for self-management would provide relief for many.

At basis, it is suggested that the treatment effects seen derived through psychological adjustment resulting from the development of awareness of the nature of the problem and the provision of strategies, even nebulous or vague ones, for intervention. The response to the TENS program was comparable in most respects (i.e., dental measures, self-report, and SCL-90-R constructs) with response obtained with the Dental/Physiotherapy and Relaxation/Stress programs, despite showing no reduction of the daily incidence of pain and only minimal change of pain ratings. This suggests that the more treatment-intensive aspects of these programs are less important than the
development of awareness of pain patterns as may be obtained from self-monitoring and some means of effecting at least transient disruption of pain. However, it is also suggested that the provision of more specific strategies for self-management may potentiate longer-lasting treatment effects (although differential rates of seeking further treatment during follow-up did not reach significance). If relative cost-effectiveness is to be considered with respect to expenses to the patient (or medical coverage) monetarily and the therapist temporally, the utility of dental splints or biofeedback training may be debatable.

Some alternative explanations which may qualify the obtained results have already been suggested, most notably the size of the treatment groups. Another issue mitigating treatment success may have been the duration of the programs. However, as the interest was the comparison of relative effectiveness for programs of equal duration, and notable effects were achieved overall, it may be concluded that the programs were sufficient for most, but that longer treatment may be required for a problematic few. This issue is a focus for differential assessment for identification at pre-treatment, or may be dealt with by conducting treatment until some criterion for symptom remission has been reached. The impression is that those less responsive to the treatments offered here may gain more from cognitively oriented psychotherapies of longer duration.
SUMMARY.

Twenty-one subjects (representing 16.4% of 128 subjects screened) were obtained for the purposes of this study. All were female, and their demographic profile concurs with previous studies as a predominant representation of the 20 to 40 year age group and a tendency to professional or skilled labour.

Dental assessment of pain to palpation and measure of jaw opening showed significant response overall to treatment and no-treatment differences. Self-report pain ratings and pain incidence showed significant overall reductions and suggestion of some treatment differences, in that the Dental/Physiotherapy and Relaxation/Stress programs demonstrated better reductions of pain incidence and the Relaxation/Stress program demonstrated the best reduction of weekly mean pain ratings. EMG measures showed significant overall reductions pre- to post-treatment with no differential treatment effects. Equivalent treatment expectations and therapist ratings were achieved across treatments. At 3-month follow-up, 42.9% of both the Dental/Physiotherapy and TENS programs had been found to seek further treatment, while 14.3% of the Relaxation/Stress program did so.

Dental assessment of pain to palpation evidences questionable reliability of ratings, obtaining a coefficient of .68 for mean pain ratings over 7 muscle groups and a coefficient of .22 for specific muscle ratings. EMG response to task conditions demonstrated significant elevations over baseline levels reflecting suggestions in previous reports of a tendency in the MPD population to respond to tasks ("stress"—concentration,
frustration, anxiety) with increased masseter activity. Overall elevations showed a general reduction pre- to post-treatment, but the increased EMG of tasks relative to baseline persisted post-treatment. No differential treatment effects were evidenced.

Assessment with the SCL-90-R reflected scale elevations for group mean scores relative to a standardizing non-patient female sample. Treatment effects overall showed a reduction of these scores but no differences among treatments. This instrument did not provide discrimination of Good versus Poor treatment outcome. The Internal-External locus of control did not contribute to assessment. Selected variables used to assess pre-treatment status may be of further interest toward the prediction of poor treatment outcome.
CONCLUSIONS AND RECOMMENDATIONS
FOR FURTHER RESEARCH

There is an apparent need to improve the specificity of criteria and to report accurately the criteria used in the diagnosis of MPD in order to allow more meaningful comparison of research studies. Also, better reporting of subject characteristics with respect to the problem history, such as duration of the problem, previous treatment, identification of oral habits, association of stress effects, and occlusal status, would contribute to better understanding of the problem and ultimate treatment recommendations.

The implications of the high female ratio in treatment populations has not been adequately addressed. This ratio may derive from an increased tendency of females to seek professional advice and treatment in contrast to a tendency for males to "grin and bear it." Another explanation may be increased effects of stress on females relative to increasing roles in demanding jobs, and conflict with the perceptions of more traditional female roles. Such aspects require further research.

Treatment effects with the population seen here may be attributable to the reduction of stress associated with uncertainty about the nature of the disorder and the provision of some reduction in the frequency of episodes of muscle hyperactivity contributing to pain. Such reduction may derive through development of awareness of temporal patterns of pain and transient disruption of the perception of pain. It is
concluded that the most cost-effective treatment may result from TENS applications, which can be time-efficient for the therapist, and the provision of relaxation training with targeting to stressful stimuli identifiable through self-monitoring, and administered by para-professionals at less cost to the patient.

Further research in this area should focus on the identification of patients who may be predicted to be more problematic or likely to poor outcome with the more time-efficient conservative programs. Such identification would facilitate more cost-effective treatment by differential treatment assignments at the outset of treatment rather than after a course of unsuccessful programs. Based on assessment, treatments for such individuals may ultimately fall into longer-term psychologically oriented programs or pharmacotherapy. Variables used in the assessment of pre-treatment status for this study may be of use for further research.

Similarly, the implications of differential results from psychometric assessment, and of changes in response to treatment, are of interest to the development of differential treatment recommendations. Such research will require extensive and systematic comparisons over differentiated diagnostic groups and treatment programs before accurate characterization of the TMJ and MPD syndromes can be achieved.
REFERENCE NOTES

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APPENDIX 1

INTRODUCTION TO THE TREATMENT MANUALS

TREATMENT MANUAL FOR PROGRAM A (DPT)
INTRODUCTION TO THE MANUALS

The therapist manuals have been prepared with the intention of providing guidelines for the format and content of the respective treatment programs in the interests of maintaining standardized presentation and maximal distinctiveness between the programs. The programs are:

1) the Dentistry-Physiotherapy program, in which the emphasis is on physical interventions utilizing splints and exercises which are presented to the subjects as active treatments of which they are passive recipients. In this therapy, things are done to the patient to improve his symptoms;

2) the Relaxation Training-Stress Management program, in which the emphasis is on the recognition of psycho-social stressors and the use of relaxation training as a strategy to offset the impact of such stressors. These therapies are presented to the subjects as treatments of which they are active recipients—things provided for the patients which they use to improve their symptoms; and

3) TENS and "rest," which is provided as a minimal treatment intervention in order to establish a baseline condition for treatment comparisons.

It is not the intention to provide "scripts" for anticipated dialogues, but to outline the content and format for the presentation of each program for the purposes of standardization.

Potential problems have been addressed and sample responses
provided to indicate the tone and strategy which may be adopted. Other problems not specifically mentioned may arise; however, the basic response strategies should remain the same.
DENTAL PROTOCOL:

Session 1
1. Fitting of the splint
   a. Bite adjustments are made using articulating paper and drill with acrylic burrs.
   b. The splint will create even contact bilaterally when the teeth are brought together and allow smooth glide from side to side.
   c. Splints will fit on the lower arch.
   d. Splints will be worn both during the day and at night with the exception of:
      i. cleaning the splint
      ii. eating
      iii. for one 4-hour period during the afternoon
      iv. for any social or business reasons (these to be recorded by the patient)
   e. Splints are to be cleaned with toothpaste and toothbrush.

2. To physiotherapy.

Sessions 2 and 3 — physiotherapy

Session 4
1. Check occlusion on splint, readjusting as necessary to continue equal contact bilaterally and free glide side to side.

2. To physiotherapy.
Session 5 — physiotherapy

Session 6

1. Check splint as in Session 4.
2. To physiotherapy.

Session 7 — physiotherapy

Session 8

Physiotherapy, completion of treatment ratings, and reminder to make appointment for post-treatment assessment.

Note: The splint used was a lower acrylic appliance covering all the posterior teeth on both sides and connected by a stainless steel lingual bar.
Session 1 — patient first attends Dentistry for fitting of occlusal splint.

1) Introduction of patient to therapist and program.
Explanation of program — i.e., is research program to evaluate different treatment approaches for jaw pain.
The program is designed to cover 8 weeks.
The patient is asked to attend for this 8-week (or 8-session) period.
If further treatment is required at the end of the program, this will be arranged.
Answering any questions the patient may have concerning the program.

2) Explanation of the treatment program:
   a) Emphasizing the nature of the problem in physical terms — i.e., the problem being spasm (increased tone) of the muscles of mastication.
   b) Defining the aims of treatment — i.e., to decrease spasm (normalize tone) thereby decreasing pain and improving range of motion.
   c) Discuss the modalities to be used and the reasons for using them — i.e., heat/ice, postural exercise.
   d) Discuss the importance of static and dynamic posture of the head and neck especially; and the close relationship of the muscles of the neck and jaw. The patient must understand that direct
exercise to the jaw will not be started immediately — i.e., that initial treatment will focus on posture and swallowing patterns, and that active exercise to the jaw will not be included until later treatment. All these factors are included with the aim of decreasing muscle spasm.

3) Completion of treatment expectation form by the patient.

4) Assessment of the patient:

— The physiotherapist will have a photocopy of the examination form filled out by the dentist. This will be reviewed prior to seeing the patient in order to avoid duplication in the examination. The physiotherapist's examination will consist of:

a) Review and confirmation of the history with the patient.

b) Postural evaluation of the patient in standing and sitting. This will include a description of head position, shoulder levels, iliac crest levels, and thoracolumbar curves.

c) Measurement of range of motion of the jaw, noting any limitations of range or accompanying pain.

d) Measurement of cervical range of motion, noting any limitation of range or accompanying pain. The ability or inability of the patient to take his neck into axial extension will be noted, as will swallowing patterns.

e) Questioning the patient re: sleeping positions.
5) Education of the patient re: avoidance of painful activities; detailed explanation of which activities to avoid: e.g., yawning, eating hard foods, chewing gum.

6) Application of heat/ice (20-30 minutes).
Instruction in home use of heat/ice to be carried out at least twice a day.

7) Review recommended sleeping positions.

8) Supply patient with information sheet hand-out.

9) Supply and provide explanation of the weekly symptom report, stressing the need to fill in each day to maximize accuracy. Point out recording of "pills for pain" and clarify that the subject is asked to refrain from using pills so as not to mask treatment effects, but if they feel they must use pills, then the number and type of pill is to be recorded.

Sessions 2 and 3

1) Brief subjective and objective reassessment:
   — collect symptom report and review
   — remeasure jaw range of motion

2) Brief review of instructions from first treatment session:
   — check home use of heat/ice
   — check sleeping positions
   — check avoidance of painful activities

3) Application of heat/ice

4) Teach axial extension exercise for the neck with patient supine, and explain rationale (postural correction)
   — instruct patient to do this at least twice daily at home.
5) Check tongue position and swallowing patterns with patient sitting, with neck in neutral and in axial extension.
   — if okay, note and leave;
   — if not, instruct in correct tongue position and home practice of this. (For tongue strengthening exercises, patient should practice 6 times a day — 6 repetitions.)

6) Supply patient with information hand-out.

Session 4 — patient first attends Dentistry for check of occlusal splint.

1) Brief subjective and objective review:
   — collect symptom questionnaire
   — remeasure jaw range of motion

2) Brief review of instructions from treatment session 3.

3) Check axial extension exercise in supine.

4) Teach axial extension exercise in sitting (review rationale with patient: i.e., effect of forward head position on postural muscles and pain)
   — patient to utilize this in correcting posture on ongoing basis

5) Review tongue position and swallowing pattern:
   — re-educate as necessary
   — patient to practice this at home on ongoing basis.

6) Application of heat/ice.

Session 5

1) Brief subjective and objective review:
   — collect symptom questionnaire
   — remeasure jaw range of motion
2) Review of postural correction in sitting and standing. Review of tongue position and swallowing patterns with neck in axial extension. Pelvic tilt if necessary.

3) Application of heat/ice.

**Session 6** — patient first attends Dentistry for check of occlusal splint.

1) Brief subjective and objective review:
   - collect symptom questionnaire
   - remeasure jaw range of motion.

2) Review total home program:
   - sleeping positions
   - posture
   - swallowing patterns
   - tongue position
   - home exercise

3) Application of heat/ice.

4) Add active jaw opening and closing:
   - to be done within pain-free range
   - to be done at home 6 times each, 6 times daily.

**Session 7**

Repeat treatment program of Session 6, patient does not attend Dentistry first.

**Session 8**

1) Subjective and objective review:
   - collect symptom questionnaire
   - perform complete reassessment.
2) Review home program.
3) Application of heat/ice.
4) Answer any questions from the patient; arrange any necessary follow-up.
5) Completion of treatment evaluation and therapist ratings with envelope provided for confidentiality.
6) Remind client to schedule post-treatment assessment through Department of Oral Medicine — Dentistry.

PROBLEM CONSIDERATIONS

Program A — Dental/Physiotherapy

The basic strategy for response to inquiries or complaints that are problematic (with respect to maintaining the integrity of the treatment distinctions for the purpose of this study), such as: "The program is not helping; what should I do?" "Are there other treatments I could try?" or complaint of increased stress perception and associated pain — is to listen, be supportive, and redirect the subject to the treatment rationale and the need to allow the treatment time to be effective, i.e., that the treatment is effective and the program is planned for 8 weeks.

Thus, allow the subject to voice their complaint and then respond with a statement such as:

"Yes, I can understand that it must be difficult for you but you do need to give the treatment time to work. You should have positive results by the end of 8 weeks, and if not, you can be referred on then."
Redirect the patient to the treatment:

"To get the benefit of treatment may take a few weeks and requires that you wear your splint regularly, attend the physiotherapy sessions, and complete your exercises as directed."

Should a patient become particularly agitated or hostile, or if psychiatric referral is considered, contact M. Foreman at 228-5581, Dr. Lynn Alden at 228-2198, or Dr. D. Crockett at 228-7308. Should apparent organic problems arise, such as gum inflammation or specific dental problems, refer the patient back to their regular dentist.
NON-COMPLIANCE — Programs A, B, and C.

Problems of non-compliance with treatment requirements such as completion of the weekly symptom reports, daily exercise programs, or failure to attend treatment sessions, should be first dealt with as an instructional problem — inquire of the client as to their understanding of the program requirements.

e.g., "What was your understanding for this part of the program?"

"What prevented you from doing . . . ?"

"Were you not able to get in touch with me?"

— reflect back to client and inquire of motivation to continue:

"I can appreciate you have a tight schedule but it really is necessary that . . . . How do you feel about it? Do you want to continue?"

If second such problem arises, explain to the subject that there are required aspects of the treatment program and if there is some difficulty in meeting these requirements they may have to consider withdrawing from the program and re-applying to the waiting list at the UBC Dental Clinic or seeking treatment elsewhere. Refer specific problems to Mike Foreman.

If problems arise for third time, inquire if feel program is not working out for them and explain that it is perhaps becoming a waste of time for both them and you as therapist. As such, it would be best to terminate treatment at this point and they may reconsider their motivation for treatment and if
desired, reapply or seek treatment elsewhere.

Any combination of events comprising three incidents of failure to meet treatment requirements should result in that subject being discontinued from the program.
APPENDIX 2

TREATMENT MANUAL FOR PROGRAM B (RBS)

SCRIPTS FOR THE RELAXATION EXERCISE SETS
Program B — Relaxation-Stress Management Training

Session 1.

1A. Introduction to treatment program.

Goals: Establish rapport, investigate potential stressors, provide treatment rationale, and answer initial questions.

1. Introductions

a) Introduce yourself to the client: name, phone numbers where you can be contacted, involvement in research program to evaluate different treatment approaches for jaw pain problems; the program will run 8 weeks.

b) Ask the subject how they came to the UBC Dental Clinic. — interest in referral process and previous treatment.

c) Ask the subject what expectations or hopes they have for this treatment.

— engender realistic expectations for progress; may be slow, and will require motivation on the subject's part to comply with program components such as regular homework exercises — turn back to the subject, asking: "How do you feel about that; do you see any problems?"

2. Client report of problem.

Goal: Allow client to present information to an interested listener providing occasional reflective summaries.

— take notes as necessary for information that can be pursued further.

e.g., "Perhaps we can begin with you telling me a bit
about your problem. Tell me in your own words."

3. Enquiry of subjective aspects of symptoms and chronological report of symptom changes.

Goal: elicit more specific background information and lead into relation of stress, tension, and pain; wish to pursue chronological enquiry from first incident and attempt association of life events which may parallel changes in symptoms; if difficulty in identifying stressors, supply examples or anecdotes of stressors identified by others.

e.g., a) "When did you first notice the discomfort?"

"How did the pain symptoms develop after you first noticed them, were they continuous or did they develop slowly. Did they get worse during any particular part of the day? Did you notice things then that made the pain worse? Was there anything you could to to make it go away or get better? What kinds of things were going on for you then?
— Were you living with (mate)?
— Where were you working? Change of job? school?
— Financial worries?
— Family problems? children?
— Friends?
— Physical problems?
— Drug use? alcohol? coffee? analgesics?
— What were you doing to relax?

b) When was the next time you were aware of the pain?
What kinds of things were going on for you then?"

(— enquiry as above).

c) Follow this sequential enquiry up to period of last few weeks.

d) "What about during this last week?"

i) "Did you have any pain today?"

— "When did it start? What were you doing?

What were you thinking about?

— What did it feel like?

— What did you do? Did it help?

— What about an hour later — had it faded?

Were you less aware of more aware of it?

— What caused changes?"

ii) "How about yesterday?"

(— pursue as above).

iii) "The day before?"

etc.

4. Provision of treatment rationale

goal: emphasize role of stress in tension response and resulting physical symptoms. Bring subject to see value of developing awareness of stressors and tension and learning to minimize through the use of relaxation training.

— when outlining treatment rationale, avoid "lecturing"

— allow pauses in which the client may ask questions.

Don't overload the client with information if apparently not assimilating (e.g., "blank" or
quizzical looks). Occasionally ask subject to restate what has been said, by such as:
"How could you apply this to your problem?"
— use subject's own vocabulary where possible in presentation
— given that the subject has or has not been able to identify events or concerns that interact with pain symptom, you will want to alter the initial presentation to suit.
e.g., "As you are aware, there are events in one's life that are stressful—that is, things that arouse us and contribute to tension . . ."
or: "Although we may not be able to identify particular things now that may act as stressors and contribute to tension, as we proceed through this treatment program you may become aware of things that do contribute to tension and the pain symptoms you experience . . ."
continuing as:
"We are constantly exposed to things that may be stressful — stress is any change you must adjust to. One usually thinks of stressful events as being negative — pressures at work, problems at home — but they can also be positive events: for instance, getting a new home or a promotion brings with it the stress of change of status and new responsibilities. And such things needn't be of
monumental proportions to result in the pain symptoms you experience — the cumulative effects of many little events can be a real problem."

"The problem arises when we are not aware of how we react to stress and where tensions result. Have you ever suddenly realized you were very tense? In the case of your problem, pain around the jaws, considerable research has shown an association of stress and the build-up of tension in the muscles of the jaw through clenching and grinding of the teeth. You may be aware of occasionally catching yourself clenching or grinding. These habits can result as a means of reducing the stress you experience — a learned coping response like "biting the bullet." The muscle tension that these habits generate results in the pain symptoms you feel. How does that sound to you? Does it make sense?"

"The interest of this program is to enable you to develop two kinds of awareness: an awareness of things you find stressful and of the tension that builds in the muscles of your jaw. But just to become aware of these things won't help unless there is something you can do about it, so, to counteract this tension and stress we will also teach you the ability to relax deeply as a strategy by which you can minimize the impact of stressors,
relieve the tension, and thus prevent pain. The point here is that relaxing is not an automatic process and is not necessarily achieved by playing recreational sports or having a quiet drink. Achieving a really relaxed state is a skill that must be learned and requires considerable practice. And because of this fact — that it does require practice — you may not experience results immediately, but if you apply yourself to this program, particularly the homework exercises, you will get results. How do you feel about daily homework? Is this something you will make a priority?"

"This program also incorporates biofeedback — a process of providing you with information about your muscle tension — to teach you how to really relax the muscles of your jaw in particular."

"As the program progresses and you become more skillful with the relaxation exercises and how it feels to really relax, the exercises will be shortened until eventually you will be able to relax quite completely in just a few minutes. In this way, relaxation becomes a strategy you can adopt in stressful situations, whenever they arise, to minimize tension and prevent pain."

5. Final clarification of questions regarding treatment rationale.

1B. Explain the weekly symptom report. Outline and
stress need to fill in each day to maximize accuracy. The report will function also to facilitate awareness of daily fluctuations of pain and possible mediating events. The report will be discussed at the next session. Point out recording of "pills for pain" and clarify that subject is asked to refrain from using pills so as not to mask treatment effects, but if they feel they absolutely must use pills, then the number and type of pills is to be recorded.

e.g., "There is one more aspect of the program that will require your attention daily, a symptom report form which you should fill in daily and bring with you to each weekly session to provide a record of your pain symptoms through the week. This report will serve two purposes: one, it will allow you to become more aware of daily fluctuations of pain and of events or situations you may associate with becoming tense; and two, it will provide a record from which we can follow your progress through treatment. For both purposes, it is important that you complete the record each day so as to maximize your accuracy in recording. It becomes difficult to recall exactly how you felt two or three days ago. So each day fill in the appropriate boxes with the number from the rating scale that you think most closely describes the pain you felt. Use the boxes labelled "other" to note any
situations or painful areas you were aware of that are not specifically listed. Also be sure to fill in "PILLS FOR PAIN" with the type and number of any analgesics you have taken. We ask that you not take any pills for pain so as not to mask treatment effects, but if you feel you must at some time, please note them. The last thing you will record on this form is the completion of exercises at home. You won't have these exercises this week, but starting next week you can note how often you completed them."

1C. Have subject fill in treatment expectancy rating form.

1D. Set next appointment.

Session 2.

2A. Collect symptom report.

goal: to facilitate recognition of problem situations associated with pain.

1. review with respect to reported incidences of pain — where and when.
   e.g., "I notice you have rated considerable muscle pain when working last Wednesday."
   — follow up inquiry as outlined in Session 1, section A3 d) i).
   — pursue similarly for highest rated incidences.

2B. Introduction to relaxation exercises.

goal: to familiarize the subject with the exercises that
will be practiced at home and to allow the opportunity to discuss sensations, reactions, and problems.

e.g., "Now as I mentioned last week, we want to develop the skill of deep muscle relaxation. In order to do this I'm going to teach you a relaxation program specifically designed for this purpose. We'll go over the program together today and then you will be responsible for practicing the exercises at home using a tape to guide you."

"Now make yourself comfortable in the chair, but first remove your glasses (contacts), watch, shoes and anything else that may be a distraction to you (bracelets, earrings), and loosen your belt."

1. See relaxation exercise introduction and script attached.

2. Follow-up discussion of exercises.

— interest in difficulties experienced tensing or relaxing any muscle groups; sensations felt, such as warmth, heaviness, floating, recovery like waking from a nap; reactions such as unique experience of relaxation.

e.g., "Did you have any difficulties with any muscles in either tensing or relaxing them?"

"How did that feel? Any unusual sensations?"

— reassure that some people do find experience unusual. "Do you see how this is indeed a different form of relaxation from what you may have been used to?"
2C. Clarify any further questions.

2D. Clarify homework requirements.
   — completion of relaxation exercise daily, preferably twice daily.

Pursue potential problems with the client:
e.g., "When do you think you would be able to do this? Do you have a quiet spot where you won't be disturbed? Are there any problems you might expect? How can you deal with them?" (e.g., interruptions, visitors)
   — completion of weekly report to be filled in daily.

2E. Set next appointment — next week will begin biofeedback.

Session 3.

3A. Collect symptom report.
   goal: to facilitate recognition of problem situations associated with pain and to discuss any problems with exercises.

1. review with respect to reported incidences of pain — as Session 2, section A1.

2. review with respect to completion of exercises — when able to do, reactions, problems.
e.g., "How did the exercises go with the tape?"
   "I notice you completed the exercises twice most days — that's good."
   "Did you have any particular problems or reactions with the exercises?"
   "Do you feel you achieved greater relaxation than you have before?"
3B. Introduction to EMG biofeedback.

   goal: to inform subject of function of biofeedback.

1. Introductory statements.

   e.g., "You have probably heard of biofeedback, There has
   been an amazing growth over the past decade in its
   applications. It is a process by which one can "tune
   in" to body activities and gain control of various
   body responses. It has been successfully used as an
   aid in the treatment of tension headache and migraines,
   control of blood pressure, improved circulation, and
   for various muscle problems including TMJ pain. For
   this application, TMJ pain, we want to provide you
   with specific information about the levels of tension
   in your jaw muscles to enable you to become aware of
   this tension and to really relax it."

2. Explanation of procedure.

   e.g., "In order to monitor the muscle activity I will be
   fastening two electrical pickups to your jaw [show
   client electrodes] and one to your wrist as a ground
   for the circuit. The pickups will be coated with a
   jelly-like substance in order to make the best connec-
   tion possible and I will scrub the skin at the spots
   where the electrodes are attached. The electrodes
   (pickups) are not harmful and will not shock you; they
   only pick up electrical activity from the muscles and
   allow the feedback of this activity through this
   monitoring device and a speaker. The equipment is run
with batteries so there is no danger of shock at all. In this way, tension in the muscles can be monitored and measured in a manner analogous to a thermometer or a speedometer. OK so far?"

"Once the electrodes are attached, you will hear a tone from the speaker. The tone will vary in pitch in proportion to the activity of your muscles; that is, the higher the activity of the muscles (tension), the higher the pitch of the tone; and the lower the activity (more relaxed), the lower the pitch of the tone. Your task will be to find out how you can keep the pitch low. There is also a threshold setting, which I will adjust from time to time, which will shut the tone off when you are relaxing the muscles the most, so you can bring the tone down and then try to turn the tone off; it will come back on if the muscles become more active and will work as before. You want to eliminate those things that make the tone go up and focus on the things that make the tone go off. Any questions?"

"We will provide the tone for about 20 minutes and then we will turn the tone off and take some additional readings on your muscle tension. We want to see the degree to which you learned to control your muscle tension and how well you can maintain it in the absence of the feedback. When the tone is turned off, remain as relaxed as you can. Use the techniques you have
learned for relaxing to remain as relaxed as possible."
— answer questions and assure yourself that the subject
understands the rationale for the treatment procedure.
3C. equipment hook-up (J & J, model M-52 with D200 digital
integrator).
(FIRST: check batteries "OK" [ > half scale deflection]
with FUNCTION selector-battery test 1 + 2.)
1. ground (placed on the wrist with strap around the wrist
fitted snugly but comfortably.
2. 2 active electrodes (yellow and red) positioned one on
either side of the jaw, located over the bulge of the
masseter produced when clenching the jaw.
— clean all skin surfaces with alcohol, and abrade with
abrasive pad lightly until skin pinkens slightly
before applying electrodes. Apply electrode paste
evenly.
— once applied, move to OPERATE mode and set range to
10μv and time interval to 1 minute.

Fig. 1.
electrode locations
active
(yellow and red)
3D. EMG feedback administration.

1. Once hooked up, have subject relax in chair with head resting on the back of the chair and shoulders square—
even posture with head straight, i.e., do not tilt or turn head to one side or the other.
e.g., "Now make yourself as comfortable as possible with your head resting on the chair back. Just relax now while I take a couple of measures."
— record 4 one-minute intervals as initial baseline.

2. Remind of intentions.
e.g., "Now listen to the tone, clench lightly and notice the change in the tone, and relax. Try to eliminate those things that make the tone go up and focus on those things that make the tone go down and off. Do not try too hard or struggle with the tone, as this will defeat the goal of relaxing; just let yourself relax and focus on relaxing your jaw. Remember to keep your attention on the tone; try not to let your mind wander or drift off to sleep."
— provide feedback for 20 minutes, recording each one-minute interval except any interval that is inflated by movement of the head or swallowing.
— for initial threshold setting use mean of baseline measures; if this threshold is met easily (tone off for 2 of 3 minutes), decrease slightly. Reduce threshold slightly whenever subject has managed to keep tone off for 5 minutes out of 7; thus threshold
should be lowering as subject progresses through program. Advise subject of this strategy — setting new limits as one gains control, gradually developing more relaxed state (low threshold limit may be 1.0μv).

3. Tone off — post baseline
   — remind of intentions
   e.g., "Now I'm going to turn the tone off and I want you to remain as relaxed as possible. Use the techniques you have learned to remain as relaxed as you can."
   — record 4 one-minute intervals.

3E. Post EMG discussion.

   goal: to clarify problems and reactions.
   — inform all subjects they did "quite well." Encourage those having difficulty attaining the threshold (i.e., failing to eliminate the tone for 3 minutes out of 7) that time is required to become familiar with the task. Suggest alternate strategies for those with apparent anxiety with the equipment ("fighting" with the tone — "I just can't do it"), such as imagining passive and peaceful scenes, focusing on relaxing the jaw, focusing on minimizing the tone, or performing relaxing mental exercises (count by twos) rather than trying to deduce the specific mechanisms by which they can interact with the equipment. Inform the subject that they may expect to reach temporary plateaus throughout the program, but not to become upset, as only further
practice is required.

3F. Homework assignment.

— remind of necessity of completing symptom report daily and relaxation exercises preferably twice daily.
— set next appointment.

Session 4.

4A. Review symptom report, stressors, and exercises (as previously outlined — Section 3A).

4B. Hook up and provide feedback with attendant records (as previously outlined — Section 3D).

4C. Following feedback, inquire about subject's reactions, problems. Reinforce all progress.

4D. Encourage subject to practice relaxation skills in situations when tension is noticed. Should be attempting to relax away tension when it is first noticed.

4E. Remind of homework and set next appointment.

Session 5.

5A. Review symptom report, exercises, and stressors.

5B. Provide shortened version of exercises.

— see Relaxation Exercises program 2 (7 muscle groups)

5C. Hook and provide feedback — take records.

5D. Reinforce progress. Subjects may at times be discouraged and feel they are not making progress. Explain that deeper relaxation is more difficult to attain and that learning the skill involves reaching temporary plateaus with future progress to be expected with continued practice.
5E. As 4D.

5F. Remind of homework and set next appointment.

Session 6.

6A. As 5A.

6B. Hook up, take 4-minute baseline and 10 minutes feedback. Provide 15 minutes of feedback with subject sitting upright and have the subject string and unstring 20 paperclips, manipulate puzzles (2), and write out the words to "O Canada" from memory, or other such writing from memory task.

6C. As 5D.

6D. as 4D.

6E. Homework and next appointment.

Session 7.

7A. As 5A.

7B. Provide shortened version of exercises. — see Relaxation Exercises program 3 (4 muscle groups and cue controlled response).

7C. As 6B.

7D. As 5D.

7E. As 5E.

7F. Homework and next appointment.

Session 8.

8A. Review symptom report and exercises. Discuss perceived stressors and ability to interact with them.
8B. As 6B.

8C. Following feedback, inquire about subject's experiences.
Emphasize the importance of utilizing information gained about the relaxed position of the jaw to facilitate continued relaxation and tension relief. Encourage the subject to make use of relaxation skills in everyday life to minimize the impact of stressors.

Point out that change may be an up-and-down process and they may experience a relapse of symptoms. What kind of situations might they think could provoke that? How can they deal with it if it happens? What improvements have they noticed since beginning treatment, and what would they attribute them to? Need to continue with awareness of stressful situations and take active role in minimizing their impact.

8D. Have subject complete treatment and therapist evaluations and assure of confidentiality — provide with envelope to seal and leave with secretary on way out.

8E. Remind subject of necessity to make an appointment through the Dental Clinic for post-treatment assessment. Thank them very much for their cooperation.

END OF PROGRAM
Therapist responses to potentially problematic behaviour exhibited by the subject


<table>
<thead>
<tr>
<th>behaviour</th>
<th>therapist response</th>
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| 1. helplessness         | Ignore, reward movements toward independence.  
|                          | avoid: sympathetic support or directive advice.            |
| 2. demands              | Agree on plan early. Ask that new demands be formulated as suggestions for treatment strategy.  
|                          | avoid: giving in to demands or directive limit setting.   |
| 3. compliance           | Encourage subject to help self.  
|                          | avoid: praise for ingratiation, appreciation.              |
| 4. veiled hostility     | Acknowledge limits to what therapist can provide; refocus on subject's alternatives.  
|                          | avoid: worry and renewed effort or direct attempts to unmask anger. |
5. threats

Tell subject must make own choices.

\textit{avoid}: reinforcing with lengthy discussion, amelioration, or tighter controls.

6. argumentativeness

Stay out of arguments. Ask subject to formulate implications of his position for treatment plans.

\textit{avoid}: explanations or confrontation.

7. requests for comparison of progress with respect to others

Point out continuous, gradual improvement to be expected; each individual will progress at own rate.

\textit{avoid}: providing comparisons.
PROBLEM CONSIDERATIONS

Program B. Relaxation strategies.

The basic strategy for responses to inquiries or complaints that are problematic, such as "The program is not working; what should I do?" "Are there other treatments I could try?" is to listen, be supportive, and redirect the subject to the treatment rationale and the need to allow the treatment to be effective, i.e., that the treatment is effective and the total program takes 8 weeks (should have results by 8 weeks and, if not, can refer on then).

Thus, allow the subject to voice their complaint and then respond with a statement such as:

"Yes, I can understand that it is difficult for you but you do have to give the treatment time to work."

— redirect the subject to the treatment:

"To get the benefit of the treatment may take a few weeks and requires our weekly sessions and your own cooperation in completing your exercises daily."

— situational problems (family visits, vacation) should not be excuse for failing to complete exercises.

Individuals coming to treatment complaining of severe pain or using this as a reason not to attend treatment should be encouraged to participate in the treatment session and attempt to use it at least to diminish discomfort, with a reminder that they are acquiring a skill that requires practice, and eventual goal is to be able to prevent pain by use of relaxation as
strategy to offset stress and tension.

Should a subject become particularly agitated or hostile, it may be considered to refer the individual for psychiatric care. If so, contact M. Foreman, or Dr. Lynn Alden at 228-2198 or Dr. D. Crockett at 228-7308.

Should apparent organic problems arise, such as gum inflammation or specific dental problems such as a broken crown or tooth, have subject contact their regular dentist.
NON-COMPLIANCE — Programs A, B, and C.

Problems of non-compliance with treatment requirements such as completion of the weekly symptom reports, daily exercise programs, or failure to attend treatment sessions, should be first dealt with as an instructional problem: inquire as to the subject's understanding of the program requirements.

e.g., "What was your understanding for this part of the program?"

"What prevented you from doing . . . ?"

"Were you not able to get in touch with me?"

— reflect back to subject and inquire of motivation to continue:

"I can appreciate that you have a tight schedule but it really is necessary that . . . . How do you feel about it? Do you want to continue?"

If second such problem arises, explain to the subject that there are required aspects of the treatment program, and if there is some difficulty in meeting these requirements they may have to consider withdrawing from the program and re-applying to the waiting list at the UBC Dental Clinic or seeking treatment elsewhere. Refer specific problems to Mike Foreman.

If problems arise for third time, inquire if subject feels program is not working out for them and explain that is perhaps becoming a waste of time for both them and you as therapist. As such, it would be best to terminate treatment at this point, and they may reconsider their motivation for treatment and, if
they desire, re-apply or seek treatment elsewhere.

— any combination of events comprising 3 incidents of failure to meet treatment requirements should result in that subject being discontinued from the program.
RELAXATION EXERCISE PROGRAM 1 (and Script)

These exercises can serve two purposes toward eliminating and preventing the pain symptoms. Presently you are aware of tension in the muscles of your jaw only after it has become painful. These exercises will enable you to relax all the muscles of your body including your jaw and also to become aware of tension in muscles early—before the tension results in pain. The exercises involve tensing sets of muscles and then relaxing these same muscles, then tensing and relaxing the opposing sets of muscles [demonstrate with hand — clench fist, relax, extend fingers, relax]. As you do this you can learn the sensations associated with increased tension and the feeling of letting the tension go and allowing the muscles to relax.

We will follow this sequence [run through sequence quickly to demonstrate the muscle groups and the techniques for tensing].

— both hands — fists, relax, extend fingers, relax.
— both arms — flex biceps, relax, extra straight, relax.
— shoulders back, relax, hunch forward, relax.
— roll neck 3 times one way, 3 times other way, relax.
— jaws bite slightly, relax, repeat.
— tongue to roof, relax, pull down, relax.
— eyes closed, imagine distant, peaceful scene [have practice].
— deep breath and hold, release.
— arch back out from chair, relax.
— clench buttocks, relax.
— lift feet, relax.
— suck stomach in, relax.
— feet downward, relax, upward, relax.
— toes curl upward, relax, downward, relax, wiggle, relax.
— regular breaths and cue of "relax," "calm."

When you've run through the exercises and are going to move again, we'll use a four-step countdown to limber you up as:

4 — move your feet and legs
3 — move your arms and hands
2 — move your head
1 — open your eyes.

[From the foregoing outline, ask subject if any potentially problematic muscles. Inquire whether the client has suffered any injuries (e.g., whiplash or back injury) or has any other disability which may result in pain when tensing particular muscles. If so, the subject may omit tensing these muscles or use minimal tensing. Advise also of potential problem of intrusive thoughts and prompt to make use of relaxing, peaceful imagined scene.]

"Now we will run through the exercises together and when they're finished we can discuss any sensations and reactions you may have. In order to practice the exercises I'll provide you with a cassette tape of the exercise program for you to practice at home. As you become more skilled with this technique, the exercises will be shortened, and eventually you will be able to relax quite completely in only one or two minutes.
In this way, the relaxation exercises can become a very effective means of dealing with daily stresses and prevent tension and pain, by remaining relaxed in situations that may have provided tension before."

[When the subject is tensing muscles, remind him to tense only those muscles as asked and not to tense others. Observe for tension in muscles other than should be (as face or jaw when making a fist), and mention and remind client while going through exercises (blend into talk as you proceed).]
OK, now make yourself comfortable and take a deep breath, and let it out slowly (5 sec. pause). Continue to breathe slowly and regularly, like waves washing on the shore, slowly in, and slowly out again. Quietly, slowly, regularly (5 sec. pause). This is time just for you, time just to relax. Do not waste it on any thoughts of things you should have done or are going to do. Focus only on what is being said and on what your body is feeling. Spend the next few seconds relaxing and just letting your thoughts flow (5 sec. pause). If thoughts intrude, do not dwell on them, just let them flow through your mind, let them pass by.

Now, as we go through the exercises I want you to tense or clench when I ask you to and just let the tension go — relax — when I say relax.

Now focus your attention on your hands; clench your hands into fists very tightly; as you tense, notice the feeling of this tension in your muscles. Tension building in your hands and forearms, clench your fists and notice the discomfort of this tension. Now when I say relax, I want you just to let go, let your hands go completely limp, okay, relax; notice the feeling as the tension drains out of the muscles now and your hands become more and more relaxed (10 sec. pause). Now extend your fingers out, the opposite of making a fist, tense those muscles and feel the tension building in your hands and fingers, notice the discomfort, notice the tension. And, relax, let your hands go limp, notice the contrast as your
hands become more relaxed (10 sec. pause).

Next, I want you to flex your biceps, but as you do, try not to allow any tension in your hands, keep your hands limp and just flex your arms now; again, focus on the tension, on the discomfort building in your biceps as you flex. And now, when I tell you to relax, just let your arms fall limp to your lap, okay, relax. Focus on the contrast as the tension flows out and your arms become more and more relaxed (10 sec. pause). Now extend your arms and straighten them out extra straight at the elbow, pull, and notice the tension, how it feels (5 sec. pause). Relax, let your arms fall limp onto the chair. Notice the feeling as your arms relax, becoming more and more relaxed (10 sec. pause).

Now, focus on keeping your hands and arms relaxed, and concentrate on the muscles of your shoulders. Pull your shoulders back slightly, feel the tension over your shoulders and in your upper back; focus on the tension (5 sec. pause). Now, relax; feel the difference as the tension drains away and the muscles become more relaxed, focus on the feeling as your muscles become more and more relaxed (10 sec. pause). Now hunch your shoulders forward, pull them forward. Feel the tension build over your shoulders and across your chest (5 sec. pause). Now relax; again focus on the feeling as your muscles become more relaxed and the tension drains away (10 sec. pause).

Now, keeping your hands, arms, and shoulders relaxed, slowly roll your head around, without moving your shoulders try to touch your ear to your shoulder, now draw your chin to your
chest, then the other ear to your other shoulder, tilt back, ear to your shoulder, and so on until you've gone around three times, then go three times in the opposite direction. [Therapist be prepared to demonstrate.] When you finish this, stop with your head resting on the chair and relax (45 sec. pause).

Now I want you to focus on your jaw muscles. I want you to bite down slightly now, not too hard, but just hard enough to produce some tension in the jaw. Tune in on that jaw tension very carefully now. Where do you feel it? (3 sec. pause). OK, now release the tension, let the tension dissolve away; let your jaw relax more and more until it becomes loose and slack, teeth slightly apart. A loose, slack, limp jaw (5 sec. pause). Focus on the feeling as your jaw muscles relax and try to tune in that feeling during the day. You often have tension in your jaw muscles during the day and you want to become aware of it so you can relax it... One more time now; because these are important muscles to become aware of; clench your teeth again now, not too hard. Notice where you feel the tension now (3 sec. pause). OK, now relax, let the tension drain away. Notice how good that feels as your muscles become more relaxed, as your jaw becomes loose and slack (10 sec. pause).

Okay, now to your tongue. Press your tongue against the roof of your mouth; feel the tension build at the base of your tongue and in your throat (5 sec. pause). And now relax, feel the tension drain away and note the feeling as these muscles relax; becoming more relaxed (10 sec. pause). Now pull your tongue down to the floor of your mouth; notice the tension
building (5 sec. pause). Relax, and note the contrast as the muscles become more relaxed and the tension drains away (10 sec. pause).

Now, to relax your eyes and facial muscles, I want you just to keep your eyes closed comfortably and imagine a distant, peaceful scene such as snow-capped mountains seen in the light of sunset — any scene with which you are familiar and find peaceful and relaxing. Picture this scene as vividly as you can and concentrate on your eyes and face relaxing, allow the muscles just to go loose and relax; no expression on your face, your teeth slightly apart; your whole face becoming more and more relaxed (10 sec. pause).

Now, take in a deep breath, and hold it. Take in as much air as you possibly can, stretch your chest, and hold the breath (5 sec. pause), and now slowly let the breath out, just part your lips and let the air leak out (2 sec. pause) and resume breathing with slow, regular breaths (10 sec. pause).

Now just scan your upper body for residual tensions, allow all the muscles of your upper body to relax more, your hands and arms relaxed, your shoulders and neck relaxed, your face and jaw relaxed, your chest relaxing.

OK, now I want you to arch your back slowly out from the chair and focus on the feeling of tension building as you do (5 sec. pause); and relax, now concentrate on the contrast as the muscles relax and the tension dissolves, your back becoming more and more relaxed (10 sec. pause).

Now clench your buttocks, tense those muscles as though
to push yourself up in the chair; feel the tension building in your buttocks and upper thighs (5 sec. pause). And, relax, focus on the feeling as these muscles relax and the tension drains away, the muscles relaxing more and more (10 sec. pause). Now lift your legs from the footrest a few inches and hold them there; feel the tension building in your thighs (6 sec. pause). And relax, concentrate on the contrast, tension draining away and the muscles becoming more and more relaxed (10 sec. pause).

And now, suck in your stomach as far as you can, make your waist as small as possible, really pull your stomach in (4 sec. pause). Feel the tension (2 sec. pause), and relax, note the feeling as the muscles relax (5 sec. pause), your whole upper body now becoming very relaxed (5 sec. pause).

And now, with your body relaxed, bend your feet downward, away from you, and feel the tension in your calves, building, becoming uncomfortable (5 sec. pause). And relax, note the contrast as you let these muscles relax (10 sec. pause). Now, bend your feet upward, toward you, pull them up and feel the tension building over your shins and ankles (5 sec. pause). Relax. Focus on the contrast as the tension drains and the muscles relax more and more (10 sec. pause).

Now, lastly, your toes. Curl your toes upward (3 sec. pause) and relax. Focus on the sensation of these muscles relaxing (5 sec. pause). Now curl your toes downward (3 sec. pause) and relax. Just wiggle your toes slightly, and relax. Focus on the feeling as these muscles relax, and your whole body becomes more and more relaxed (10 sec. pause).
Concentrate now on your breathing, slow, regular breaths. Now, as you exhale, say to your self "calm" [Therapist: stretch word out — c-a-l-m.] (pause) "relax" [stretch]. Repeat this to yourself and concentrate on the feeling in your body as you become completely relaxed. Focus on the sensations as your muscles are allowed to relax more than ever before. Don't think of anything else now except how it feels to relax. Scan your body again and allow your muscles to relax (5 min. pause).

Now, to rouse you again we will count out:

4 — move your feet and legs (3 sec. pause)
3 — move your arms and hands (3 sec. pause)
2 — move your head (3 sec. pause)
1 — open your eyes.

Just sit quietly for another few minutes and consider the sensations of tension and relaxation. Use your awareness of the sensations of tension and relaxation during the day to become aware of tension before it becomes a pain, and to relax the tension away. Picture yourself in situations which you may find stressful and tension-provoking and see yourself remaining more relaxed, more calm, in control of the situation. Use your relaxation skills to do away with tensions and prevent pain.
RELAXATION SCRIPT — EXERCISE SET 2

This set of exercises comprises the second phase of your relaxation program — as a progression to less time involved in the actual tension/relaxation exercises and toward a more efficient means of effecting a generalized state of muscle relaxation with which you can interrupt tension when and where it occurs. You will not exercise fewer muscles in this set of exercises but you will do more muscles together in a group, so that overall there are fewer steps in this set. With your practice of the first set of exercises, the completion of this set should be very easy.

The muscle groups for tension/relaxation will be as follows [run this sequence and demonstrate]:

1. a) (both arms) clench fists and flex biceps and hunch shoulders forward; relax.
   b) (both arms) extend fingers and straighten elbows and shoulders back; relax.
2. Roll neck three times one way; rest, three times other way.
3. Tense jaws and tongue to roof of mouth; relax; repeat.
4. Eyes closed, image distant scene and face "waxy" — no expression.
5. Deep breath and arch back, hold; relax.
6. Clench buttocks, lift feet, suck in stomach, feet away and toes down; relax.
7. Feet back and toes up.
   — now regular breaths and "relax," "calm" as exhale.
   — then relaxation period, then count out as before.
Okay? Any questions? Problems?

Okay. Now we will run through the exercise sequence again together so that you have some feel for what you're doing when you practice with the tape at home. [Repeat above sequence guiding client through.]

EXERCISE SCRIPT 2

Okay, make yourself comfortable (pause) and take a deep breath, and let it out slowly (5 sec pause). Continue breathing with slow, regular breaths as though keeping time with a slowly-moving pendulum, slowly in (pause), and slowly out. Quiet, slow, regular breaths (5 sec pause). This is your time, time just to relax. Focus your attention only on what is being said and on what your body is feeling. Spend the next few seconds getting comfortable and just letting your thoughts flow (pause). If thoughts intrude, do not dwell on them, just let them flow through your mind, let them pass by. Envision a calm and peaceful scene in your mind.

Now, as we go through the exercises, I want you first to listen to the instructions for the muscle groups and then tense or clench when I ask you to and just let the tension go — relax — when I ask you to do that.

Now, bring your attention to your hands and arms; you are going to clench (not yet) both fists, flex your biceps and hunch your shoulders forward all in one motion; okay, tense and notice the tension building (pause), just becoming uncomfortable (pause) and, relax; now focus on the sensations as the tension leaves the muscles and relaxation flows in
(pause 10). And now to the opposite set of muscles, you will (not yet) extend your fingers, straighten your elbows, and pull your shoulders back; okay, tense these muscles, focus on the sensation (pause 5), and relax, and notice the contrast as the tension drains away and the muscles become more relaxed, relaxing more and more (pause 8). And now, keeping your hands, arms, and shoulders relaxed, roll your head slowly as you have practiced with the other exercises, without moving your shoulders, try to touch your ear to your shoulder, then roll your chin to your chest, your other ear to your shoulder, tilt back, and so on until you've gone around three times, then pause and then go around three times in the opposite direction (pause 45).

Now focus on your jaw muscles: you are going to tense them as before but this time you will also press your tongue to the roof of your mouth at the same time; okay, clench your jaws slightly and press your tongue up, focus on the tension (pause 3); and relax; focus on the sensation now as the tension leaves and relaxation flows over these muscles of your jaw and throat, your jaw slack, teeth slightly apart (pause 5). And now repeat the exercise, clench your jaw slightly and press your tongue up, tune in on the tension, how does it feel as it builds (pause 5), and relax, focus on the feeling as your jaw muscles relax and try to tune in that feeling during the day, relaxing away tensions before they build up.

Now, to relax your eyes and facial muscles, we will continue as you have practiced: keep your eyes closed and just imagine your distant, peaceful scene, warm, and relaxing.
Picture the scene as vividly as you can and feel the warmth of sunlight on your face, your eyes and face relaxing, the muscles just loose and slack, no expression, your teeth slightly apart, your jaws and whole face becoming more and more relaxed (pause 10).

Okay, now I want you to take in a deep breath and, as you do, slowly arch your back out from the chair; okay, breathe in, as much air as you can, stretch your chest and arch your back, hold (pause 2), and relax, let the breath slowly out (pause 5), and continue breathing with slow regular breaths (pause 5). Scan your upper body for tensions, let all these muscles relax more, your hands and arms, your shoulders and neck, face and jaw, your chest, all becoming very relaxed.

Now, keeping all the muscles of your upper body relaxed, I want you to (not yet) clench your buttocks, lift your feet from the foot rest, suck in your stomach, point your feet away from you, and curl your toes down all at the same time; okay, tense, buttocks, legs up, stomach in, feet away and toes down, feel the tensions (pause 3), okay, relax, notice the contrast as the tensions drain away and the relaxation flows in. Relaxing your whole body more and more, face, jaws, upper body, arms, legs, all becoming more relaxed (pause 10).

Now, lastly, tilt your feet back toward you and curl your toes up, tense these muscles and note the sensations and relax, and focus on the contrast.

With slow, regular breaths, as you exhale say to yourself "c-al-m" (pause) and "re-lax" a few times, and focus on
the sensations of relaxation. Scan your body, your face and jaw, your arms and legs, all becoming very relaxed. Take the next few minutes to focus on the relaxation of your muscles, dissipating all the tensions of the day (5 min. pause).

And now to return you to normal wakefulness, we will count you out: 4 — move your feet and legs (4 sec pause) 3 — move your arms and hands (4 sec pause) 2 — move your head (4 sec pause) 1 — open your eyes.

Just sit quietly for another few minutes and consider the sensations of tension and relaxation you have experienced. Picture yourself in situations which you may find stressful and which may provoke tension, and see yourself remaining more calm, more relaxed, in control of the situation and able to relax tensions away. Use your relaxation skills during the day to do away with tensions and prevent pain by cueing in to tension early and relaxing it away. Help yourself relax with a couple of deep breaths, and as you exhale say to yourself "calm"; "relax."
This set of exercises completes the third phase of your relaxation program as a progression to less involved in the actual tension/relaxation exercises and toward a most efficient means of effecting a generalized state of muscle relaxation with which you can interrupt tension when and where it occurs. This set of exercises builds upon your mastery of the previous two sets from which you will utilize the learned sensations of relaxation in the various muscle groups of your body; as such, this set of exercises minimizes the tension cycle and allows you to maximize the relaxation cycle. As well, you will further combine muscle groups of the torso so as further to shorten the steps to complete relaxation. The muscles for this set will be as follows:

1. Both arms — clench fists and flex biceps and hunch shoulders, suck in stomach, clench buttocks, lift legs, feet forward and toes down.
2. Both arms — straighten elbows, extend fingers, shoulders back, arch back, deep breath, feet back and toes up.
3. Roll neck once around and once the other way.
4. Tense jaws and tongue to roof, relax, repeat.
5. Eyes closed, face waxy, distant scene, regular breaths, "calm"; "relax" as exhale.

Then, as relaxing, focus on sensations as waves of relaxation wash over you as you exhale and repeat to yourself "calm" — "relax," use these words as cues to help you to relax during the day and use the brief format of exercise through the day as the opportunity arises.
EXERCISE SCRIPT 3

Make yourself comfortable (pause) and take a deep breath, and let it out slowly (5 sec pause). Continue breathing with slow, regular breaths, slowly in, and slowly out (pause), quiet, regular breaths. This is your time, time just to relax. Focus your attention only on what is being said and on what your body is feeling. Spend the next few seconds just getting comfortable and letting your thoughts flow (pause). Do not dwell on any thoughts, just let them flow, let them pass by. Picture your calm and peaceful scene in your mind (pause).

Now, as we go through the exercises, first listen to the instructions and then tense or clench when I ask you to, and relax — let the tension go — when I ask you to do that.

This first cycle will involve most of the muscles of your torso — you will clench both fists; flex your biceps; hunch the shoulders forward; suck in your stomach; clench your buttocks; lift your legs; tilt your feet forward; and curl your toes down; okay, now tense fists, biceps, shoulders forward, stomach in, buttocks tight, legs up, feet out and toes down (pause 4), and relax, focus on the sensations of relaxation flowing over your body as the tension drains away and you allow the muscles to relax (pause 10).

Now the second cycle will involve the balance of the muscles of the torso — you will extend the fingers; straighten the elbows; draw your shoulders back; arch your back from the
chair; tilt your feet toward you; and curl your toes up; okay, now tense these muscles, fingers out, arms straight, shoulders back, arch out, deep breath, tilt feet up and curl your toes; feel it; and relax. Note the contrast now as the tension drains away and the muscles relax more and more. Allow all the muscles of your torso to relax more and more now (pause); your feet and toes relaxing; legs relaxing; stomach, back and chest relaxing; shoulders, arms and hands relaxing.

Now roll your neck as you have practiced, but now roll around only once in one direction and then once around the other way, and rest with head back against the chair (pause 15).

Now I want you next to clench your jaw lightly and, as you do, press your tongue to the roof of your mouth; okay, now tense these muscles—jaws together and tongue pressing up, note the tension, and relax—focus on the contrast—aware of the sources of tension, and now the sensations as these muscles relax (pause 8). Okay, now repeat this exercise—tense the jaw slightly and press the tongue up—be aware of the tension (pause), and relax; allow the muscles to relax more and more now, jaw slack, teeth slightly apart, tension draining away.

And now, with your head resting back, and your eyes closed, imagine your peaceful, quiet scene; your face relaxing, no expression, jaw slack, picture your scene vividly in your mind, feel the warmth of sunlight on your face; scan your body for tensions and allow your whole body now to relax more and more (pause 5). Breathe slowly and regularly; as you exhale, repeat to yourself, "calm," "relax," "calm," and "relax."
Focus now on the sensations as you allow yourself to become very relaxed (5 min pause).

And now to return you to normal wakefulness, we will count you out:

1. Move your feet and legs (pause 4)
2. Move your arms and hands (pause 4).
3. Move your head (pause 4).
4. Open your eyes (pause 4).

Just sit quietly now for another five minutes and consider how you can make use of these brief relaxation strategies through the day; the exercises when the opportunity arises, and just using the cue words of "calm" and "relax" and your awareness of the sensations of relaxation to do away with tensions any time. See yourself in situations which you may find stressful or tension-provoking; and know that you can control your reactions to these situations, that you are aware of tension and can relax it away before it becomes a problem.
APPENDIX 3

TREATMENT MANUAL FOR PROGRAM C

(TENS)
PROGRAM C: TRANSCUTANEOUS NERVE STIMULATION (TNS) AND "RELAX"

Subjects report to Rehab. Services, Acute Care.

Session 1.

A. — intention to establish rapport and introduce program.

1. Introduction of self to client.
   — name, credentials, phone numbers at which can be reached, involved in research program to evaluate different treatment approaches for jaw pain, program designed to cover 8 weeks.

   e.g., "Perhaps we can begin with you telling me a bit about the problems that have brought you to treatment."
   — inquire of previous treatments, referral to present treatment (i.e., to Dental Clinic), subjective aspects of pain — constant or changing, where it hurts, frequency, degree of discomfort.
   — maintain focus on symptom complaints, avoid inquiry of strategies of coping with discomfort, and do not offer strategies for coping.

3. Introduction to treatment plan.
   e.g., "I can understand that this problem has been a source of considerable discomfort for you and I do intend to help you with it."
   "This program involves the application of a
mild electrical current to the muscles of your jaw. It is not painful nor will it cause a shock; you will only just be able to feel it as perhaps a slight tingling. This electrical stimulation will cause the muscles of your jaw to relax and will relieve the pain that you feel, which results from the muscles being overly tense and in spasm. Unfortunately, the effect of relieving the pain may not happen immediately but may take a few weeks and may happen gradually. To help the process, we also want you to make time each evening (morning), about 20 minutes, that you can just sit quietly and relax in a comfortable chair." (Do not offer any particular strategies to effect relaxation — instruct only as outlined "to sit quietly and relax.")

"In order to provide the stimulation, called TNS, we use a small, battery-powered device [show to subject] to generate a mild electrical current and apply it to the muscles of your jaw with electrodes [show]. The electrodes will be applied with a jelly-like substance, which just makes the best contact possible. The electrodes will be placed over areas that correspond to acupuncture points — areas that are the particular points at which the electrical stimulation causes the muscles to relax."

"So this treatment will consist of this electrical stimulation being applied for about 35
minutes each week and you taking about 20 minutes each day to sit quietly and relax. Have you any questions?"

(Answer questions as possible within constraints of offering no specific strategies for relaxation or implications of psycho-social stressors.)

"Also, you will be responsible for some homework. We want you to fill in a symptom report form (show) each day so as to keep track of the discomfort during the day and where you feel it. In this way we can monitor your progress with treatment. You can also record having taken your relaxation period each day. It is important that you complete the report each day, as it becomes difficult to recall accurately how one was feeling a day or two before. You will bring this report in with you each week. We ask that you not take any pills for pain during the treatment program so as not to mask the effects of treatment. If you feel you must take pills for discomfort at some time, record the type and number of pills you take on the report form."

(Enforce realistic expectations for progress — may be slow but if program followed will get results.)
4. Completion of treatment expectation form.

"We would like you to fill in this form now, which is a rating for you to make, based on what we have discussed about the treatment plan as to how effective you feel this treatment will be in relieving your symptoms."

B. — Hook-up for TNS for balance of session (allow 10 minutes at the end of session for discussion).

— attach electrodes to relevant locations and provide electrical current that can only just be felt by the subject.

"Okay, I'm going to adjust the current; you let us know as soon as you can feel anything."

— always adjust current upwards from zero to point at which subject reports just noticing the sensation.

— once set, allow stimulation for balance of session, allowing about 10 minutes at the end of the session to inquire of sensations, reactions to stimulation; and remind of homework responsibilities.

Sessions 2 through 7.

A. 1. collect and review symptom report

— note pain ratings and incidence

— commend for completion of relaxation periods

— note if pills used — commend if none

B. 1. application of TNS
C. 1. inquire of reactions, sensations
   2. remind of homework

Session 8.
A. 1. collect and review symptom report
B. 1. application of TNS
C. Completion of treatment success and therapist rating scales.
   — assure of confidentiality — subject to seal in envelope addressed to M. E. Foreman, c/o Rehab. Services.
D. Remind subject of necessity to make an appointment through the Dental Clinic for the post-treatment assessment.

Thank the client for their cooperation.
PROBLEM CONSIDERATIONS

Program C — TNS and "RELAX"

The basic strategy for response to inquiries or complaints that are problematic, such as "The program is not helping; what should I do?" "Are there other treatments?" "Other things I could try?" or complaint of increased stress perception and associated pain, is to listen, be supportive, and redirect the subject to the treatment rationale and the need to allow the treatment time to be effective, i.e., that the treatment is effective and the program is anticipated to take 8 weeks (should have results by the end of 8 weeks and, if not, can refer on then).

Thus, allow the subject to voice their complaint and then respond with a statement such as:

"Yes, I can understand that it is difficult for you but you do need to give the treatment time to work."

redirect the subject to the treatment:

"To get the benefit of the treatment may take close to the full 8 weeks and requires the weekly application of the electrical stimulation and your own cooperation to spend at least 20 minutes daily just sitting in a quiet, comfortable spot relaxing."

Complaint of reactive problems to the TNS application presumably requires some adjustment of the electrode placement.

Should a subject become particularly agitated or hostile, it may be considered to refer the individual for psychiatric
care. If so contact Mike Foreman at 228-5581 of Dr. Lynn Alden at 228-2198 or Dr. David Crockett at 228-7308.

Should apparent organic problems arise, such as gum inflammation or specific dental problems such as a broken crown or tooth — refer the subject back to their regular dentist.
NON-COMPLIANCE — Programs A, B, and C.

Problems of non-compliance with such treatment requirements as completion of the weekly symptom reports and daily exercise programs, or failure to attend treatment sessions, should be first dealt with as an instructional problem — inquire as to the subject's understanding of the program requirements.

e.g., "What was your understanding for this part of the program?"

"What prevented you from doing . . . ?"

"Were you not able to get in touch with me?"

— reflect back to client and inquire of motivation to continue:

"I can appreciate you have a tight schedule but it really is necessary that . . . . How do you feel about it? Do you want to continue?"

If second such problem arises, explain to the subject that there are required aspects of the treatment program, and, if there is some difficulty in meeting these requirements, they may have to consider withdrawing from the program and re-applying to the waiting list at the UBC Dental Clinic or seeking treatment elsewhere. Refer specific problems to Mike Foreman.

If problems arise for third time, inquire if subject feels program is not working out for them, and explain that it is perhaps becoming a waste of time for both them and you as therapist. As such, it would be best to terminate treatment at this point, and they may reconsider their motivation for . . .
treatment and, if they desire, re-apply or seek treatment elsewhere.

— any combination of events comprising 3 incidents of failure to meet treatment requirements should result in that subject being discontinued from the program.
APPENDIX 4

FORMS AND QUESTIONNAIRES

— Consent Forms
— SCL-90-R
— Perception of Events Scale (l-E Locus of Control)
— MHLC Form A
— TMJ Pain — Structured Interview
— Pain Rating Adjective Lists
— EMG Assessment Form
— EMG Summary Form
— Treatment Expectation Rating Form
— Weekly Symptom Report Form
— Treatment Success and Therapist Rating Forms
— Data Record Form
Subject Consent

This research program involves three treatment strategies for the pain symptoms you are currently suffering. At present, there is no one strategy that is necessarily the "best" treatment and as such it is the interest of this research to evaluate the effectiveness of various approaches to TMJ problems. It is hoped that this study will contribute to the development of a most effective treatment program. It is asked that you complete the entire treatment to which you are assigned, including post-treatment assessment.

Should you feel at the end of the program that further treatment is necessary, it would be possible for you to continue in the treatment of your choice. You may, of course, withdraw from the program at any time and return to the waiting list of the UBC Dental Clinic to continue in treatment as soon as possible, or seek treatment at some other facility.

I have read the above statement and understand that for the purposes of this research I will be assigned by chance to one of three treatment conditions and that I may withdraw from treatment anytime and receive further treatment as may be necessary as soon as possible.

Signature _______________________________
INTRODUCTION TO QUESTIONNAIRES

These questionnaires are included in the interest of studying some aspects of living which may be involved in TMJ problems. All information is confidential and your cooperation in completing the forms fully is appreciated. Information derived from these forms as well as the results of the treatment research will be of benefit to the development of the best possible treatment for TMJ problems.

Following this assessment, you will be assigned to one of three treatments for TMJ problems. It is asked that you complete the entire treatment program to which you are assigned. However, if at the conclusion of the program you feel further treatment is necessary, you will be able to continue in the treatment of your choice. Upon completion of this assessment it is assumed that you have consented to take part in this study and will endeavor to complete the program as directed.

Patient ____________________

Date ______________________
Program A. Dental splints and physiotherapy.

This treatment program involves providing you with dental "splints" - a fitted bite plate which you will wear each night as you sleep, and physiotherapy treatment - the application of hot and cold packs and regular exercises of the jaw both in treatment and for practice at home.

It is asked that you conscientiously complete all aspects of treatment as they are outlined for you. You may, of course, withdraw from treatment at any time and reapply for treatment here or elsewhere.

Signature

Date
Program B. Relaxation training, biofeedback, and stress management.

This treatment program involves three components: relaxation training — specific exercises with which you will learn the sensations of muscle tension and how to relax the tension away, biofeedback — the provision of a feedback tone with which you will learn how to relax the muscles of your jaw in particular, and stress management — the application of the relaxation techniques you learn to offset or minimize the impact of stressors you may experience in your daily life. The relaxation exercises will, for the most part, be your responsibility for practice at home using an audiotape. Biofeedback and stress management will be the major focuses in treatment weekly.

It is asked that you conscientiously complete all aspects of treatment as they are outlined for you. You may, of course, withdraw from treatment anytime and reapply for treatment through the UBC Dental Clinic or elsewhere.

Signature

Date
Program C. Transcutaneous nerve stimulation and rest.

This treatment involves providing you with a mild electrical stimulation which is applied to the muscles of your jaw. You will receive these applications weekly. As well, you are expected to take approximately one-half hour each day to just sit quietly in a comfortable chair and relax.

It is asked that you conscientiously complete all aspects of treatment as they are outlined for you. You may, of course, withdraw from treatment anytime and reapply for treatment at the UBC Dental Clinic or elsewhere.

Signature ____________________________

Date ________________________________
### SCL-90-R

**Name:**

**Location:**

**Age:**

**Sex:** M

**Date:**

**Technician:**

**Visit No.:**

**Mode:** S-R

**Nar**

**Ident. No.:**

**Remarks:**

---

**INSTRUCTIONS**

Below is a list of problems and complaints that people sometimes have. Read each one carefully, and select one of the numbered descriptors that best describes HOW MUCH DISCOMFORT THAT PROBLEM HAS CAUSED YOU DURING THE PAST INCLUDING TODAY. Place that number in the open block to the right of the problem. Do not skip any items, and print your number clearly. If you change your mind, erase your first number completely. Read the example below before beginning, and if you have any questions please ask the technician.

#### EXAMPLE

**HOW MUCH WERE YOU DISTRESSED BY:**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. Body Aches</td>
<td>0: Not at all</td>
</tr>
</tbody>
</table>


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<table>
<thead>
<tr>
<th>Problem</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Headaches</td>
<td></td>
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<tr>
<td>2. Nervousness or shakiness inside</td>
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<td>3. Repeated unpleasant thoughts that won't leave your mind</td>
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<td>4. Faintness or dizziness</td>
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<td>5. Loss of sexual interest or pleasure</td>
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<td>6. Feeling critical of others</td>
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<td>7. The idea that someone else can control your thoughts</td>
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<td>8. Feeling others are to blame for most of your troubles</td>
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<td>9. Trouble remembering things</td>
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<td>10. Worried about sloppiness or carelessness</td>
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<td>11. Feeling easily annoyed or irritated</td>
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<td>12. Pains in heart or chest</td>
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<td>13. Feeling afraid in open spaces or on the streets</td>
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<td>14. Feeling low in energy or slowed down</td>
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<td>15. Thoughts of ending your life</td>
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<td>16. Hearing voices that other people do not hear</td>
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<td>17. Trembling</td>
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<td>18. Feeling that most people cannot be trusted</td>
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<td>19. Poor appetite</td>
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<td>20. Crying easily</td>
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<td>21. Feeling shy or uneasy with the opposite sex</td>
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<td>22. Feelings of being trapped or caught</td>
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<td>23. Suddenly scared for no reason</td>
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<td>24. Temper outbursts that you could not control</td>
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<td>25. Feeling afraid to go out of your house alone</td>
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<td>26. Blaming yourself for things</td>
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<td>27. Pains in lower back</td>
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<td>28. Feeling blocked in getting things done</td>
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<td>29. Feeling lonely</td>
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<td>30. Feeling blue</td>
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<td>31. Worrying too much about things</td>
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<td>32. Feeling no interest in things</td>
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<td>33. Feeling fearful</td>
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<td>34. Your feelings being easily hurt</td>
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<td>35. Other people being aware of your private thoughts</td>
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<td>36. Feeling others do not understand you or are unsympathetic</td>
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<td>37. Feeling that people are unfriendly or dislike you</td>
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<td>38. Having to do things very slowly to insure correctness</td>
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<td>39. Heart pounding or racing</td>
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<td>40. Nausea or upset stomach</td>
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<td>41. Feeling interior to others</td>
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<tr>
<td>42. Soreness of your muscles</td>
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<tr>
<td>43. Feeling that you are watched or talked about by others</td>
<td></td>
</tr>
<tr>
<td>44. Trouble falling asleep</td>
<td></td>
</tr>
<tr>
<td>45. Having to check and doublecheck what you do</td>
<td></td>
</tr>
<tr>
<td>46. Difficulty making decisions</td>
<td></td>
</tr>
<tr>
<td>47. Feeling afraid to travel on buses, subways, or trains</td>
<td></td>
</tr>
<tr>
<td>48. Trouble getting your breath</td>
<td></td>
</tr>
<tr>
<td>49. Hot or cold spells</td>
<td></td>
</tr>
<tr>
<td>50. Having to avoid certain things, places, or activities because they frighten you</td>
<td></td>
</tr>
<tr>
<td>51. Your mind going blank</td>
<td></td>
</tr>
<tr>
<td>52. Numbness or tingling in parts of your body</td>
<td></td>
</tr>
</tbody>
</table>

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**PLEASE CONTINUE ON THE FOLLOWING PAGE**
### SCL-90-R

**HOW MUCH WERE YOU DISTRESSED BY:**

<table>
<thead>
<tr>
<th>HOW MUCH WERE YOU DISTRESSED BY:</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>53. A lump in your throat</td>
<td></td>
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<tr>
<td>54. Feeling hopeless about the future</td>
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<td>55. Trouble concentrating</td>
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<td>56. Feeling weak in parts of your body</td>
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<tr>
<td>57. Feeling tense or keyed up</td>
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<td>58. Heavy feelings in your arms or legs</td>
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<tr>
<td>59. Thoughts of death or dying</td>
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<td>60. Overeating</td>
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<tr>
<td>61. Feeling uneasy when people are watching or talking about you</td>
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<tr>
<td>62. Having thoughts that are not your own</td>
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<tr>
<td>63. Having urges to beat, injure, or harm someone</td>
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<tr>
<td>64. Awakening in the early morning</td>
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<tr>
<td>65. Having to repeat the same actions such as touching, counting, washing</td>
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<tr>
<td>66. Sleep that is restless or disturbed</td>
<td></td>
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<tr>
<td>67. Having urges to break or smash things</td>
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<tr>
<td>68. Having ideas or beliefs that others do not share</td>
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<tr>
<td>69. Feeling very self-conscious with others</td>
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<tr>
<td>70. Feeling uneasy in crowds, such as shopping or at a movie</td>
<td></td>
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</tr>
</tbody>
</table>

**Descriptive Categories:**

- 0 Not at all
- 1 A little bit
- 2 Moderately
- 3 Quite a bit
- 4 Extremely

**HOW MUCH WERE YOU DISTRESSED BY:**

<table>
<thead>
<tr>
<th>HOW MUCH WERE YOU DISTRESSED BY:</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>71. Feeling everything is an effort</td>
<td></td>
<td></td>
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<tr>
<td>72. Spells of terror or panic</td>
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<tr>
<td>73. Feeling uncomfortable about eating or drinking in public</td>
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<tr>
<td>74. Getting into frequent arguments</td>
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<tr>
<td>75. Feeling nervous when you are left alone.</td>
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<tr>
<td>76. Others not giving you proper credit for your achievements</td>
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<tr>
<td>77. Feeling lonely even when you are with people</td>
<td></td>
<td></td>
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<tr>
<td>78. Feeling so restless you couldn’t sit still</td>
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<tr>
<td>79. Feelings of worthlessness</td>
<td></td>
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<tr>
<td>80. The feeling that something bad is going to happen to you</td>
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<tr>
<td>81. Shouting or throwing things</td>
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<tr>
<td>82. Feeling afraid you will faint in public</td>
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<tr>
<td>83. Feeling that people will take advantage of you if you let them</td>
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<tr>
<td>84. Having thoughts about sex that bother you a lot</td>
<td></td>
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<tr>
<td>85. The idea that you should be punished for your sins.</td>
<td></td>
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<tr>
<td>86. Thoughts and images of a frightening nature</td>
<td></td>
<td></td>
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<tr>
<td>87. The idea that something serious is wrong with your body</td>
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<tr>
<td>88. Never feeling close to another person</td>
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<tr>
<td>89. Feelings of guilt</td>
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<tr>
<td>90. The idea that something is wrong with your mind.</td>
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</tr>
</tbody>
</table>
The following items each involve a statement labelled 'a' or 'b'. For all items (1 - 29) please circle the letter (a or b) corresponding to the statement with which you best agree as being true.

1. a. Children get into trouble because their parents punish them too much.
   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.
   b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.
   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.
   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.
   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.
   b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try some people just don't like you.
   b. People who can't get others to like them don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality.
   b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.
    b. This world is run by the few people in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.
    b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyway.
14. a. There are certain people who are just no good.
   b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.
   b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
   b. Getting people to do the right thing depends upon ability; luck has little to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand nor control.
   b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
   b. There really is no such thing as "luck".

19. a. One should always be willing to admit mistakes.
   b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.
   b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.
   b. Most misfortunes are the result of lack of ability, ignorance, laziness or all three.

22. a. With enough effort we can wipe out political corruption.
   b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.
   b. There is a direct connection between how hard one studies and the grades one receives.

24. a. A good leader makes it clear to everybody what their jobs are.
   b. A good leader expects people to decide for themselves what they should do.

25. a. Many times I feel that I have little influence over the things that happen to me.
   b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.
   b. There's not much use in trying too hard to please people, if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.
   b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.
   b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.
   b. In the long run the people are responsible for bad government on a national as well as on a local level.
This is a questionnaire designed to determine the way in which different people view certain important health-related issues. Each item is a belief statement with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you disagree or agree with the statement. The more strongly you agree with a statement, then the higher will be the number you circle. The more strongly you disagree with a statement, then the lower will be the number you circle. Please make sure that you answer every item and that you circle only one number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

Please answer these items carefully, but do not spend too much time on any one item. As much as you can, try to respond to each item independently. When making your choice, do not be influenced by your previous choices. It is important that you respond according to your actual beliefs and not according to how you feel you should believe or how you think we want you to believe.

1. If I get sick, it is my own behavior which determines how soon I get well again.  
   1 2 3 4 5 6

2. No matter what I do, if I am going to get sick, I will get sick.  
   1 2 3 4 5 6

3. Having regular contact with my physician is the best way for me to avoid illness.  
   1 2 3 4 5 6

4. Most things that affect my health happen to me by accident.  
   1 2 3 4 5 6

5. Whenever I don't feel well, I should consult a medically trained professional.  
   1 2 3 4 5 6

6. I am in control of my health.  
   1 2 3 4 5 6

7. My family has a lot to do with my becoming sick or staying healthy.  
   1 2 3 4 5 6

8. When I get sick I am to blame.  
   1 2 3 4 5 6
9. Luck plays a big part in determining how soon I will recover from an illness.
10. Health professionals control my health.
11. My good health is largely a matter of good fortune.
12. The main thing which affects my health is what I myself do.
13. If I take care of myself, I can avoid illness.
14. When I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.
15. No matter what I do, I'm likely to get sick.
16. If it's meant to be, I will stay healthy.
17. If I take the right actions, I can stay healthy.
18. Regarding my health, I can only do what my doctor tells me to do.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Moderately Disagree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Luck plays a big part in determining how soon I will recover from an illness.</td>
<td>1 / 3 / 4 / 5 / 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Health professionals control my health.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11. My good health is largely a matter of good fortune.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
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<td></td>
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<tr>
<td>12. The main thing which affects my health is what I myself do.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13. If I take care of myself, I can avoid illness.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
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<tr>
<td>14. When I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
<td></td>
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</tr>
<tr>
<td>15. No matter what I do, I'm likely to get sick.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
<td></td>
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<tr>
<td>16. If it's meant to be, I will stay healthy.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
<td></td>
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</tr>
<tr>
<td>17. If I take the right actions, I can stay healthy.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
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</tr>
<tr>
<td>18. Regarding my health, I can only do what my doctor tells me to do.</td>
<td>1 / 2 / 3 / 4 / 5 / 6</td>
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</tbody>
</table>
# TMJ PAIN ASSESSMENT QUESTIONNAIRE

**Date**

**Patient's Name**

**Address:**

**Referring Doctor:**

**Age:**

**ID:**

**Phone:**

**Yrs. in Pain:**

### Present Drug Intake:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Frequency</th>
<th>Duration of relief</th>
<th>Amount of relief</th>
<th>Date Started</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Comments, Side Effects:**

### Present Pain Pattern:

**Throughout the Day:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Time-Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afternoon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Has your mood (outlook on life, attitudes to other people, etc.) changed since your pain began? Yes _____ No _____

If yes: how?

Causes of Increase (+) or Decrease (-) of Pain:

<table>
<thead>
<tr>
<th>Cause</th>
<th>Increase (+)</th>
<th>Decrease (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquor</td>
<td>Sleep, rest</td>
<td></td>
</tr>
<tr>
<td>Stimulants (Coffee, etc.)</td>
<td>Lying down</td>
<td></td>
</tr>
<tr>
<td>Eating</td>
<td>Distraction (T.V., etc.)</td>
<td></td>
</tr>
<tr>
<td>Heat</td>
<td>Urination, Defecation</td>
<td></td>
</tr>
<tr>
<td>Cold</td>
<td>Tension</td>
<td></td>
</tr>
<tr>
<td>Damp</td>
<td>Bright lights'</td>
<td></td>
</tr>
<tr>
<td>Weather changes</td>
<td>Loud noises</td>
<td></td>
</tr>
<tr>
<td>Massage, Vibrator</td>
<td>Going to work</td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td>Intercourse</td>
<td></td>
</tr>
<tr>
<td>No movement</td>
<td>Mild exercise</td>
<td></td>
</tr>
<tr>
<td>Movement</td>
<td>Fatigue</td>
<td></td>
</tr>
</tbody>
</table>

Comments:

Pain and Sleep:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>always</th>
<th>sometimes</th>
<th>never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trouble falling asleep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication needed to fall asleep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awakened by Pain</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments: Average No. Hours Sleep
Pain and Sexual Relations:

<table>
<thead>
<tr>
<th>Desire</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as before</td>
<td></td>
</tr>
<tr>
<td>Somewhat less than before</td>
<td></td>
</tr>
<tr>
<td>Very much less than before</td>
<td></td>
</tr>
<tr>
<td>None at all</td>
<td></td>
</tr>
</tbody>
</table>

Comments:

Pain and Work/Activity:

A) Type of work (incl. housewife):

B) Compensation: Yes _______ No _______
Type: _______________________________

C) Ability to work at regular job: _______________________________

D) Occasional need to stop all activities because of pain:
Yes _______ No _______

E) If "Yes" to D), Number of times: Daily: _______
Weekly: _______

F) Comments:

Eating Habits:

A) Has your food intake changed since the onset of pain? _______
Details: _______________________________

B) Do you follow a specific diet? _______
Details: _______________________________
Pain Description:

A) Choose one word group

<table>
<thead>
<tr>
<th>Continuous, Steady, Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhythmic, Periodic, Intermittant</td>
</tr>
<tr>
<td>Brief, Momentary, Transient</td>
</tr>
</tbody>
</table>

The following words represent pain of increasing intensity:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Discomforting</td>
<td>Distressing</td>
<td>Horrible</td>
<td>Excruciating</td>
</tr>
</tbody>
</table>

B) Choose the number of the word which best describes:

<table>
<thead>
<tr>
<th>Your pain right now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your pain at its worst</td>
</tr>
<tr>
<td>Your pain at its least</td>
</tr>
<tr>
<td>The worst toothache you ever had</td>
</tr>
<tr>
<td>The worst headache you ever had</td>
</tr>
<tr>
<td>The worst stomach-ache you ever had</td>
</tr>
</tbody>
</table>

Where is your Pain?

Please mark, on the drawing below, the areas where you feel pain. Put E if external, or I if internal, near the areas which you mark. Put EI if both external and internal.

ALSO: If you have one or more areas which can trigger your pain when pressure is applied to them, mark each with an X.
From the adjectives listed on the following two pages, please check all those which you feel best describe the pain or discomfort which you have experienced over the past three to four weeks.
<table>
<thead>
<tr>
<th>Number</th>
<th>Word</th>
</tr>
</thead>
<tbody>
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<td>Bruising</td>
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<td>Like a boil</td>
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<td>Pins and needles</td>
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<td>5</td>
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<td>Battered</td>
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<td>Swollen</td>
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<td>Hard</td>
</tr>
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<td>Impossible</td>
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<td>Irritation</td>
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<td>Terrific</td>
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</tbody>
</table>
EMG ASSESSMENT

Patient _________________________ Date ____________

A. Oral habit specifics:

1. Clenching during day — Y N; Freq. ___; How known: self others ___
2. Grinding at night — Y N; Freq. ___; How known: self others ___
3. Chewing habits (gum, meats):
4. Change of diet: Y N; Avoidances:
5. Use of diet aids (pills, supplements):
6. Smoking: cigarettes __, pipe __; Recently quit: now then no
7. Lip or cheek biting: Y N; Problems swallowing: Y N
8. Clenching when speaking (as when angry or speak to baby):
   Y N Freq. ___

B. EMG task assessment:

   Electrode test resistance ___, ___

1. Baseline resting (1 min. intervals) ___, ___, ___
2. Task conditions:
   a) Static steadiness

      Untimed: left: contact time ___, # of contacts ___
                 right: contact time _____, # of contacts ___

      EMG (15 sec. intervals) _____ _____ _____ _____

      Timed: left: contact time ___, # of contacts ___
              (15 sec. per hole)
             right: contact time ___, # of contacts ___

             EMG (15 sec. intervals) _____, _____, _____, _____, _____, _____,
                 _____, _____, _____, _____, _____, _____,
b) Maze condition

Untimed: left: contact time ____,# of contacts ____  
right: contact time ____,# of contacts ____  
EMG (15 sec. int.) ____ ,____ ,____ ,____ ,____ ,____ ,____

Timed (back & forth as many times as possible in 60 sec.)

Left: contact time ____,# of contacts ____ ,completed ____  
Right: contact time ____,# of contacts ____ ,completed ____  
EMG (15 sec.) ____ ,____ ,____ ,____

d) Dynamometer (15 sec. pressure, 30 sec. rest)

1) Left: EMG ____ , force ____

2) Right: EMG ____ , force ____

3) EMG ____ , force ____

4) EMG ____ , force ____
EMG SUMMARY FORM

Subject ____________________________

Date ____________________________

Baseline:  $M = \quad SD =$

Tasks:

A. Static steadiness

Left:  $M = \quad SD = \quad$ Contacts:
     $M = \quad$ Contacts:

Right:  $M = \quad SD = \quad$ Contacts:

Large (1-4 L & R):  $M = \quad SD =$

Small (6-9 L & R):  $M = \quad SD =$

B. Maze coordination

1. Untimed:  left:  $M = \quad SD = \quad$ Contacts:
    $M = \quad$ Contacts:
    right:  $M = \quad SD = \quad$ Contacts:

2. 60 sec.:  left:  $M = \quad SD = \quad$ Contacts:
    $M = \quad$ Contacts:
    right:  $M = \quad SD = \quad$ Contacts:

3. 30 sec.:  left:  $M = \quad SD = \quad$ Contacts:
    $M = \quad$ Contacts:
    right:  $M = \quad SD = \quad$ Contacts:

C. Dynamometer

Left:  $M_{EMG} = \quad M_{F} =$

Right:  $M_{EMG} = \quad M_{F} =$
TREATMENT EXPECTATION

Subject ____________________________

Date ____________________________

On the basis of the introduction to this treatment program you have received, how probable do you think it is that this treatment will provide relief from pain? Indicate your rating by circling a number on the scale below which most closely represents your expectation:

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>no relief, problem as bad or worse</td>
<td>some relief</td>
<td>moderate relief</td>
<td>good relief, minimal or infrequent pain</td>
<td>excellent, no pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
patient: __________________________

week: __________________________

**WEEKLY SYMPTOM REPORT**

Instructions: using the rating scale below, indicate the severity of your pain symptoms in the appropriate boxes.

<table>
<thead>
<tr>
<th>pain</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

**DATE**

PAIN WHEN:
- during eating ........
- while opening wide ...
- when waking ..........
- when driving ..........
- when working ..........
- when resting ..........
- Other _______________ ..
- _______________ ..

PAIN WHERE:
- pain in front of ear.
- pain in muscles .......
- pain in temple area ..
- pain in gums ........
- pain in teeth ..........
- pain in neck area ....
- Other _______________ ..
- _______________ ..

PILLS FOR PAIN .........
TREATMENT SUCCESS

Based on your experience with this treatment program and the change effected in your symptoms, how would you rate the success of this treatment for providing relief of your symptoms:

0 1 2 3 4 5 6 7 8 9 10

- no relief, some moderate good excellent, problem as bad relief relief, no pain
- minimal or infrequent pain

THERAPIST RATING

Based on your experience with your therapist, please provide ratings (a number from the scale below) to the following statements. These responses are entirely confidential and will not be made known to the therapist.

0 1 2 3 4 5 6

- not at all agree
- moderately strongly agree

1. The therapist appeared genuinely interested in my problems. ____
2. The therapist responded to questions in a friendly and understanding manner. ____
3. I would recommend this therapist to friends with similar problems. ____
4. Considering everything, how would you rate your therapist for this treatment program: 1) very poor 2) poor 3) fair 4) good 5) very good?
DATA RECORD

Pre-treatment Assessment

Subject ID: ____

A. Sex: M F  Age: ____  Occupation: ______________________
   Onset of problem: _______  Duration: _______
   Previous treatment: Y N  Number of times ___
   Describe:
   Report mediating stressors: Y N  Describe: ____________

   Report oral habits: Y N  How known (self, others) _____

B. Occlusal rating: _____
   Mandibular range: open ____ left ____ right ____ protrude ____
   Dental pain rating: _______

C. EMG assessment: attached form

D. McGill Pain Questionnaire pain rating index: _______
   Number of words chosen: _______
   Present pain intensity: _______
   Analgesic use: dose ______ frequency ______ type ______

E. SCL-90 scores: Som _____, ObC _____, IntP _____, Dep _____
   Anx _____, Hos _____, PhAnx _____, ParI _____, P _____
   Rotter score (external direction): _______

F. Treatment expectancy rating: _______
DATA RECORD

Post-treatment Assessment

Subject ID: _________ Treatment expectancy rating: ______

B2 Mandibular range: open ____ left ____ right ____ protrude ____
   Dental pain rating: __________

C2 EMG assessment: form attached

D2 McGill Pain Questionnaire pain rating index: _________
   Number of words chosen: _________
   Present pain intensity: _________
   Analgesic use: dose _________ frequency _________ type _________

E2 SCL-90 scores: Som ______ ObC ______ IntP ______ Dep ______
   Anx ______ Hos ______ PhAnx ______ ParI ______ P ______
   Rotter score (external direction): _________

F. Symptom self-reports:

Week 1: Incidents ______ Pain rating ______
Week 2: ______
Week 3: ______
Week 4: ______
Week 5: ______
Week 6: ______
Week 7: ______
Week 8: ______

G. Rating of treatment success: _________
   Rating of therapist warmth: _________