# Effects of intraoral appliance and biofeedback/stress management alone and in combination in treating pain and depression in patients with temporomandibular disorders

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To assess the differential efficacy of two commonly used treatments for temporomandibular disorders (TMD), intraoral appliances (IAs) and biofeedback (BF), separately and in combination, two studies were conducted. The first study directly compared IA treatment, a combination of biofeedback and stress management (BF/SM), and a waiting list control group in a sample of 80 TMD patients. Both treatments were determined to be equally credible to patients, ruling out this potential threat to the validity of the results obtained. The results demonstrated that the IA treatment was more effective than the BF/SM treatment in reducing pain after treatment, but at a 6-month follow-up the IA group significantly relapsed, especially in depression, whereas the BF/SM maintained improvements on both pain and depression and continued to improve. The second study examined the combination of IA and BF/SM in a sample of 30 TMD patients. The results of this study demonstrated that the combined treatment approach was more effective than either of the single treatments alone, particularly in pain reduction, at the 6-month follow-up. These results support the importance of using both dental and psychologic treatments to successfully treat TMD patients if treatment gains are to be maintained. (J PROSTHET DENT 1993;70:158-64.)

Traditional treatments for TMD pain sufferers have varied from the use of different intraoral appliances (IAs) or electromyographic (EMG) biofeedback (BF) to more complicated surgical or prosthodontic reconstruction, with the two former approaches receiving the greatest amount of research attention. Although many published studies support the efficacy of IA and BF, the results of these studies are equivocal.

Some studies have reported on the efficacy of BF,[1-5] whereas others have not found BF to produce positive outcomes.[6, 7] A range of IAs have been demonstrated to be efficacious in some studies[8-11] but not others.[12-14] Studies on both BF and IAs have been plagued by short follow-up periods and consequently have not demonstrated the long-term efficacy of treatment with either BF or IAs.

A few studies have directly compared the clinical efficacy of IAs with that of BF. Again, the results are equivocal. Hijzen et al.[12] found BF to be effective in reducing symptoms, but an IA did not affect symptoms. Dahlstrom et al.,[2, 15] Crockett et al.,[16] and Brooke and Stenn[17] demonstrated that IAs and BF were both effective treatment modalities, but there were no significant differences in efficacy between them. By way of contrast, Okeson et al.[11] reported that intraoral appliances were more effective than brief relaxation (without the use of biofeedback instrumentation).

Several studies have examined predictors of response to BF treatment for TMD. In an early study, Gessel[5] noted that the patients who were not treated successfully by BF were characterized by higher levels of depression and marked reductions in regular daily activities. These results were replicated by Funch and Gale[18] who also reported that unsuccessful patients also reported lower feelings of control than did successfully treated patients. Schwartz et al.[19] suggested that nonresponsive TMD patients tended to be more psychologically disturbed.

The studies that evaluated IAs did not attempt to examine the predictive utility of psychologic factors or to measure psychologic factors and response to treatment. Thus, it is impossible to determine whether psychologic distress would be significant in treatment outcome, as was demonstrated for the BF studies. Suvinen and Reade[20] did note that IAs that stabilized occlusal patterns were associated with success and that in those cases where "... stabiliza-

tion patterns occurred but pain continued there was an indication of a complicating psychosocial disorder."

Both IA and BF approaches have been designed to treat the cause of symptoms presumed to be physical. One explanation for the inconsistency of the results on the efficacy of IAs and BF may be that both interventions have some beneficial effect for some patients; however, neither treatment is likely to be effective in the end for all patients, because each fails to deal with the psychologic factors associated with TMJ pain. Both treatments will have some initial beneficial effects because they draw the patient's attention to their oral habits and level of muscle tension (cognitive awareness)[21] and provide some symptomatic relief by preventing bruxing and helping to relax muscles.[22, 23] However, failure to deal with the psychologic factors that are associated with the reported pain and other symptoms will be less efficacious[17, 24] and may result in relapse.[25] A growing body of literature suggests that TMJ pain is maintained and exacerbated, if not caused by, a combination of both physical and psychologic factors.[26-28]

One purpose of this study was first to examine the treatment efficacy of biofeedback-assisted relaxation and stress management (BF/SM) and occlusal appliances (IA). An approach that combined BF and SM was chosen because BF studies do not directly address the cause of the muscular arousal; instead the treatment is designed to provide proficiency in relaxation and thus reduce the symptom or muscle pain. A second purpose of this study was to compare the immediate and long-term efficacy of BF/SM and IA on both pain symptoms and levels of psychologic distress.

A second study was conducted to compare both the short- and long-term efficacy of a combined treatment consisting of an IA and BF/SM. This was done to compare the additive effect of the two treatments with the effect of each treatment by itself.

We hypothesized that in the short-term both the IA and the BF/SM would significantly reduce both reported pain and accompanying psychologic distress, with little difference between the two modes of treatment. However, we predicted that there would be significant relapse for both individual treatments at the follow-up, with the group treated with the IA showing the greatest relapse on both outcome measures because it did not directly address the sources of psychologic distress believed to maintain and exacerbate pain. We predicted further that the combination of the two treatments, IA and BF/SM, would demonstrate greater maintenance of treatment effects at the follow-up than either of the two treatments administered separately.

## METHODS

### Study 1

*Subjects.* Subjects were 80 consecutive referrals to an outpatient TMD clinic at the University of Pittsburgh. Each patient received a comprehensive dental and psychologic evaluation that included a set of standardized psychologic tests. Inclusion criteria consisted of (1) pain and tenderness of the muscles of mastication and TMJ region and limited mandibular movements of 2 months duration or longer, (2) no evidence of serious psychopathology, (3) no history of TMJ-related surgery, and (4) at least 18 years of age. The mean age of patients was 34.1 (SD 8.4, range 18 to 55), 82% were women, and 56% were married. The median duration of pain was 4.9 years (range 2 months to 21 years).

*Procedure.* After completion of written informed consent and dental and psychologic evaluations, subjects were randomly assigned to one of three experimental conditions: (1) IA therapy (n 30); (2) BF/SM treatment (n 30); or (3) a 6-weeks waiting list control condition (n 20). Chi-square and analysis of variance (ANOVA) analyses indicated no significant differences among the three groups in years of age (IA mean age 35.9, SD 9.1; BF/SM 33, SD 7.9; and WL 33.1, SD 8), duration of pain in years (IA mean duration 5.3, SD 4.7; BF/SM 7.1, SD 5.5; and WL 7.6, SD 7.2), or percent reporting daily pain (75%, 77%, and 65%, respectively). Similarly, there were no significant differences between the groups in the gender composition (women: 75%, 90%, and 80%, respectively).

*Interocclusal appliance treatment (IA).* Patients included in the IA treatment received a full-arch IA. The IA used was a flat heat-cured acrylic resin splint and was constructed on the maxillary or mandibular arch.[29, 30] The waxed IA covered all occlusal and incisal surfaces with 2 mm overlap on the labial or buccal surfaces and covered halfway on the palatal rugae. All centric cusps of the opposing arch were touching evenly on the flat occlusal surface of the IA, with uniform canine guidance anteriorly and laterally. The interocclusal thickness of the IA ranged from 1 to 2 mm in thickness, allowing comfortable closure of the mandible with proper lip seal. After processing, the IA was adjusted in the patient's mouth by use of articulating papers. The goal of the IA was to isolate the contact relation of the teeth from the masticatory system without introducing disturbing influences related to the presence of the splint itself. This was achieved by rendering all IAs flat, which resulted in freedom from interferences in all mandibular excursions.

Patients were instructed to wear the IA at all times for the first 6 weeks of treatment, except during eating and oral hygiene. To control for the frequency of professional contact, these patients were seen weekly by a dentist for 6 weeks, as in the BF/SM treatment condition described next. During each session, patients were instructed in oral habits, such as avoiding chewing gum and eating soft foods. The frequency of IA use was reviewed and, if irritation had occurred during that week, adjustments were made to the IA.

*Biofeedback /stress management treatment (BF/ SM).* Patients assigned to the BF/SM condition were seen for 6 weekly 1-hour sessions by a psychologist trained in biofeedback-assisted relaxation procedures and SM. The specific BF procedures used were as follows: (1) 4 mm Ag/AgCl surface electrodes were taped bilaterally over the

masseter muscle in the position suggested by Lippold[31]; (2) to ensure that electrodes were in the same position each session, a plastic template showing the position of the electrodes was made for each patient; (3) computer-controlled auditory tone and pulsating feedback directly proportionate to masseter muscle tension levels was used; and (4) each BF session began with a no-feedback resting baseline period of 5 minutes, during which time patients were instructed to relax their jaw muscles to the best of their ability, followed by 20 minutes of BF, and concluding with a 5-minute no-feedback period.

In addition to BF during each treatment session, BF/SM patients also were provided with SM therapy that included (1) didactic education regarding the association between stress, increased muscle tension, and pain; (2) training in several cognitive coping skills to control pain, for example, attention diversion; and (3) homework assignments to help patients practice relaxation skills without the BF instrumentation, as well as techniques to identify stressful situations in their natural environments and ways to deal more effectively with these sources of stress.

***Waiting list control group (WL).*** Patients assigned to the WL group received the same pretreatment assessment procedures as the IA and BF/SM groups. At the time of the pretreatment evaluation, WL patients were informed that there was a waiting list for treatment and were scheduled for a second appointment 6 weeks later. At their second appointment, these patients received an assessment procedure identical to the first. The patients then were provided with either IA or BF/SM treatment, but were not included in any of the analyses that compared treatment outcome between the IA and BF/SM conditions.

### Dependent measures

Multiple outcome criterion measures were used, each of which has been demonstrated to have good psychometric properties. The dependent measures were collected before treatment was begun, at the posttreatment assessment (1 week after the sixth treatment session), and at a 6-month follow-up evaluation.

***Pain.*** Pain was evaluated with the Pain Severity Scale (PSS) from the Multidimensional Pain Inventory,[32] which is a comprehensive self-report instrument, and with a muscle palpation pain index (PPI). Seven muscle sites were examined bilaterally: origins and insertions sites of the masseter, temporalis, and internal pterygoid muscles, and one palpation site for the external pterygoid. These sites were scored dichotomously for the presence or absence of pain on palpation.[33] Item response theory,[34] which is designed specifically for the analysis of dichotomous and ordinal-level data, was used to evaluate the statistical appropriateness of creating a summed score from the 14 sites examined. This analysis lead to the rejection of the bilateral scores for the origin of the internal pterygoid. The remaining 12 sites had an internal reliability coefficient of 0.94. PPI scores were computed as the sum of the number

of painful sites, which could range theoretically from 0 to 12. Interrater reliability for 20 patients, separated by 1 week before beginning treatment, was 0.86 for this summated scale.

***Depression.*** Depression was evaluated with the Center for Epidemiologic Studies-Depression (CES-D)[35] and the depression scale from the Profile of Mood States (POMS).[36]

***Credibility ratings.*** Patients in the active treatment groups (IA and BF/SM) rated how credible they felt the treatment they were receiving was on a set of five 10-point scales developed by Borkovec and Nau.[37] These ratings included questions related to how confident the patients were that the treatment they were receiving would help them with their pain problem, how confident they were in recommending this treatment to a friend, and so forth. These credibility ratings were made after the first week of treatment and at the posttreatment evaluation. The measurement of treatment credibility was considered important to assess whether patients perceived the IA and BF/SM treatment conditions as having equal face validity to the patients. If not, differences in patients' expectations of success and faith in the therapist may produce differential placebo effects that may confound interpretations of treatment response differences. A mean credibility score was computed and demonstrated good internal consistency (coefficient alpha 0.91).

## RESULTS

### Pretreatment versus posttreatment differences

During treatment, two IA and no BF/SM patients dropped out of treatment, leaving an effective treatment sample size of 58 patients. All WL patients returned for re-examination 6 weeks after the first examination. Mixed model MANOVAs that simultaneously considered conceptually related measures, for example CES-D and POMS depression scores, were used to test for before-and-after treatment differences. This type of analysis increases the reliability of detecting treatment outcome differences and simultaneously helps to better control type I error rates.[38] The means and standard deviations for all of the outcomes measures are presented in Table I.

***Treatment credibility.*** Before-and-after treatment credibility ratings were high for both IA and BF/SM groups. Pretreatment ratings between the IA and BF/SM groups were not different statistically ($F$ 2.61, $df$ 1,56, $p$ ns), nor were posttreatment ratings ($F$ 0.11, $df$ 1,56, $p$ ns). The credibility ratings for both groups displayed a statistically significant increase from before to after treatment ($F$ 10.99, $df$ 1,56, $p$ < 0.001), which suggests the subjects' increasing confidence in whichever treatment they received.

***Depression measures.*** Analysis of CES-D and POMS scores showed a significant group by time (before and after) interaction ($F$ 5.58, $df$ 2,75, $p$ < 0.005). Planned contrasts showed significant reductions in depression levels for

both the IA and the BF/SM patients ($F$ 25.41, $df$ 1,56, $p < 0.001$), but no significant changes for the WL group ($F$ 0.35, $df$ 1,19, $p$ ns). IA and BF/SM posttreatment depression scores were not different statistically ($F$ 0.03, $df$ 1,56, $p$ ns).

**Pain measures.** A significant group by time interaction was found for pain severity scores ($F$ 15.85, $df$ 2,75, $p < 0.001$). Both the IA and BF/SM patients had significant reductions in pain levels ($F$ 120.2, $df$ 1,56, $p < 0.001$), but the WL patients did not ($F$ 0.44, $df$ 1,19, $p$ ns). Further analysis of IA and BF/SM before-and-after pain scores, however, indicated a significant group by time interaction ($F$ 6.86, $df$ 1,56, $p < 0.01$). Compared with the BF/SM group, IA patients had significantly lower pain scores for both the PPI ($F$ 8.55, $df$ 1,56, $p < 0.005$) and PSS ($F$ 6.21, $df$ 1,56, $p < 0.01$) measures.

## Posttreatment versus follow-up differences

Three patients in the IA treatment condition and four patients in the BF/SM treatment condition were unable or refused to return for the 6-month follow-up evaluation. The means and standard deviations for the dependent measures for the IA and BF/SM groups at the 6-month follow-up are presented in Table I.

**Depression measures.** Analysis of the posttreatment and follow-up depression measures for the IA and BF/SM treatment groups revealed a significant group by time interaction ($F$ 5.23, $df$ 1,49, $p < 0.03$). Further analysis of these scores showed that at 6 months the mean depression score for IA patients increased significantly from their posttreatment levels ($F$ 7.57, $df$ 1,24, $p < 0.01$) and were not different significantly from their pretreatment depression scores ($F$ 0.41, $df$ 1,24, $p$ ns). The posttreatment reductions in depression scores for the BF/SM group, however, were maintained at the 6-month follow-up ($F$ 0.01, $df$ 1,25, $p$ ns). Fig. 1 illustrates the significant group by time interaction for CES-D mean depression levels.

**Pain measures.** Analysis of the posttreatment and follow-up pain scores showed a significant group by time interaction ($F$ 10.02, $df$ 1,49, $p < 0.003$). Additional analyses that compared changes in pain measures from posttreatment to the follow-up indicated that pain levels decreased significantly for the BF/SM group ($F$ 5.31, $df$ 1,25, $p < 0.03$), but increased significantly for the IA group ($F$ 4.88, $df$ 1,24, $p < 0.04$). Pain levels between groups, however, were not different statistically at the time of the 6-month follow-up ($F$ 1.39, $df$ 1,49, $p$ ns). Fig. 2 depicts these findings for PPI scores.

## Study 2

**Subjects.** Subjects were 30 consecutive referrals to the outpatient TMD pain clinic after the completion of Study 1. The inclusion/exclusion criteria were identical to those described in Study 1. The patient sample receiving IA + BF/SM treatment had a mean age of 33.6 (SD 8.9), their

**Table I.** Dependent outcome measures by time of assessment and experimental group

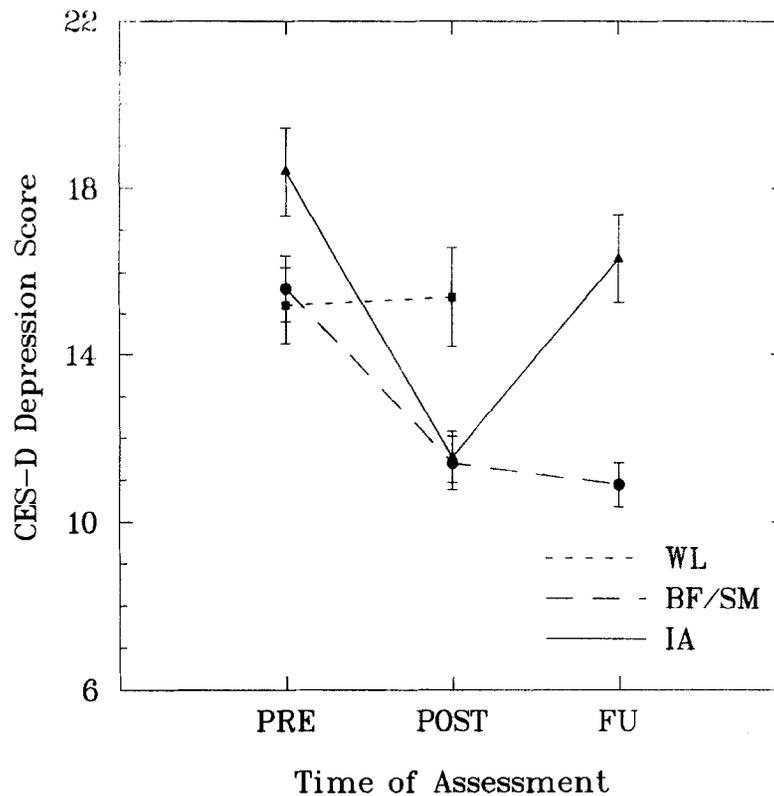| Measure Group | Pre-treatment | | Post-treatment | | 6-Month follow-up | |
|---|---|---|---|---|---|---|
| | $\overline{X}$ | SD | $\overline{X}$ | SD | $\overline{X}$ | SD |
| CES-D (depression) | | | | | | |
| IA | 18.4 | 11.0 | 11.5 | 6.4 | 16.3 | 9.5 |
| BF/SM | 15.6 | 8.7 | 11.4 | 6.9 | 10.8 | 5.4 |
| WL | 15.2 | 8.2 | 15.4 | 0.7 | — | |
| POMS (depression) | | | | | | |
| IA | 14.1 | 10.8 | 7.5 | 6.8 | 13.2 | 10.4 |
| BF/SM | 12.0 | 8.4 | 7.7 | 6.7 | 6.7 | 5.8 |
| WL | 11.2 | 6.7 | 11.4 | 8.1 | — | |
| BDI (depression) | | | | | | |
| IA + BF/SM | 11.0 | 5.6 | 5.9 | 5.2 | 5.8 | 5.0 |
| ADS (depression) | | | | | | |
| IA + BF/SM | 3.3 | 1.0 | 1.9 | 0.9 | 2.0 | 1.0 |
| PSS (pain severity) | | | | | | |
| IA | 3.5 | 1.3 | 1.6 | 1.2 | 2.3 | 1.7 |
| BF/SM | 3.4 | 0.9 | 2.4 | 1.2 | 2.0 | 1.3 |
| WL | 3.3 | 1.2 | 3.0 | 1.5 | — | |
| IA + BF/SM | 3.4 | 1.1 | 1.2 | 1.0 | 1.3 | 1.1 |
| PPI (pain severity) | | | | | | |
| IA | 5.9 | 1.8 | 1.9 | 2.5 | 2.7 | 2.1 |
| BF/SM | 6.1 | 2.0 | 3.6 | 1.9 | 1.8 | 2.4 |
| WL | 5.3 | 2.2 | 5.1 | 3.0 | — | |
| IA + BF/SM | 5.9 | 2.0 | 1.4 | 1.5 | 1.0 | 1.8 |
| Treatment credibility | | | | | | |
| IA | 8.0 | 1.5 | 8.9 | 1.1 | — | |
| BF/SM | 8.6 | 1.2 | 9.0 | 1.2 | — | |
| IA + BF/SM | 9.3 | 0.8 | 9.4 | 0.9 | — | |

CES-D, Center for Epidemiologic Studies–Depression Scale; IA, intraoral appliance treatment; BF/SM, comb. biofeedback and stress management; WL, waiting list control group; POMS, Profile of Mood States; BDI, Beck Depression Inventory; ADS, Affective Distress Scale from the West Haven–Yale Multidimensional Pain Inventory; PSS, Pain Severity Scale from the West Haven–Yale Multidimensional Pain Inventory; and PPI, muscle palpation pain index.

mean duration of pain was 6.2 (SD 5.8) years, and 73% reported daily pain. Eighty-three percent of the sample were women. Chi-square and ANOVA analyses indicated no significant group differences between this patient sample and the three patient groups described in Study 1.

**Procedure.** Evaluation and treatment procedures in this study were identical to those described in Study 1, with the exception that the TMD patients in this study received a treatment protocol that combined the IA and BF/SM treatments used in Study 1 (IA + BF/SM).

## Dependent measures

As in Study 1, multiple outcome criterion measures were used to evaluate treatment success, and collected before treatment, at the posttreatment assessment, and at a 6-month follow-up evaluation. Treatment credibility and pain measures were identical to those described in

**Fig. 1.** Mean and standard errors for pretreatment (PRE), posttretment (POST), and 6-month follow-up (FU) scores on the CES-D by experimental group.

Study 1. Depression measures were altered to include the Beck Depression Inventory (BDI)[39] and the Affective Distress Scale (ADS) from the Multidimensional Pain Inventory.[32] These measures have demonstrated high correlation with the depression measures used in Study 1.[32, 35]

## RESULTS

### Pretreatment versus posttreatment differences

During treatment, one subject from the combined treatment group dropped out of treatment, leaving an effective sample size for the IA + BF/SM treatment condition of 29 patients. Before-and-after treatment scores for IA + BF/SM patients are displayed in Table I. IA + BF/SM patients displayed high treatment credibility ratings (Table I). Their posttreatment credibility ratings were not significantly different from those of IA and BF/SM patients in Study 1 ($F$ 3.24, $df$ 1,85, $p$ ns)

IA + BF/SM patients were found to have significant before-and-after treatment changes for both pain measures ($F$ 332.6, $df$ 1,28, $p < 0.001$), and depression measures ($F$ 25.24, $df$ 1,28, $p < 0.001$). IA + BF/SM posttreatment pain scores were found to be significantly lower than BF/SM posttreatment pain scores ($F$ 24.53, $df$ 1,85, $p < 0.001$), but were not significantly lower than IA pain scores ($F$ 1.69, $df$ 1,85, $p$ ns). For depression scores,* an

analysis with the three treatment groups combined showed a significant pretreatment to posttreatment reduction in depression scores ($F$ 49.48, $df$ 1,85, $p$ < 0.001), but the depression scores at posttreatment were not significantly different among the three groups ($F$ 0.985, $df$ 2,85, $p$ ns).

### Posttreatment versus follow-up differences

One IA + BF/SM patient failed to return for the 6-month follow-up evaluation. As displayed in Table I, IA + BF/SM pain scores revealed no relapse at 6-months and were not significantly different from their posttreatment scores ($F$ 0.68, $df$ 1,27, $p$ ns).

Analysis of posttreatment and follow-up pain scores for the three treatment conditions indicated a significant group by time interaction ($F$ 6.51, $df$ 2,75, $p < 0.003$). Analyses showed that the follow-up pain scores for IA + BF/SM patients were significantly lower than the follow-up pain scores for IA patients ($F$ 11.70, $df$ 1,75, $p$ < 0.001) and BF/SM patients ($F$ 4.02, $df$ 1,75, $p < 0.05$). These differences are displayed in Fig. 2. In Study 1, follow-up depression scores for IA patients demonstrated significant re-

*Because different depression measures were used between Studies 1 and 2, depression scores were normalized to proportions by dividing the scores for each measure by the total possilbe score for that measure before these analyses.
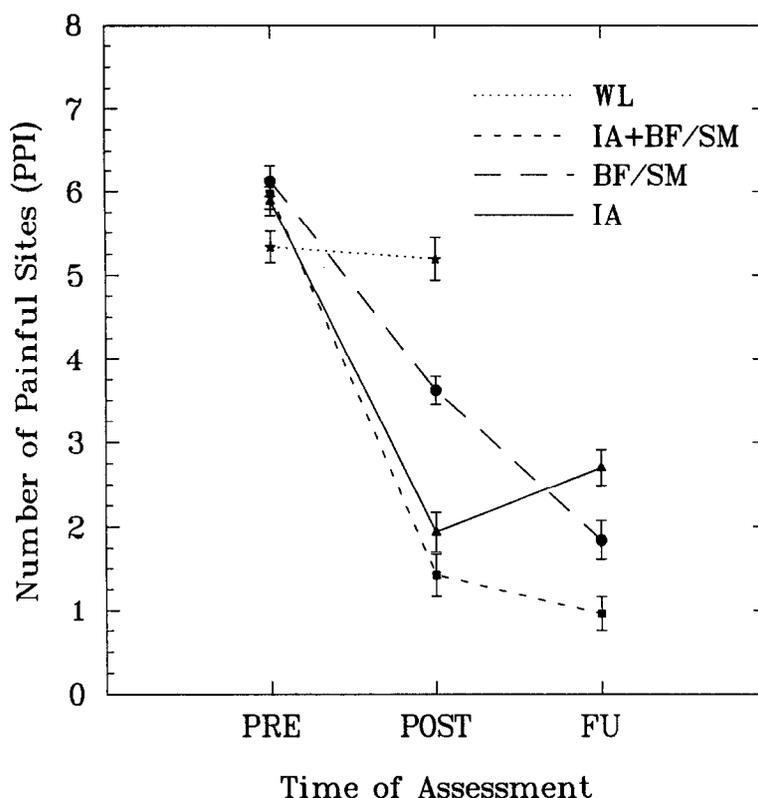
**Fig. 2.** Mean and standard errors for pretreatment (PRE), posttreatment (POST), and 6-month follow-up (FU) scores on the PPI by experimental group.

gression, returning to their pretreatment levels, whereas depression scores for the BF/SM group, as found for the IA + BF/SM patients in this study, maintained the statistically significant improvement seen at posttreatment. Comparison of follow-up depression scores between BF/SM and IA + BF/SM patients indicated no significant differences ($F$ 0.01, $df$ 1,75, $p$ ns).

## DISCUSSION

The results of this study confirm most of our major predictions. Both BF/SM and IA treatments produced significant short-term effects on pain and depressed mood. The IA treatment appeared to have a greater initial effect than the BF/SM; however, at the 6-month follow-up the IA treated patients displayed significant relapse both in pain and especially in depression. The patients receiving the BF/SM treatment appeared to maintain their initial gains and continued to improve. At the time of the follow-up, the BF/SM group equaled the reduction in pain reported by the IA group but also demonstrated significantly lower levels of depression than the IA group. Comprehensive treatment consisting of the combination of an IA with BF/SM produced greater long-term maintenance of therapeutic benefits for pain than either of these individual treatments. Finally, there was no significant difference between the BF/SM and combined treatments for depression.

The results of both studies reported suggest that a treatment such as IA that directly targets pain can have an effect on that symptom in a reasonably short period of time. Symptomatic relief of pain also appears to lead to significant reduction in depression that accompanies the pain. The IA is not specifically designed to address depression and thus it is not surprising that the initial positive effects were not maintained. By way of contrast, the BF/SM treatment was designed to address both pain and depression. The IA appears to have a more immediate effect on pain that the BF/SM but by the follow-up the BF/SM demonstrates significant reductions in pain and at follow-up there are no differences between the two groups on pain severity. This lag effect is not unexpected since BF/SM takes time to learn and requires practice. Moreover, one purpose of the BF/SM was reduction in stress and factors that contribute to depression. Thus, the maintenance of the improvements in depression observed were predicted.

The combined IA + BF/SM treatment seems to combine the advantages of both of the individual treatments such that it produced the immediate pain relief of the IA alone and the maintenance of pain relief and reduced depression of the BF/SM treatment. These results suggest the combined treatment has significant advantages over either the IA or the BF/SM treatment alone.

Results complementary to those reported in this article

were published by Tversky et al.,[24] who compared the responses of depressed patients to the IA, antidepressive medication, and the combination of IA and antidepressants. The combined treatment succeeded in resolving the symptoms both of TMD and depression, whereas, the single treatments were only partially successful. The IAs, by themselves, were successful in alleviating TMD symptoms in a nondepressed sample.

The results of our studies support the complexity of TMD. We must be cautious, however, to note that the results of this study do not directly address the etiologic basis for TMD. However, consistent with other classes of chronic pain, over time, it appears that physical as well as psychologic factors are important.[40] In particular, it appears that depression plays a particularly important role in TMD and should be assessed and treated directly. The results of the studies reported in this paper suggest that combining traditional dental treatments with psychologically based treatments may be the most efficacious approach for successful treatment of TMD, and importantly the long term maintenance of initial treatment success.

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