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The American Academy of Pediatric Dentistry
Volume 11, Number 2

Time course of the discomfort in young patients undergoing orthodontic treatment*

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Abstract

Discomfort may accompany orthodontic movement of teeth. The purpose of this study was to determine the time envelope of discomfort induced in young patients (10-16 years) following placement of orthodontic separators and arch wires. Secondly, psychosocial factors concerning feelings of "self" were investigated. Forty-five experimental and 14 control patients seeking orthodontic treatment were included. A data sheet consisting of several visual analogue scales measuring patient perceptions of dental discomfort and psychosocial factors was used. The results indicated that the experimental group experienced significant discomfort with both separators and arch wires at 4 and 24 hr compared to controls; however, the discomfort dissipated by 7 days. The appearance of the teeth and face were significant factors predicting the patient's perspective of "self." The results have significant clinical implications and these are discussed.

The movement of teeth by orthodontic appliances typically causes some discomfort to the patient. It has been reported that fear of pain is a key factor discouraging a patient from seeking orthodontic treatment (Oliver and Knapman 1985).

Although there have been no clinical trials in which patients have rated discomfort as a function of separator placement, one report indicated that patients experience discomfort within 24 hr following the placement of arch wires (Jones 1984). Although the discomfort is known empirically to last for a few days, the time envelope of the discomfort has not been evaluated adequately. Furthermore, there is little association between the type of tooth movement induced by the arch wire and the degree of discomfort elicited (Jones and Richmond 1985).

In recent years, several investigators have demonstrated that psychological factors of patients are important in evaluating their responses to painful treatment modalities (Taenzer et al. 1986). It has been suggested that these findings may have significant implications for the health care provider in terms of the patient's expected treatment outcome (Kiyak et al. 1986).

The purpose of this study was to determine the patient's degree of dentally related discomfort over time following placement of separators and arch wires. Secondly, measurements related to general health and psychosocial factors were studied.

Materials and Methods

This report is based on a subset of a larger prospective study that involved both adult and adolescent orthodontic patients. The data presented are that of a population of middle-aged children and young adolescents between the ages of 10 and 16 years selected as patients for comprehensive orthodontic treatment at The Ohio State University College of Dentistry. Forty-five patients screened were designated as the experimental group and the next 14 were identified as controls (they did not receive orthodontic treatment).

A data sheet consisting of 14 separate visual analogue scales (VASs) was constructed (modified from that of Kiyak et al. 1986). Each VAS was a line 10 cm in length anchored at either end by both "happy/sad" cartoon faces and extreme descriptor terminology (Figure, next page). The first 4 VASs referred to discomfort associated with the dentition, and the remaining VASs measured factors of general health and psychosocial functions. Each patient was asked to make a small vertical line along the rule that indicated their feelings on each given item. All items were rated by every patient. The score for each VAS was the distance in millimeters from the left side of the line to the vertical mark made by the patient.

The experimental group was directed to complete 3 identical data sheets in their homes at 4 hr, 24 hr, and 7

*Portions of this manuscript were reported at the the Research Section of the 1988 Annual Session of the American Academy of Pediatric Dentistry, San Diego, California.

days following placement of separators. Subsequently, they were requested to complete the data sheets at the same time periods following arch wire placement. Quikstik S2® (Unitek; Monrovia, CA) elastic orthodontic separators were placed between the mesial and distal contacts of the first permanent molars in each quadrant for 7 days. Either Begg® or edgewise brackets were used for orthodontic movement of teeth and 0.016-inch Response® arch wires (Ormco, Division of Sybron Corp; Glendora, CA) were placed initially. The control group completed the form once. The data sheets had self-addressed stamped envelopes and were to be returned immediately after each rating was completed.

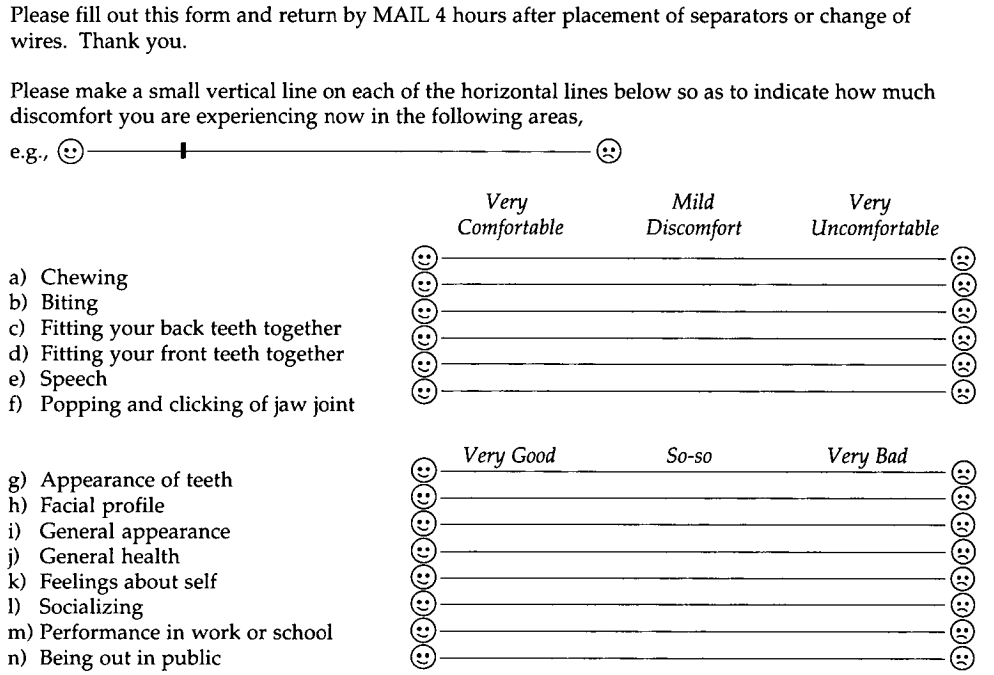

FIG. Example of data sheet with VASs used in this study.

The data were analyzed with independent t-tests and repeated measures of ANOVA. Pearson product moment correlation coefficients and multiple step-wise regressional analysis also were performed.

Results

The mean ages of the experimental and control groups were 13.7 ± 1.5 and 12.7 ± 1.7 years, respectively, and there was no significant difference in the distribution of ages in either group.

The first four VASs were measures of discomfort associated with the dentition. For the present purposes, these VASs were added to yield a "discomfort score." The main finding was that there was a significant difference between the experimental and control groups in the amount of the discomfort score reported at 4 and 24 hr following placement of either separators or arch wires. However, there was no significant difference between the groups in the amount of discomfort reported at 7 days. The greatest amount of discomfort was noted 24 hr after placement of either separators or arch wires. These results are summarized in Table 1.

An ANOVA (Table 2, next page) indicated that there were significant differences in the amount of discomfort within the experimental group at 4 and 24 hr compared to 7 days following the placement of either separators or arch wires. The interaction between the variables of time and treatment (separators or wires) was not statistically significant. However, the degree of discomfort as indicated by the mean VAS score was slightly greater following the placement of arch wires compared to separators.

Pearson correlation coefficients indicated that those patients who tended to rate high levels of discomfort at 4 hr also tended to rate high levels of discomfort at 24 hr and 7 days following the placement of separators (Table 3, next page). A similar finding was noted following placement of arch wires in that there was a significant correlation between the discomfort reported at 4 hr to that at 24 hr. However, the relationship between 24 hr

TABLE 1. Independent *t*-Tests Comparing Experimental Versus Control Discomfort Scores As a Function of Time

Separators	Mean*	SD	*t*	df	*P*
4 Hr	78	47	3.14	59	.003
	152	83			
24 Hr	78	47	3.50	59	.001
	179	104			
7 Days	78	47	0.58	52	.565
	67	68			
Wires	**Mean**	**SD**	***t***	**df**	***P***
4 Hr	78	47	3.36	37	.002
	185	112			
24 Hr	78	47	2.86	36	.007
	190	140			
7 Days	78	47	1.06	27	.297
	53	72			

* Score represents the mean summated values (mm) of 4 VAS associated with dental pain.

TABLE 2. ANOVA of Discomfort Scores for Experimental Group As a Function of Time and Treatment

Source	*DF*	*F*	*P*
Time	2	25.24	0.001
Treatment	1	0.79	0.38
Time × treatment	2	0.73	0.48

and 7 days was not significant. The reason for this latter finding is not clear; however, adaptation and changes in patient expectations may have been involved.

Overall, the findings showed a high degree of intra-rater reliability on the VASs across time even though the amount of discomfort changed. In the present study, no attempt was made to obtain ratings for discomfort at baseline. However, because of the possibility that the initial ratings may have influenced subsequent ratings and to test the reliability of repeated measurements specifically with VASs across time, we sampled data from another control group that was used to determine intra-rater reliability at 4 time periods (initially, 4 hr, 24 hr, and 7 days) without placement of either separators or arch wires. The latter group also demonstrated a high reliability (Cronbach's alpha = 0.89) in ratings between time periods and there were no significant differences in discomfort between any time periods.

A preliminary analysis indicated that the psychosocial variables as measured in this study were linearly related to "feelings about self" and "facial profile" (these were 2 factors measured by the VASs). Therefore, a multiple regression analysis was used to determine if any of the VAS factors predicted patients' feelings toward themselves, since this has been shown to be a prominent factor for patients in seeking orthodontic care (Breece and Nieberg 1986). The analysis indicated that in this population the appearance of their teeth was found to be the most significant variable and facial appearance was the second most significant variable in predicting self-perception (viz., the factor of "self" on the VAS was the dependent variable). No other measured variable was found to contribute significantly to the prediction of self-perception.

When the variable of face was used as a dependent variable in the regression analysis, the variable of general appearance was found to be the most significant in predicting satisfaction with the face. This was followed in turn by the factors of self and the public. No other variable contributed significantly in the analysis. This analysis is summarized in Table 4. Again, when residuals of the psychosocial variables found to be significantly related to "self" and "face" were plotted against the predicted values of either self or face, they indicated a random relationship and thus supported the use of a linear regression model.

TABLE 3. Correlation Coefficients Between Reported Discomfort Scores at Different Time Periods for the Experimental Group

	Separators		
	4 Hr	24 Hr	7 Days
4 Hr	–		
24 Hr	.4304*	–	
7 Days	.4021*	.4005*	–
	Wires		
	4 Hr	24 Hr	7 Days
4 Hr	–		
24 Hr	.6918*	–	
7 Days	.3662	.3174	–

* Probability < .01.

Discussion

The findings of this study indicated that patients receiving orthodontic treatment incur a statistically significant degree of dental discomfort following placement of either separators or arch wires. The time envelope, as measured in this study, for the discomfort begins within 4 hr and continues for at least 24 hr after teeth are activated. However, the discomfort dissipates by 1 week. This tends to support the findings of Jones (1984) who showed that the greatest amount of analgesic intake occurred within the first 3 days following arch wire placement.

The lack of an interaction effect between time measurements (4 hr, 24 hr, and 7 days) and treatment (separators or wires) suggest that the means by which orthodontic forces cause discomfort has little or no influence on the period of discomfort experienced. Interestingly, Jones and Richmond (1985) found no relationship between the degree of arch discrepancies (anterior and overall crowding) and the pain ratings following placement of an arch wire. Hypothetically, the greater the degree of crowding, the more teeth are actively engaged by the arch wire which would result in greater discomfort. Nonetheless, this does not discount the possibility

TABLE 4. Multiple Stepwise Regression Analysis of the Psychosocial Factors Evaluated with the Visual Analogue Scales

Dependent Variable = Self		
Independent variable entered	Step	Multiple R
Appearance of teeth	1	.7270*
Face	2	.7866*
Dependent Variable = Face		
Independent variable entered	Step	Multiple R
General appearance	1	.7179*
Self	2	.7848*
Public	3	.8093*

* Probability < 0.01.

that unilateral or segmental placement of orthodontic appliances may produce less discomfort than bilateral or multisegmental appliances.

There have been recent reports indicating that prostaglandins and substance P may be involved in mediation of discomfort (Ferreira et al. 1973; Rhodus 1979; White 1984; Kamogashira et al. 1988). Animal studies have demonstrated that substance P concentration levels following placement of orthodontic forces on teeth followed the same general time envelope as that of this report (Kamogashira et al. 1988). Future study will be required to determine the nature of the relationship between orthodontic discomfort and both prostaglandin and substance P concentrations.

The findings in this study suggest that the patients perceived their dentition as an important element reflecting their concept of "self." This is clinically relevant in the sense that these feelings may provide a strong impetus both in seeking orthodontic treatment (Breece and Nieberg 1986) and in the expectations regarding treatment outcome. Since this population sought orthodontic treatment, they may have a better self-concept. Treatment satisfaction may depend significantly on many psychosocial factors including patient-dentist rapport. Some of these factors already have been addressed in reports of orthognathic surgical and conventional orthodontic interventions (Kiyak et al. 1986).

This study also indicates that this population is also concerned with their face, their feelings toward themselves, and how they may be projected in public. This corresponds to findings that relative motivating factors responsible for the seeking of orthodontic care include dental health and appearance, facial appearance, and facial appearance in a social environment (Breece and Nieberg 1986). It may be revealing to investigate the factors of age and degree of awareness of perceived malocclusion as they relate to the patient's perspective in psychosocial relations.

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