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Pain and discomfort associated with orthodontic separator placement in patients attending the Lagos University Teaching Hospital, Lagos, Nigeria

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Abstract

Objective : To determine the perception of pain and discomfort associated with orthodontic separator placement in patients attending the Lagos University Teaching Hospital, Lagos, Nigeria

Method : Sixty four patients scheduled for treatment with fixed orthodontic appliances completed questionnaires before insertion of separators and after placement at 4 hours, 24 hours and 7 days. The level of pain and discomfort during these time periods was assessed by a visual analogue scale.

Results : There was a significant increase in the level of pain/discomfort 4 hours and 24 hours after placement of the separators for all the activities. The level of pain/discomfort peaked at 4 hours but did not return to baseline levels after 7 days. Patients more than 16 years old reported significantly more pain/discomfort over time than those 16 years and under. No significant difference in pain/discomfort was found between the sexes.

Conclusion : Patients experience pain/discomfort following placement of orthodontic separators. Pretreatment counselling and analgesics are recommended.

Keywords:
Pain, Separators, Orthodontics

Résumé

Douleur et inconfort associés à la pose de séparateur orthodontique chez des patients consultant au Centre Hospitalier Universitaire de Lagos, Nigeria

Objectif : Déterminer la perception de douleur et d'inconfort durant la pose de séparateur orthodontique chez des patients fréquentant le Centre Hospitalier Universitaire de Lagos, au Nigéria.

Méthode : Soixante-quatre patients devant suivre un traitement orthodontique multi-attaches ont répondu à un questionnaire avant l'insertion de séparateurs et après la pose à 4 heures, 24 heures et 7 jours. Les niveaux de douleur et d'inconfort durant ces laps de temps ont été évalués grâce une échelle analogique visuelle.

Résultats : Il y avait une augmentation significative du niveau de douleur/inconfort 4 heures et 24 heures après la pose des séparateurs pour toutes les activités. Le niveau de douleur/d'inconfort a culminé à 4 heures, mais n'est pas revenu au niveau de référence après 7 jours. Les patients de plus de 16 ans ont signalé de façon significative plus de douleur/d'inconfort au fil du temps que ceux âgés de 16 ans ou moins. Aucune différence significative dans la douleur/l'inconfort n'a été trouvée entre les sexes.

Conclusion : Les patients ont ressenti de la douleur/inconfort après la pose de séparateurs orthodontiques. Un prétraitement est recommandé fait de conseils et de médicaments analgésiques.

Mots-clés :
Douleur, Séparateurs, Orthodontie

Introduction

Pain is one of the most reported negative effects of orthodontic treatment (1-4). It is of major concern to both patients and clinicians. Previous studies to assess the experience of orthodontic pain indicate that it is a key

deterrent to orthodontic therapy and a major reason for discontinuing treatment (1, 2, 5, 6). Orthodontic patients often experience some degree of pain and discomfort with the insertion of separators and initial arch wires and

during periodic adjustment of orthodontic appliances (7). The various discomforts experienced by patients after appliance placement are described as feelings of pressure, tension, soreness of teeth and pain (7). Orthodontic appliance – induced pain may negatively affect patient cooperation and has been reported as one of the most important factors in discouraging patients seeking orthodontic care (8).

Creating space mesially and distally to teeth which are to be banded during separation forms the initial step in fixed orthodontic mechanotherapy. Several studies concerning the placement of orthodontic separators (brass wire, elastomerics, spring type steel separators and latex elastics) show that it results in painful experiences for all patients (9, 10).

Pain is a subjective response which shows large individual variation. It is dependent on factors such as age, gender, individual pain threshold, magnitude of force applied, present emotional state and stress, cultural differences and previous pain experiences (6-8, 11, 13). Previous studies regarding the percentage of patients experiencing pain reported values ranging from 70-95% (1, 8, 11, 13). Different prospective studies performed by SCHEURER et al (8) and KVAM et al. (14) have reported that about 95% of patients experienced pain during orthodontic treatment. PATEL (15) and LEW (13) have reported that about 8% and 30% of patients respectively discontinued treatment because of pain experienced at the early stages of orthodontic treatment.

Reports from existing literature indicate that all orthodontic procedures such as separator placement, arch wire placement and activations, application of orthopedic force (7, 14, 16) and debonding procedures produce pain in patients (16).

The subjective perception of pain is difficult to measure and there is a wide range of individual

responses to fixed orthodontic appliances even when similar forces are applied to the teeth. The cause of the pain encountered during orthodontic treatment is not fully understood. FURSTMAN and BERNICK (17) suggested that periodontal pain is caused by a process of pressure, ischaemia, inflammation and edema. Previous studies indicate that the perception of pain is due to changes in blood flow in the periodontal ligament (14, 18, 19) and are correlated with the presence of substances such as prostaglandins, histamines, bradykinin, serotonin, and substance P (12, 14, 17, 18).

Several studies have described patient responses to fixed orthodontic appliances. These reports showed that pain begins a few hours after application of an orthodontic force and lasts approximately 5 days (7, 14, 19, 20-22). Perception of discomfort in patients undergoing orthodontic treatment including 7 days of separation by elastomeric separators was evaluated by NGAN et al. (9). It was found that the separators caused high levels of discomfort at 4 and 24 hours after placement, and that the discomfort was significantly reduced by analgesics.

There is however less unanimity as to how fast pain starts, whether or not force, sex, and the age of the patient influence the outcome of pain reports. This may be due to differences in experimental design e.g. reporting methods, number and schedule of questionnaires.

Lagos, the commercial capital of Nigeria, is the most densely populated cosmopolitan urban city in Nigeria. The Lagos University Teaching Hospital (LUTH) was the first public hospital to offer comprehensive orthodontic services in Nigeria. It is a major referral centre in Lagos and has been offering orthodontic services for over 30 years. Despite the fact that the first days of orthodontic treatment are distressing

to orthodontic patients, there is little or no information on the negative effects of orthodontic therapy among Nigerian orthodontic patients. Information on pain experienced during orthodontic separation will provide baseline data for treatment planning and further research.

The aims of this study were to :

1. To assess by use of the V. A.S the level of pain/discomfort perceived by patients at 4 hours, 24 hours, and 7 days after insertion of orthodontic separators,
2. To assess gender and age differences.

Materials and methods

The study population consisted of 64 patients : 28 males and 36 females aged 8 to 38 years who were scheduled for treatment with fixed orthodontic appliances at the Orthodontic clinic of the Lagos University Teaching hospital, Lagos. Informed consent was obtained from all the patients and for the children through their parents.

At the initial visit a questionnaire which gathered information on patient demographics was administered to the patients. The questionnaire also consisted of four VAS which assessed the perceived pain/discomfort without separator placement. The patients were instructed to draw a line through the scale to represent the perceived pain/discomfort associated with chewing, biting and fitting of front and back teeth together according to the methods of NGAN et al. (9). The score for each VAS was the distance in millimeters from the left side of the line to the vertical line that was made by the patient.

The separators used were elastomeric separators (Masel Orthodontics, USA).

The orthodontic separators were placed on the mesial and distal surfaces of all the first perma-

nent molars in each of the four quadrants with separating pliers. Following placement of the separators, the patients were given three similar questionnaires. They were requested to take the questionnaires home and return them 7 days later.

Each patient was given a verbal and written instruction to complete one questionnaire for each of the following intervals :

T1 = 4 hours after insertion of separators,

T2 = 24 hours after insertion of separators,

T3 = 7 days after insertion of separators.

The questionnaires used a Visual Analogue Scale (VAS). A visual analogue scale is a line usually 10cm in length, the extremes of which are taken to represent the units of pain experience. The beginning is 0cm indicating no pain and 10 cm the greatest pain. The patients were asked to mark the line at a point corresponding to the severity of their pain. The distance of the mark from the beginning of the scale is then taken to represent pain severity or the "pain" score.

This method is widely used for measuring pain and has been described by other investigators as being sensitive and reliable and having advantages over verbal scales (23, 24).

Moreover, even small children manage it very well (23, 24). In addition, there is a high correlation between successive measurements of pain on a VAS confirming the reproducibility of the method. However, it is difficult to measure the quality of a patient's pain with the VAS.

Validity and reliability of the visual analogue scale

The reliability of the VAS in this study was tested in an independent sample of four patients. In this group the questionnaire was administered to the patients at the initial visit, 4 hours, 24 hours and 7 days without insertion

of the separators (table 1). A repeated measures analysis of variance on the three measurements showed no significant difference among the various time periods tested for each of the listed activities. Cronbach's alpha at 4 hours, 24 hours and 7 days was 0.741.

Analysis of data

Data was analysed using SPSS version 16.0. After data exploration, a repeated analysis of variance (ANOVA) was used to determine whether there were any significant differences in the amount of pain reported by the patients over time after placement of the separators.

A pair wise comparison of means using the t-test for paired samples was used to determine significant differences in the discomfort report-

ed between each time period. Repeated ANOVA was conducted after stratifying the samples by gender (male, female) and age (Young = less than 16years; Old =16 years and above). Similar analysis was also conducted to see if there were any significant differences in discomfort experienced for each listed activity before treatment. Pearson's correlation coefficient was computed pretreatment to determine the correlation between the discomfort on chewing, biting, fitting of back teeth and fitting of front teeth.

A discomfort index was calculated by adding the response in the four areas of discomfort (chewing, biting, fitting front teeth and fitting back teeth). This was used to assess the overall level of discomfort experienced by patients. P values of < 0.05 were considered to be statistically significant.

Results

Sixty four patients, 28 males and 36 females with a mean age of 17.58 ± 6.22 years participated in the study.

The amount of discomfort experienced by the patients in the areas of chewing, biting, fitting back and fitting front teeth are shown in the Table 2. The mean discomfort on chewing pretreatment was 5.64 ± 2.68 . This increased to a maximum level of 46.25 ± 29.53 after 4 hours. It then slightly decreased at 24 hours and further decreased to 20.13 ± 20.47 but did not return to baseline levels after 7 days. Similar results were seen on biting and fitting either front or back teeth.

A statistically significant difference was observed in the mean discomfort on chewing over time ($F = 56.13$; $p < 0.000$). Similar results were seen on biting and fitting either front or back teeth (Table 2).

Table 1 : Discomfort over time associated with no orthodontic treatment

Time after treatment (n = 4)	Mean discomfort	SD	F	P
Chewing				
0 hour	4.00	0.82	1.23	0.36
4 hours	3.75	0.96		
24 hours	4.75	1.26		
7 days	3.75	0.50		
Biting				
0 hour	5.25	2.06	0.40	0.63
4 hours	5.00	2.16		
24 hours	5.75	1.70		
7 days	3.75	2.06		
Fitting back teeth				
0 hour	2.75	0.96	1.25	0.35
4 hours	3.75	2.50		
24 hours	4.00	2.16		
7 days	4.75	0.50		
Fitting front teeth				
0 hour	4.25	0.50	0.85	0.56
4 hours	5.50	3.31		
24 hours	4.75	1.26		
7 days	3.75	2.87		

Table 2 : Discomfort reported for various activities over time

Time after treatment (n = 64)	Mean discomfort	SD	F	P
Chewing				
0 hour	5.64	2.68	56.13	0.000
4 hours	46.25	29.53		
24 hours	42.69	31.48		
7 days	20.13	20.47		
Biting				
0 hour	6.13	3.11	45.12	0.000
4 hours	40.92	2.16		
24 hours	37.63	32.42		
7 days	17.31	22.51		
Fitting back teeth				
0 hour	5.78	3.30	53.29	0.000
4 hours	43.14	26.93		
24 hours	35.36	23.81		
7 days	17.63	18.91		
Fitting front teeth				
0 hour	4.99	2.20	16.40	0.000
4 hours	23.95	26.21		
24 hours	22.69	25.37		
7 days	13.47	18.09		
Discomfort index				
0 hour	16.76	6.25	76.99	0.000
4 hours	154.27	83.18		
24 hours	138.36	83.75		
7 days	68.53	63.13		

The discomfort index was used to assess the overall level of discomfort experienced by the patients over time. Similar results were also seen when the level of discomfort for each activity was pooled as the discomfort index (Table 2).

When compared with preplacement, there were significant differences in the level of discomfort 4 hours after placement for all the activities ($p < 0.000$). There was also significant differences in the levels of discomfort between 24 hours and 7 days ($p < 0.000$). No significant differences were noted between 4 and 24 hours except

marginally for fitting the front teeth ($p = 0.045$) (table 3).

A repeated analysis of variance was also carried out for all the activities (chewing, biting, fitting front and back teeth) before treatment. No statistically significant differences were found ($F = 2.62$, $p = 0.06$). Biting appeared to be responsible for the highest level of discomfort followed by fitting of the back teeth. In general, the level of discomfort peaked at 4 hours after insertion of separators, decreased marginally after 24 hours and decreased closer to baseline levels after 7 days.

When the data was stratified by gender, there was statistically significant differences in the discomfort index over time ($F = 75.1$, $p = 0.000$). The males (28 patients) appeared to have slightly higher levels of discomfort than the females (36 patients) but this was not statistically significant (Figure 1). There was no significant interaction between time and gender ($F = 0.162$; $p = 0.921$). However, when the data was stratified by age, older patients (16 years and above, $n = 35$) reported significantly more pain overtime than younger patients (less than 16 years, $n = 29$) as shown in Figure 2 ($F = 78.6$, $p = 0.000$). These differences were statistically significant at all the time intervals.

There was no significant correlation between the levels of discomfort on carrying out each activity. Cronbach's alpha was 0.566 among all the activities. This was however increased to 0.622 if the per-treatment variables were excluded.

Discussion

The results of this study indicate that there is pain associated with the insertion of separators. This is consistent with previous studies

Table 3 : Showing a pairwise comparison of mean discomfort over time for each activity

Time after treatment (n = 64)	T test statistic	P
Chewing		
0-4 hours	-10.992	0.000*
4-24 hours	0.878	0.383
24 hours- 7 days	6.107	0.000*
Biting		
0-4 hours	-9.02	0.000
4-24 hours	1.01	0.314
24 hours- 7 days	5.79	0.000
Fitting back teeth		
0-4 hours	11.02	0.000
4 -24 hours	2.04	0.045
24 hours- 7 days	5.83	0.000
Fitting front teeth		
0-4 hours	11.02	0.000
4 -24 hours	2.04	0.045
24 hours- 7 days	5.83	0.000
Discomfort index		
0-4 hours	-13.67	0.000
4 -24 hours	1.44	0.166
24 hours- 7 days	6.57	0.000

(7, 13, 25, 26). In this study, most peak pain levels were reported at 4 hours after separator placement. This finding is at variance with other studies (7, 13, 25, 26) which reported maximum levels of pain at 24 hours after placement. NGAN et al. (9) reported that pain and discomfort started at 4 hours and increased over the next 24 hours after the insertion of separators and archwires.

BONDEMARK et al. (10) reported recently that the worst pain with separators was experienced at day 2 and this almost completely subsided by day 5. However, some studies reported that about 42% of the patients showed some degree of pain even after 7 days (8, 12). This is consistent with the findings of the present study which showed that pain did not return to baseline pretreatment level at day 7. The pain trend observed in this study was similar to that observed by NGAN et al. (7) which noted that the pain level increased over the 24 hour period but decreased close to preplacement level at day (7).

Figure 1 : The overall level of discomfort over time by gender

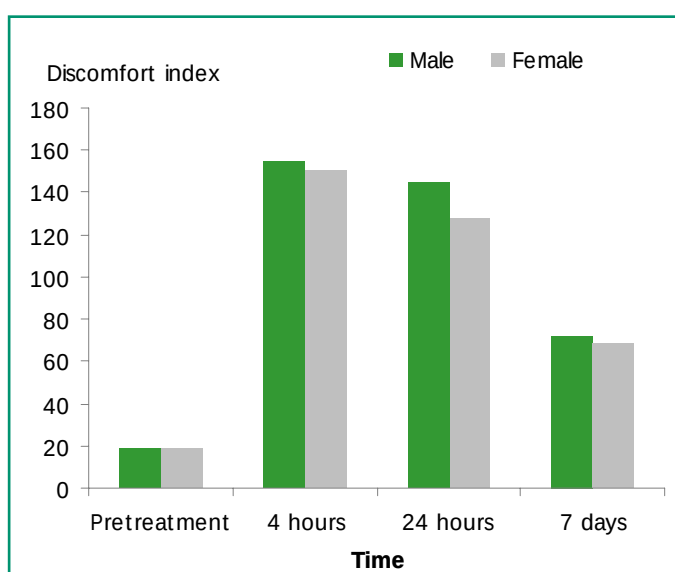
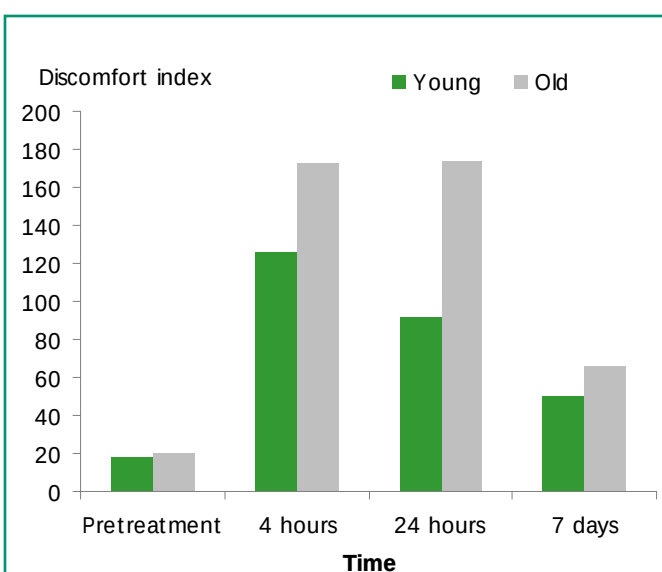


Figure 2 : The overall level of discomfort over time by age



This study showed that among daily activities, chewing consistently caused the highest levels of pain during the separation period. This is in agreement with the report of Bondemark et al. (10). In that study (10), chewing during eating caused the most pain and made 14 of 30 patients change to soft food like yoghurt, banana etc. These findings are in accordance with those found by SCHEURER et al. (8).

When informing the patients about the side effects, it should be noted that pain may occur during eating. However, BONDEMARK et al. (10) noted that the influence on leisure activities (sports or social life) as well interference with school was small or negligible. Although individual perceptions and reaction to pain vary, patients should be forewarned that their teeth might hurt after separators are placed (28).

Pain is a complex experience that includes sensations evoked by noxious stimuli and the reactions to such stimuli. Reactions to these sensations vary among individuals and can depend on a person's cultural background, past experiences and other forms of psychological input that give meaning to a situation in which pain occur (29).

Another important predictor of pain is gender (30, 31). In this study, no significant difference was found between boys and girls pain/discomfort experience during separation. This is in agreement with previous studies (13, 7, 31, 32). Although a few studies have claimed that girls report more pain/discomfort than boys (8, 14), the literature seldom points to any correlation between gender and perception of pain/discomfort during orthodontic treatment (9, 19, 3). SCHEURER et al. (8), and KVAM et al. (14) stated that girls report more pain and discomfort than boys. In the study by BONDEMARK et al. (10) no significant difference was found between boys and girls pain/discomfort experience during separation.

However, they revealed that girls reported significantly greater pain intensity and consumed significantly more analgesis than males. The influence on leisure activities (sports or social life), as well as interference with school work was considered small or negligible. BONDEMARK et al. (10) further noted that patient had no problems in discriminating between pain/discomfort in right and left posterior teeth, when two different separators were placed on the right and left side respectively.

The results of the present study showed that older patients reported significantly more pain than younger patients. This is in agreement with previous studies (6, 20, 21, 31) which showed that young patients feel less pain than older patients. NGAN et al. (7) found that orthodontic patients younger than 16 years old reported more discomfort at 4 hours after placement of separators whereas those 16 years and older experienced more discomfort at 24 hours and 7 days. The report of JONES however showed that adults experienced more pain than did adolescents undergoing orthodontic treatment. The discrepancy between these studies may be explained by the difference in experimental design. In the study by JONES (20) a verbal rating was used whereas in this study a 10cm VAS scale was used.

In this study, the VAS was used to assess the pain intensity. It is one of the most commonly used tools to measure pain intensity and is easy to both administer and score. In this study, the VAS was used to quantify the level of pain and discomfort for each of the four different response parameters such as chewing, biting, fitting of front and back teeth. In addition, the indication of the intensity (magnitude) of the discomfort was done in the patient's home setting. This eliminates the influence of doctors and the hospital environment. The VAS also eliminates the inherent difficulties in the

interpretation and meaning of verbal scales from person to person. The VAS is more sensitive than verbal descriptors for measuring successive responses to treatment, and there is a high correlation between successive measurements (9, 27). However, it is difficult to assess the quality of a patient's pain with the VAS method.

Prostaglandins have been implicated as mediators in cellular response to pressure and tension in the periodontal ligament. Within a short time after sustained pressure and tension are applied to a tooth, prostaglandin levels increase within the periodontal ligament space (32). Additional research showing that prostaglandin is released when cells are mechanically deformed indicate they may be a primary response to pressure (33). These data suggest that discomfort experienced by patients after insertion of separators may be related to levels of prostaglandin in the periodontium.

Prostaglandins have been shown to cause hyperalgesia which is an increased sensitivity to released algogens such as histamine, bradykinin, serotonin and substance P (34, 35). The tissues then become more responsive to stimuli that would not ordinarily evoke any reaction.

Several modalities have been used to control orthodontic pain. Perception of pain can be altered by analgesics (9, 25, 27). Recent

studies have shown that preoperative dose of analgesics can significantly delay the onset of pain and decrease its severity after placement of orthodontic separators (25-27). LAW et al. (25) reported that patients who took analgesics before orthodontic separator placement had significantly less pain after treatment than those who took ibuprofen post operatively.

There is currently no recommendation on the use of analgesics for postoperative orthodontic pain. Some clinicians advise their patients to take analgesics, if needed, for postoperative pain. Since in this study it has been found that pain occurring after placement of separators is significant in patients and because pain is the biggest negative factor in patient's perception of orthodontic treatment, it is worth to suggest a need for further studies to assess the effect of analgesics on postoperative pain among Nigerian orthodontic patients.

Conclusion

This study confirms that patients experience pain/discomfort overtime following placement of separators. This provides useful information for effective counselling of patients who undergo orthodontic treatment. It further suggests a need to recommend soft diet and analgesics during the separation period.

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