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Academic and emotional intelligence of orthodontic patients

Knowledge of Dental trauma and impact on tooth movement

Application of temporary anchorage devices

Combined orthodontic and periodontal management: A case report

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Contents

Original Articles

Editorial

Editor's Choice

The June 2024 edition of the Journal takes a look at the effects of academic performance and emotional intelligence on good oral health maintenance among adolescent orthodontic patients. The study showed that high academic performance was significantly related to better and favourable oral hygiene outcome. However, emotional intelligence did not show any significant effect on the oral hygiene status of these patients. The study was limited in sample size and more elaborate studies need to be carried out to truly ascertain this relationship.

The knowledge of dental trauma and its impact on orthodontic tooth movement is very important in the management of patients undergoing orthodontic treatment. This edition also explored the knowledge and current practices of orthodontic practitioners in Nigeria regarding the orthodontic treatment of patients with a history of dental trauma. It is interesting to note that a very few Orthodontists were conversant with the management of traumatized teeth as more than two-thirds of respondents in the study claimed they had not managed any patient with traumatized teeth. The management of traumatized teeth could be a very challenging task and there is need to expose orthodontic practitioners to the management of dental trauma during their training.

Finally, an understanding of the concept of anchorage and its application is crucial.

Anchorage is a fundamental concept in orthodontics which plays a crucial role in achieving optimal tooth movement and alignment. It is the resistance to unwanted tooth movement that ensures desired changes while maintaining stability in surrounding teeth. If not properly managed, it could be an albatross to any successful treatment and a nightmare for any orthodontist. Anchorage is important for space closure, tooth movement, molar distalization, orthognathic surgery and dental alignment. It can either be absolute or relative in nature. This edition takes a look at the mini-screws for absolute anchorage (Temporary Anchorage Devices, TADs) and their application in orthodontic practice.

Olayinka Otuyemi,
Editor-in-Chief

Effects of Academic Performance and Emotional Intelligence on Oral Hygiene Status of Adolescent Orthodontic Patients

Adewuya AP[a], Otuyemi OD[a]

Abstract

Background: This study assessed the effects of academic performance and emotional intelligence on good oral health maintenance among adolescents undergoing orthodontic treatment at Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Nigeria.

Method: The study was conducted among 23 adolescent patients on fixed orthodontic appliance treatment in OAUTHC, Ile-Ife, Nigeria. Oral hygiene status was assessed objectively using the simplified Greene and Vermillion's Oral Hygiene Index. An adapted questionnaire on emotional intelligence by Haralur and associates was administered. The academic performance was based on patients' academic records in the last one year.

Results: The majority of the adolescent patients were in a very good (52.2%) grade. None of the patients reported with very fair, fair, and poor grades. Similarly, most of the patients were in high (43.2%) and average (39.1%) emotional intelligence categories. Only 17.4 per cent showed low emotional intelligence. About two-thirds (60.9%) of patients had fair oral hygiene status with oral hygiene scores ranging between 1.3 and 3.0. Only one patient had poor oral hygiene with a score of 3.1 to 6.0.

There was a significant association between academic performance and oral hygiene index scores (P= 0.032). However, no statistically significant relationship was observed between the emotional intelligence and the oral hygiene index scores of patients (p=0.162).

Conclusion: The study concluded that emotional intelligence had no significant effect on the oral hygiene status of orthodontic patients. However, the high academic performance of orthodontic patients was significantly related to better and favourable oral hygiene status.

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ORIGINAL ARTICLE

Introduction

The goal of any therapy is to achieve specific desired outcomes in the patients concerned.[1] However, these outcomes may not be achieved if the patient is non-compliant. Non-compliance to treatment has not only been associated with treatment failures but also with increased treatment cost. [2] Therefore, knowledge of the factors that can assist in predicting treatment compliance is important and it will not only assist in treatment planning but also in patient selection.

The use of multi-bracket fixed appliances as a common method of treating malocclusion is associated with an increased dental plaque accumulation around the teeth. This is due to the inability to brush and floss effectively with these appliances in place. Problems often associated with plaque build-up include enamel decalcification, and gingivitis among other deleterious effects. [3] Some of these challenges can be so severe as to necessitate the discontinuity of orthodontic treatment in order to preserve the individual's oral health. Different predictors of oral hygiene compliance have been identified among individuals undergoing orthodontic treatment which include age, gender, socioeconomic status, relationship with parents. [4,5]

The effect of academic performance or emotional intelligence of individuals on their compliance with different orthodontic treatments has been sparsely

reported in the literature. However, Al-Jewair et al [5] reported that adolescents with married parents and those with good academic performance in school were more likely to comply with fixed orthodontic treatment. Richter et al [6] also reported a positive correlation between the patient's academic performance in school with their compliance. However, not all of these studies were specific to oral hygiene compliance in the adolescent population.

Emotional Intelligence (EI), on the other hand, is simply the ability to identify and manage the emotions of self as well as others.[7] Different authors have also defined EI as the ability to perceive accurately, appraise, and express emotions; the ability to access and or generate feelings when they facilitate thought. [8]

There was a proposed model of emotional intelligence and health outcomes which is usually referred to as the hassles of daily living. [9] This model proposed that EI has a protective effect on health outcomes. This is because it moderates the negative emotions that affect health. [10]

A positive correlation has also been observed between the emotional intelligence and motivational level of orthodontic patients. [11] Thus, there may exist a possibility that emotional intelligence and academic performance can influence oral hygiene behaviour.

This study aimed to assess the relationship between academic performance and emotional intelligence as factors that can influence oral hygiene status among adolescents undergoing orthodontic treatment.

Material and methods

Ethical approval for this study was obtained from the Institutional Review Board of the Institute of Public Health, College of Health Sciences, Obafemi Awolowo University, Ile Ife, Nigeria [HREC no. IPH/OAU/12/2011]. The study population comprised 23 consecutive adolescent patient populations between the ages of 10 and 19 years undergoing fixed orthodontic appliance therapy at the orthodontic clinic, Obafemi Awolowo University Teaching Hospitals, Ile-Ife between January and May 2023. A written informed consent was obtained from identified individuals and the guardians of adolescents below 18 years of age. The study utilized a questionnaire with close-ended questions to assess the academic performance and emotional intelligence on oral hygiene compliance. The academic performance was based on the average score of the school's academic records in the last three terms for secondary school students or two semesters for undergraduate students. All patients' exact grades or scores were verified through a snapshot picture of their academic records sent to the researchers. Emotional Intelligence (EI) was adapted from the study by Haralur et al. [12] The questionnaire included four sections; three of which were completed by patients while the other section was assessed by the patient's orthodontist.

The first section assessed the socio-demographic characteristics of the patient and treatment duration; the second recorded information on the academic performance of adolescent patients in primary, secondary, or tertiary schools. The third section contained questions that assessed the emotional intelligence of the adolescent patients. [12]

The fourth section reported oral hygiene status as objectively assessed using the simplified oral hygiene index by Greene and Vermillion. [13]

Inclusion criteria were the ability to perform and understand basic oral hygiene activities and communicate in English. Patients with removable or functional appliances, or segmented fixed appliances, and those who refused to participate in the study were excluded.

Data was entered into a personal computer and analyzed using SPSS for Windows (version 26). Descriptive statistics were used to explore the distribution of the data. Analysis of variance statistical tests was also performed to assess the

relationship between emotional intelligence, academic performance, and oral hygiene index scores.

Results

Table 1 shows the distribution of patients according to gender, age, and educational level.

There was a slight male and older adolescents' preponderance with 56.5%, and 52.3% respectively. Most of the patients were in tertiary institutions (47.8%) while the least were in primary schools (17.4%).

In Table 2, the majority of the patients were in the very good (52.2%) and excellent grades (39.1%) categories. None were in the very fair, fair, and poor grades categories.

Table 3 shows the patients' distribution of emotional intelligence categories. The majority were in high (43.2%) and average (39.1%) intelligence categories. Only 17.4 percent showed low emotional intelligence.

Table 4 shows the distribution of patients' oral hygiene status according to the simplified oral hygiene index score. About two-thirds (60.9%) had fair oral hygiene with oral hygiene scores between 1.3 and 3.0. Only one patient had poor oral hygiene (4.3%).

Table 5 demonstrates the relationship between a patient's oral hygiene status compared with their emotional intelligence. The relationship between the patient's oral hygiene scores and their emotional intelligence showed no significant association with the patient's oral hygiene index scores ($p = 0.162$).

Table 6 shows the relationship between the oral hygiene scores of patients and their academic performance. The results showed a significant association between academic performance and oral hygiene index scores ($p=0.032$)

Table 1: Socio-demographic characteristics of patients

Variable	Number	Percentage
Gender		
Male	10	43.5
Female	13	56.5
Age(years)		
10-15 (young adolescents)	11	47.7
16-19 (older adolescents)	12	52.3
Educational level		
Junior secondary school	4	17.4
Senior secondary school	8	34.8
Tertiary institution	11	47.8

Table 2: Distribution of patients according to their Academic Performance (AP) in school

Grade ranks	Number	Percent (%)
Excellent	9	39.1
Very good	12	52.2
Good	2	8.7
Very fair	0	0
Fair	0	0
Poor	0	0

Table 3: Distribution of the Emotional Intelligence (EI) categories of patients

Emotional intelligence categories	Number	Percent (%)
Low (score < 90)	4	17.4
Average (score of 90-110)	9	39.1
High (score >110)	10	43.5

Table 4: Oral hygiene status of the patients based on oral hygiene index-simplified.

Oral hygiene status (score)	Number	Percent (%)
Good (score of 0.0 – 1.2)	8	34.8
Fair (score of 1.3 -3.0)	14	60.9
Poor (score of 3.1 - 6.0)	1	4.3

Table 5: Relationship between oral hygiene status and emotional intelligence of orthodontic patients.

Source of variability	Sum of squares	Degree of freedom	Mean squares	F- statistic	p-value
Emotional intelligence (Between groups)	8.383	19	0.441	3.545	0.162
Emotional intelligence (within groups)	0.373	3	0.124		
Total	8.756	22			
Not significant p>0.05					

Table 6: Relationship between oral hygiene status and academic performance of orthodontic patients

Source of variability	Sum of squares	Degree of freedom	Mean squares	F- statistic	p-value
Academic performance (Between groups)	2.559	2	1.279	4.128	0.032*
Academic performance (within groups)	6.198	20	0.310		
Total	8.756	22			
Significant p>0.05					

Discussion

The primary objective of this investigation was to assess the relationship between two critical socio-behavioural factors of academic performance and emotional intelligence on the oral hygiene status of patients undergoing orthodontic treatment. Education and emotions are important socio-behavioural factors that interact and influence an individual's behaviour which shapes decisions, actions, and overall oral well-being of patients. In this study, it was assumed that oral health status is significantly correlated to oral hygiene compliance and maintenance in individuals undergoing orthodontic treatment.

In this study, high academic performance of individual orthodontic patients was significantly related to better and favourable oral hygiene status. Several studies have also examined the relationship between these two factors, shedding light on the potential effects of academic performance on oral hygiene behaviors. Croffoot et al., [14] investigated the oral hygiene compliance of university students and found a significant association between academic performance and oral health status. The study revealed that students with higher academic performance tend to have better oral hygiene practices, including regular toothbrushing, flossing, and mouthwash use.

Similarly, Folayan et al.,[15] explored the oral hygiene compliance of dental students. They found that dental students with better academic performance exhibited higher levels of oral hygiene compliance compared to those with lower academic achievement. The researchers hypothesized that dental students with a higher academic performance may have a greater understanding of the importance of oral health and may be more motivated to maintain good oral hygiene habits. These findings suggest that there is a positive correlation between academic performance and oral hygiene status. Students who excel academically may be more likely to prioritize oral health and engage in regular oral hygiene practices. On the other hand, students who struggle academically may be more prone to neglect their oral hygiene routines.

It is important to note that academic performance can also be influenced by factors such as stress levels, time management skills, and overall well-being. Poor oral hygiene practices and oral health issues, such as dental pain or bad breath, can lead to discomfort and may affect concentration and academic performance. This highlights the bidirectional relationship between academic performance and oral hygiene status. [16]

Corrêa et al.,[17] examined the oral health habits of university students in Southern Brazil and found a positive correlation between higher GPA scores and

improved oral hygiene compliance. The researchers suggested that students with better academic performance may possess higher levels of self-discipline, time management, and organization, which could translate into better adherence to oral health routines.[18]

A previous study by Richter et al [6] evaluated the effect of behaviour modification on the compliance of 144 orthodontic patients. The authors reported a correlation between the patient's academic performance in school and their compliance. Patients with better compliance tend to have lower absenteeism rates and are regarded by their teachers as academically bright and social. [19] This may not always be the case in many other health disease burdens as Kaona et al [20] reported no significant association between educational level and treatment compliance. The authors' assessment was on factors contributing to treatment adherence amongst patients with tuberculosis.

A very few studies have been conducted to assess the effect of emotional intelligence on compliance with oral hygiene maintenance rules among patients undergoing dental treatment in the literature. [11,21] Our present Nigerian study showed no significant relationship between emotional intelligence and oral hygiene status of orthodontic patients seen in Ile-Ife Nigeria.

This is in contrast to many studies that suggest that individuals with higher emotional intelligence may have a better understanding of the importance of oral hygiene and are more motivated to maintain it. [11,21,22] The link between emotional intelligence and compliance with health treatment generally however may be influenced by several factors as Willard [23] found no correlation between emotional intelligence and treatment adherence among people with HIV disease. The author however claimed the data set was inadequate to prove any significance.

The limitation of this study may not be unconnected with its small sample size. Again the questionnaires filled out by the patients were self-administered, indicating a possibility for bias regarding the emotional intelligence questions. Further studies need to be carried out with increased sample size, andthe emotional questionnaire should be subjected to the rigour of internal validity.

The study concluded that emotional intelligence had no significant effect on oral hygiene status of orthodontic patients. However, the high level of academic performance of patients was significantly related to better and favourable oral hygiene status. Further studies with larger sample sizes and more rigour of internal validity of the emotional questionnaire are needed.

Contribution to Authorship

Conceptualized by ODO, Data collection, analysis and write-up by both authors

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Conflict of Interest

None declared by the authors

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Knowledge of Dental Trauma and its Impact on Orthodontic Tooth Movement Amongst Nigerian Orthodontists and Orthodontic Residents.

Aikins EI[a], Ernest MA[b], Isiekwe IG [c]

Abstract

Background: Knowledge of dental trauma and its impact on orthodontic tooth movement is very important in the management of orthodontic patients. This study aimed to explore the knowledge and current practices among orthodontists practicing in Nigeria in managing orthodontic patients with a history of dental trauma.

Methods: This was a cross-sectional study. Data collection was via self-administered questionnaires. The questionnaires were developed using Google Forms and sent to the WhatsApp group of the Nigeria Association of Orthodontists which contains all the orthodontic residents and consultants in Orthodontics in Nigeria. Only 35 respondents filled out and submitted the form.

Results: The knowledge of respondents about luxation, subluxation, concussion and avulsion were 65.7%, 71.4%, 82.9% and 97.1% correct respectively. Generally, the respondents had good theoretical knowledge of the management of Orthodontic trauma, however, the clinical acumen of respondents in relation to the knowledge of procedures to be done to traumatized teeth during orthodontic treatment was poor. Relatively, very few Orthodontists were conversant with the management of traumatized teeth as more than two thirds of respondents claimed they had not managed any patient with traumatized teeth before. There was a statistically significant difference between the number of orthodontic patients with traumatized teeth being managed by consultants compared to that being managed by registrars.

Conclusion: The respondents demonstrated a good understanding of the dental terms associated with traumatic dental injuries; however, they exhibited a limited understanding of the proper protocols for the orthodontic management of these cases.

Key Words: Dental trauma, Orthodontic management, Nigerian Orthodontists,

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ORIGINAL ARTICLE

Introduction

The job of the orthodontist is the correction of malocclusion and facial disharmony. Some of these malocclusions, especially increased overjet and incompetent lips may predispose the individual to trauma to the anterior teeth in the event of a fall or a blow to the mouth.[1,2] The majority of orthodontic patients are children and adolescents who are regularly involved in contact sports and games. These sports and games further predispose these individuals to dental trauma. The management of these injuries may involve the orthodontist primarily if the patient is undergoing orthodontic care or desires to have orthodontic treatment. The orthodontist may also be called upon to provide secondary care, especially to reposition a tooth displaced due to trauma.[3]

Traumatic dental injuries may occur before and during orthodontic treatment, herefore it is important for this to be elicited during history taking and, or clinical examination to draw up a good treatment plan and carry out appropriate management.[4] Research has shown that traumatized teeth are more susceptible to complications during orthodontic tooth movement.[2] Thus, a previous treatment plan may be altered, making it imperative that the orthodontist be knowledgeable about how to manage such teeth.

The gap in knowledge of the effects of orthodontic treatment on traumatized teeth has been recognized in many parts of the world, leading to a wide variety of studies on this subject.[1,5–8] Indeed, it is imperative that both general practitioners as well as dental specialists acquire this knowledge, lack of which results in inadequate treatment plans as well as further damage to the teeth when treatment is carried out.

In Nigeria, a wide variety of studies have been carried out on traumatic dental injuries in the Nigerian population.[5,9–12] However, there is very limited data on the orthodontic management of these injuries. Thus, this study aimed to explore the knowledge and current practices of orthodontists practicing in Nigeria, regarding orthodontic treatment of patients with a history of dental trauma.

Materials and methods

This was a cross-sectional descriptive study, and the study population comprised of all orthodontists and orthodontic residents in Nigeria. The study was carried out in accordance with the Helsinki declaration and informed consent was obtained from all the study participants. The data were collected using questionnaires designed from Google forms. These Google forms were then posted on the WhatsApp group of the Nigerian Association of Orthodontists. This group contains all the Orthodontists and Orthodontic residents in training in Nigeria. There are currently about 120 orthodontists and orthodontic residents in the country. The data was analyzed using the Statistical Package for Social Sciences (SPSS) version 25. The test of statistical significance was set at 0.05. A copy of the study questionnaire is included in the appendix.

Results

There were a total of 35 respondents, thus the response rate was quite poor with only about 30% of the study population responding. There was a female preponderance, with 22 females (62.9%) responding, compared to 13(37.1%) males. Table 1 shows the demographic distribution of the study participants. The study population comprised of 20(5 consultants and 15 residents.

Table 1: Socio-demographic characteristics of respondents

Variables	Frequency	Percentage
Gender		
Female	22	62.9
Male	13	37.1
Age groups		
21 – 30	3	8.6
31 – 40	11	31.4
41 – 50	14	40.0
51 – 60	6	17.1
> 60	1	2.9
Level of training		
Consultant orthodontist of less than 10 years	15	42.8
Consultant orthodontist of over 10 years	5	14.3

Registrar	4	11.4
Senior registrar	11	31.5
Cadre of practice		
Consultant	20	57.1
Registrar	15	42.9

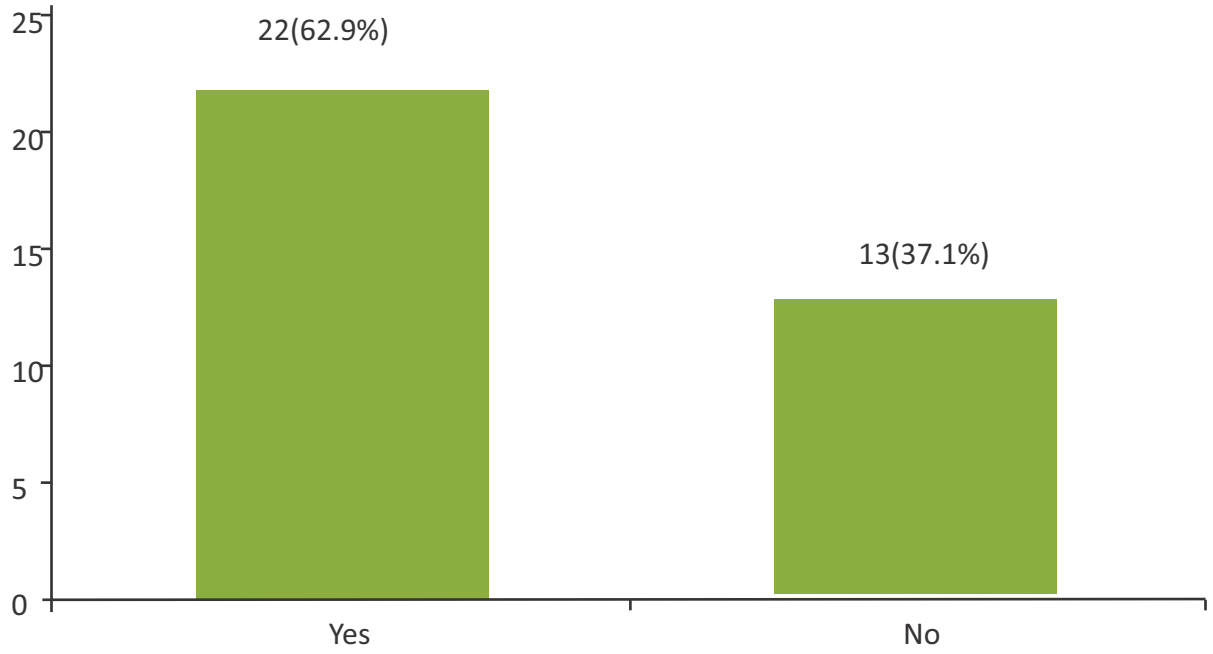

Figure 1: Currently involved in research or teaching in a university

Figure 1 shows that 62.9% are involved in research or are practicing in the teaching Hospital.

Table 2: Knowledge of respondents about three key terms that describe dental trauma namely concussion, luxation and subluxation.

Variables	Concussion (%)	Luxation (%)	Subluxation (%)	None (%)	Don't know (%)
A tooth displacement in a non-axial direction that is accompanied by communition or alveolar socket fracture is called:	4 (11.4)	23 (65.7)	4 (11.4)	3 (8.6)	1 (2.9)
An injury to the tooth- supporting structure with increase in mobility and without tooth displacement is classified as	3 (8.6)	5 (14.3)	25 (71.4)	1 (2.9)	1 (2.9)
An injury to the tooth-supporting structure with an increasing tooth mobility but without significant displacement is classified as	29 (82.9)	1 (2.9)	4 (11.4)	0 (0.0)	1 (2.9)

Table 2 shows the knowledge level of respondents about the terms: luxation, subluxation and concussion which were 65.7%, 71.4% and 82.9% correct respectively. Generally, the respondents had a very good knowledge of these terminologies.

Table 3: Knowledge level of respondents about avulsion and orthodontic management of traumatic dental injuries

Variables	Frequency	Percentage
Displacement of tooth out of alveolus		
Avulsion	34	97.1
Don't know	1	2.9
Least harmful movement to upper incisors with luxation trauma		
Extrusion	7	20.0
Inclination	11	31.4
Intrusion	8	22.9
Rotation	2	5.7
Torque	1	2.9
Translation	4	11.4
Don't know	2	5.7
Procedure to be done on patients who suffered slight dental trauma during orthodontic treatment		
Continue treatment normally	12	34.3
Wait for 30 days	15	42.9
Wait for three months	5	14.3
Don't know	3	8.6
Procedure for patients who suffered dental trauma during orthodontic treatment		
Wait for 6 months	4	11.4
Wait for 30 days	10	28.6
Wait for of three months	16	45.7
Don't know	5	14.3

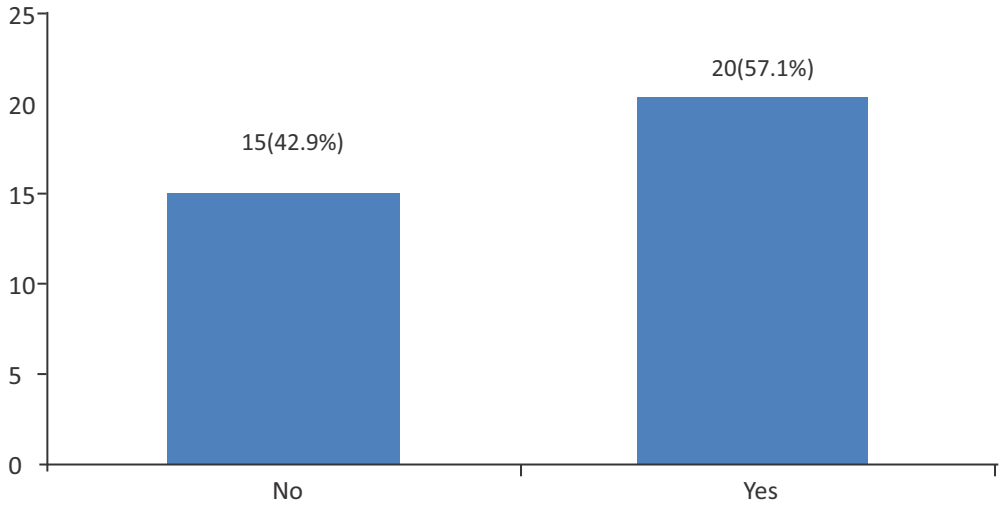

Figure 2: Change in treatment plan after observing a severe lateral luxation trauma to upper incisors after first premolars extraction for anterior-posterior retraction

Figure 2 shows responses to the change of treatment plan after a severe luxation trauma to the upper incisors. Only half of the respondents had a good knowledge and practice of what procedure to carry out.

Table 4: Knowledge of use of radiographs and impacts of trauma on orthodontic tooth movement

Variables	Yes (%)	No (%)
Continuous taking of radiographs of traumatized teeth	32 (91.4)	3 (8.6)
Tooth with root fracture in the apical third can be moved normally	10 (28.6)	25 (71.4)
Traumatized teeth can suffer root resorption with induced dental movement	32 (91.4)	3 (8.6)
The intensity of trauma can influence the prognosis of induced dental movement	34 (97.1)	1 (2.9

Table 4 shows good knowledge about the importance of continuously taking radiographs to assess traumatized teeth. In addition, it also shows that the respondents had a good knowledge of the impact of dental trauma on orthodontic tooth movement, particularly root fracture, root resorption and the inffluen

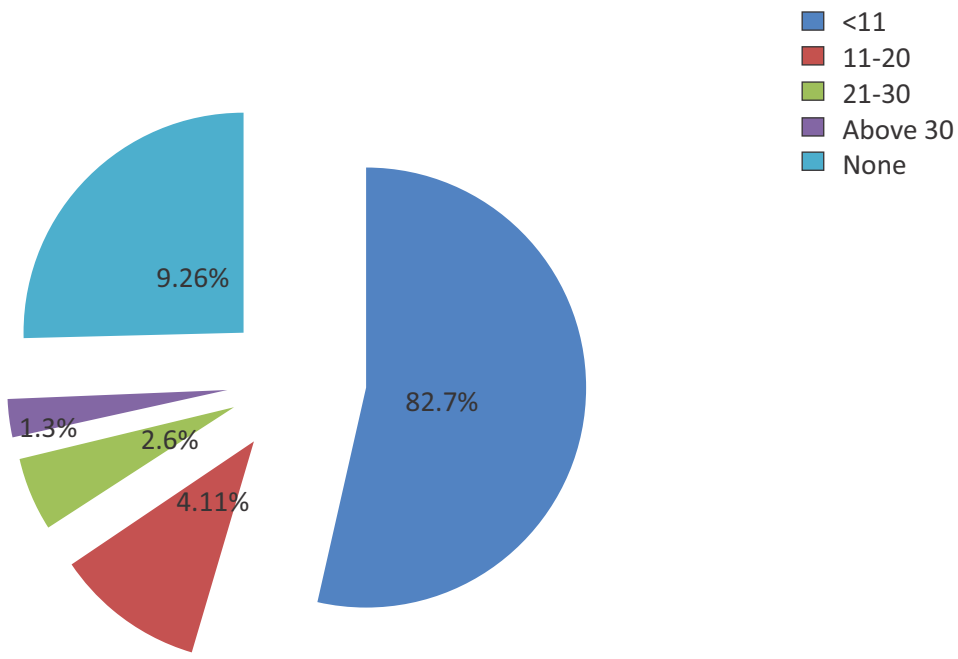

Figure 3: Number of orthodontics patients managed with traumatized teeth

Figure 3 shows that very few Orthodontists were conversant with the management of traumatized teeth. The pie chart reveals that about 80% of Orthodontists claimed they had not managed any patient with traumatized teeth, while about 10 % claimed they have managed less than eleven (11) patients with traumatized teeth.

Table 5: A comparison of treatment experience in the orthodontic management of traumatized teeth.

Variables	Cadre		χ^2	P
	Consultant (%)	Registrar (%)		
Number of orthodontics patients with traumatized teeth managed			13.318	**0.010***
< 11	12 (63.2)	7 (36.8)		
11 – 20	4 (100.0)	0 (0.0)		
21 – 30	2 (100.0)	0 (0.0)		
> 30	1 (100.0)	0 (0.0)		
None	1 (11.1)	8 (88.9)		

Table 5 shows that the orthodontists had a significantly greater experience in the management of traumatized teeth compared to the residents

Discussion

The importance of this study cannot be overemphasized bearing in mind the various ways in which traumatic dental injuries can affect orthodontic treatment.[2] Thus, a good knowledge of this as well as the best clinical practices in managing such conditions is very important to every orthodontic service provider.[3,4]

Generally, the respondents had a good knowledge of the trauma terminologies: luxation, subluxation, concussion and avulsion. This shows that the theoretical knowledge of the respondents was sound and the fact that many of them were involved in research or were practicing in the teaching hospitals may account for this . The respondents also showed adequate knowledge in other areas such as the importance of continuous radiographic assessment; orthodontic management of teeth with apical root fracture; tendency of root resorption by traumatized teeth, and how the intensity of trauma may affect the prognosis of orthodontic tooth movement.

However, the clinical acumen of the respondents in relation to knowledge of procedures to be administered to traumatized teeth during orthodontic treatment was poor. Less than 50%, knew the procedures to carry out and only half of the respondents had adequate knowledge of what procedure to carry out, after a severe luxation trauma to the upper incisors. A limited knowledge of the orthodontic management of traumatized teeth has also been reported in studies carried out in other populations.[1,5,6,8] Furthermore, the findings from those studies, also confirm the finding in this study, that only a minority of the participants knew of the existence of specific guidelines for dealing with these clinical situations, which is quite remarkable. Indeed, guidelines for the orthodontic management of traumatic dental injuries had previously been reported by Sandler et al.[3,4] However, it is important to note that these guidelines were only published in 2020, arising from the absence of clear evidence-based recommendations on how to manage traumatic dental injuries in the literature.[3] This further highlights the fact that this is an aspect of orthodontic care that has received relatively less attention, despite its relative importance bearing in mind the frequency of occurrence of dental traumatic episodes, particularly in children and adolescents.

There was a statistically significant difference between the number of orthodontic patients with traumatized teeth being managed by consultants

compared to that being managed by registrars. This is not surprising based on the differences in clinical experience between both groups. Thus, there is a need to expose the residents to managing a larger proportion of cases with traumatized incisors. This topic should also be included in their revision and update courses to facilitate continuous learning in this area.

One of the major limitations of this study is the very small study sample and the poor response rate of about 30%. A similar finding was also reported in a online study on dental trauma carried out among British orthodontists where a response rate of 14% was recorded, which is much lower than that observed in this study.[1] Thus, it is important to note that in spite of the small sample size, the findings from this study highlight the need for further training of Nigerian orthodontists and orthodontic residents in the orthodontic management of dental trauma.

Conclusion

Nigerian orthodontists and orthodontic residents have a good knowledge of the terms associated with dental trauma, however, there is a limited understanding of the proper protocols and guidelines for the orthodontic management of patients with a history of dental trauma. Thus, there is a need for further training in this regard, to improve their knowledge and clinical practice in this aspect of orthodontic care.

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Study Questionnaire
Knowledge of Dental Trauma and Orthodontic Tooth Movement Amongst Nigerian Orthodontic and Orthodontic Residents.

Part 1 - Professional and Academic Profile

1. Gender Male Female
2. Age 21-30 years 31-40 years 41-50 years 51-60 years 61 years+
3. Level of training: Orthodontic Registrar Orthodontic Senior Registrar Post Fellowship Senior Registrar
   Consultant Orthodontist (less than 10 years post specialist training)
   Consultant Orthodontist (over 10 years post specialist training)
4. Currently involved in research or teaching at a university: Yes No

Part 2 – Knowledge Of Dental Trauma

5. A tooth displacement in a non-axial direction that is accompanied by comminution (crushing) or alveolar socket fracture is classified as: ( ) concussion ( ) subluxation ( ) luxation ( ) avulsion ( ) none ( ) I do not know

6. An injury to the tooth-supporting structures with an increase in mobility and without tooth displacement is classified as:
   ( ) concussion
   ( ) subluxation
   ( ) luxation
   ( ) avulsion
   ( ) none
   ( ) I do not know

7. An injury to the tooth supporting structures without increasing tooth mobility or displacement but with significant sensibility to the percussion, is classified as:
   ( ) concussion
   ( ) subluxation
   ( ) luxation
   ( ) avulsion
   ( ) none
   ( ) I do not know

8. A complete displacement of the tooth out of its alveolus is classified as:
   ( ) concussion
   ( ) subluxation
   ( ) luxation
   ( ) avulsion
   ( ) I do not know

Part 3 - Dental Trauma Versus Orthodontic Data

9. In your opinion, which of the following is the least harmful movement to upper incisors that have suffered a lateral luxation trauma? (choose only one alternative)
( ) intrusion
( ) extrusion
( ) torque
( ) rotation
( ) translation
( ) inclination
( ) none
( ) i don't know

10. In a case of first premolars extraction for anterior-superior retraction, do you change your procedure or treatment plan after observing a severe lateral luxation trauma to the upper incisors?
( ) yes ( ) no

11. In your opinion, which of the following procedures should be used for patients who have suffered a slight dental trauma during orthodontic treatment?
( ) continue the treatment normally
( ) wait for a period of 30 days
( ) wait for a period of 3 months
( ) wait for a period of 6 months
( ) wait for a period of 1 year
( ) I don't know
( ) others. Please, specify

12. In your opinion, which of the following procedures should be used for patients who have suffered severe dental trauma during orthodontic treatment?
( ) continue the treatment normally
( ) wait for a period of 30 days
( ) wait for a period of 3 months
( ) wait for a period of 6 months
( ) wait for a period of 1 year
( ) I don't know
( ) Others. Please, specify

13 Do you continue taking radiographs of the traumatized teeth during treatment?
( ) yes ( ) no

14. In your opinion, can a tooth with root fracture in the apical third be moved normally?
( ) yes ( ) no

15. In your opinion, can traumatized teeth suffer a greater root resorption with induced dental movement?
( ) yes ( ) no

16. In your opinion, can the intensity of the trauma influence the prognosis of induced dental movement?
( ) yes ( ) no

The Use and Application of Temporary Anchorage Devices in Orthodontic Treatment: A Review

Orizu IJ[a] , Isiekwe IG[b], Aghimien OA[c], Otuyemi OD[a]

Abstract

Anchorage control plays an important role in orthodontic treatment. Tooth movement, as seen during orthodontic treatment is made possible with good and adequate anchorage to allow for tooth movement in the desired direction. The success of orthodontic treatment hinges on the anchorage protocol planned for any particular case.

Over the years, anchorage has been sought with the use of conventional methods, ranging from the use of intraoral structures (teeth) to the use of extraoral devices such as headgear, which require full patient cooperation for effectiveness.

These methods are limited in that it is often difficult to achieve results that are commensurate with the ideal goals of treatment. With the introduction of implants in the form of temporary anchorage devices (TADS), absolute and compliance-free intraoral anchorage has been provided, taking care of the possible problem of anchorage in orthodontic treatment. This is a review article that seeks to describe the current use and application of TADS in the contemporary management of orthodontic patients.

Keywords: Temporary anchorage devices, orthodontics, implant, anchorage.

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ORIGINAL ARTICLE

Introduction

All orthodontic appliances can be said to have two components- the active and the resistant components. The active component generates the force and the resistant component is responsible for providing the resistance to make the force effective.[1]

Tooth movement during orthodontic therapy is brought about by forces generated by the active components of an orthodontic appliance.[2] For every force applied, there is an equal and opposite reactive force (Newton's 3rd law of motion) on the anchorage units, tending to cause their movement, which is not desirable. For tooth movement to occur in the desired direction, this reactive force should be equal to or greater than the applied force. The areas or units which provide the resistance to the reactive force, thus preventing their undesired tooth movement, are referred to as the anchorage units.[2]

Graber defined anchorage as the 'Nature and degree of resistance to displacement offered by an anatomic unit, when used for the purpose of effecting tooth movement.[3] Anchorage, which is based on Newton's third law of motion, is a prerequisite for successful orthodontic treatment of malocclusions.[3]

Traditionally, orthodontists have used teeth, intraoral appliances, and extraoral appliances, to control anchorage. Traditional appliances for reinforcement of anchorage have included headgear and intraoral elastics.[4]

Conventional intraoral and extraoral anchorage systems often fall short of providing absolute/stable anchorage[5], even with the full cooperation of the patient.[4] These methods often have inadequate mechanical systems for anchorage control leading to anchorage loss of reactive units and results in

unfinished intra and inter-arch alignment.[6] The incorporation of bulky acrylic appliances or extraoral appliances by clinicians has resulted in poor patient compliance which contributed to loss of anchorage.[6] Absolute anchorage is defined as no movement of the anchorage units and can only be achieved by using ankylosed teeth or dental implants.[7]The introduction of skeletal anchorage in the form of temporary anchorage devices (TADs) or mini-screws has greatly benefited orthodontists in finding a way into anchorage control with minimum patient compliance, and without anycomplicated clinical and removal procedures[7]

Temporary anchorage device (TAD) is a device that is temporarily fixed to the bone to enhance orthodontic anchorage, either by supporting the teeth of the reactive unit, or by obviating the need for the reactive unit altogether, which is subsequently removed after use.[5, 7] The incorporation of TADs into orthodontic treatment made possible infinite anchorage, which has been defined in terms of implants as showing no movement (zero anchorage loss) as a consequence of the reaction forces applied.[5,7]

Types

TADS can provide anchorage in two different ways-directly and indirectly. In direct anchorage, the mini-screws directly receive the reactive forces by acting as the anchor unit, while in indirect anchorage, the mini-screws are connected by bars or wires to the reactive unit.[3]

Multiple types of implant anchorages are available, these include palatal plates, onplants, miniplates, and mini-screws.[8]

Temporary anchorage devices have been classified according to different types:[9]

1. Based on morphology
   i. Screw type - mini screw implant
   - Micro implant
   - Aarhus implant
   - Spider screw
   - Disc type - On plant
   - Plate type - Mini plate implants
   - Zygoma anchorage system

2. Based on head exposure
3. Open
4. Closed
5. Based on surface texture
6. Threaded
7. Non-threaded
8. Porous
9. Non-porous

Temporary anchorage devices used are subdivided into two main types.[10]

1. Surgical miniplate implants – Orthodontic anchorage is accomplished via altered or mini plates of sterile titanium with intra-oral expansion.

2. Mini-screw implants – In dental orthopaedics, these devices feature mechanical retention and provide short-term anchoring.

Classification of Skeletal anchorage devices

Skeletal anchorage devices can be classified into two groups based on their origin.[7] The first group belongs to osseo-integrated dental implants and includes the orthodontic mini-implants, the retromolar implants, and the palatal implants.

The second group originates from the surgical mini-implants such as the one used by Creekmore and Eklund.[7]

Orthodontic implants have been classified according to:[10]

1. Shape and size
   a) Conical (cylindrical)
      - Mini screw implants
      - Palatal implants
      - Prosthodontic implants
   b) Miniplate implants
   c) Disc implants (onplants);
2. Implant bone interface
   a) Osseointegrated
   b) Non-osseointegrated
3. Application
   a) Orthodontic implants
   b) Prosthodontic implants
4. Location
   a) Subperiosteal: Implant body lies over the bony ridge
   b) Transosseous: Implant body penetrates the mandible completely.

c) Endosseous: Partially submerged and anchored within the bone. Endosseous implants are commonly used for orthodontic purposes.

5. Configuration design
   a) Root form implants: These are the screw-type endosseous implants – the name derived from their cylindrical structure.
   b) Blade/plate implants: These are flatter and can be used in resorbed knife-edge ridges.
6. Composition
   a) Stainless steel
   b) Cobalt- chromium-molybdenum (Co-Cr-Mo)
   c) Titanium
   d) Ceramic implants
   e) Miscellaneous, such as vitreous carbon and compositescarbon and composites
7. Surface structure

   a) Threaded or non-threaded: The root form implants are generally threaded as this provides for a greater surface area and stability of the implant.
   b) Porous or non-porous: The screw type implants are usually non-porous, whereas the plate or blade implants (non-threaded have vents in the implant body to aid in the growth of bone, and thus a better interlocking between the metal structure and the surrounding bone.[5,11]

Surface modification

Mini-screws need to be mechanically stable during treatment to provide sufficient anchorage and predictable force control, and as temporary devices, they need also to be easily removable after treatment. These requirements dictate the approach as to how their clinical performance can be optimized. The stability of orthodontic mini-screws is paramount to their clinical acceptability. Their clinical stability has been proven to be exceptionally high.[12]

Various surface modifications have been proposed to enhance their stability, thereby allowing the orthodontist to optimize and expand their clinical uses. The various surface treatments of titanium implants have been known to modify both the surface composition as well as its topography, thereby increasing the implant surface roughness and area, which might lead to enhanced bone screw contact (BSC).[12-14] Surface modification also enhances the interactions with biological fluids and cells, and thereby, accelerates peri-implant bone healing and improves osseointegration at sites with insufficient quantity and/or quality of bone.[12]

Broadly, surface modification can be categorized into either subtractive or additive methods. The subtractive methods are machining/turning, sandblasting, acid-etching, sandblasting (large-grit) combined with acid etching (SLA), dual acid-etching, and laser treatment.[12]

The additive methods are anodization (also known as anodic oxidation), fluoride surface treatment, plasma spraying (titanium or hydroxyapatite), sol-gel coating, sputter deposition, electrophoretic deposition, biomimetic precipitation (Ca-P), and most recently, nanoscale modifications with or without drug incorporation.[12,15] A more recent method is the non-additive and non-subtractive method – the ultraviolet (UV) photo-functionalization.[12]

The SLA, micro-grooving, anodization, plasma ion implantation, resorbable blasting media (RBM), and nanoscale modifications are techniques meant to be incorporated into the manufacturing process, while the UV photo-functionalization technique can be used as a chair-side method for surface treatment of mini-screws. This technique (UV photo-functionalization) is yet to be tested clinically with orthodontic mini-screws.[12]

Indications for temporary anchorage devices (TADS)

TADs are generally mini-screws placed in either the alveolar bone or extra-alveolar bone, to provide anchorage. As opposed to a dental implant that serves as an anchor device with the intention of utilization as a dental prosthesis following its use as an orthodontic anchor. The hallmark of the TAD is its intended removal once its function is completed in the treatment regimen.[16] TADs have found application in the following clinical situations:[17,18]

Absolute anchorage: In maximum retraction requirements, for patients not compliant with headgears, in cases of missing first molars – TADs can provide anchorage as well as space management for difficult tooth movements such as anterior or posterior intrusion, en masse distalization of the upper or lower arches.[6]

Anterior retraction: This is the commonest use of TADs, it is utilized in cases where the bicuspids have been extracted, or in cases with generalized spacing where anchorage concerns are significant. This could be achieved through direct or indirect methods.[16]

Protraction of posterior teeth: In this clinical situation, posterior teeth are moved anteriorly, often to prevent having to place an implant and a lifetime maintenance for a young patient. One of the promising uses of TADs for protraction occurs when a second primary molar is lost and there is no second bicuspid to replace it. The molar relationship is determined by the absence or presence of teeth in the opposing quadrant.[16]

Molar or posterior arch intrusion: This is done in conjunction with the prosthodontic replacement of teeth, in cases where there is supra-eruption of unopposed teeth in an opposing arch. It is useful for the correction of occlusal cants and the intrusion of posterior teeth for open-bite correction.[6,16]

Molar distalization for Class II correction: This could be achieved by the use of palatal TADs attached to a trans-palatal arch bonded to the first or second bicuspids.[16] This can also be achieved by TADS placed distal and buccal to the molars to be distalized.

Anterior intrusion for deep bite correction: This could be achieved through direct or indirect anchorage for the intrusion of anterior teeth for the correction of a deep overbite especially in patients with excessive gingival display and maxillary incisor display.[16]
Reads can be used additionally with expansion appliances for palatal expansion in patients who were thought to have passed the age at which the palate can be expanded,[16] and in adult orthodontics for complex tooth movements.[6] Other uses of TADs include - Uprighting molars, appliance anchorage, eruption of impacted teeth, correction of midline asymmetry and cant of occlusion[6], and

- As attachments for elastics in condylar fractures in young patients (especially in those whose have erupted all permanent teeth) essentially replacing archbars.[6,16]

For patients with a need for asymmetrical tooth movement in all planes of space andin some cases, as an alternative to orthognathic surgery,[19, 20] this is particularly common in the management of moderate cases of Class III skeletal malocclusion with a reverse overjet, where surgery may be indicated, TADs are used to achieve sufficient molar distalization and subsequent correction of the Class III incisal relationship.

Contraindications

1. Mixed dentition where developing permanent teeth will interfere with the placement of the mini-screws (US Food and Drug Administration has approved orthodontic mini-screws for adults and adolescents of age 12 and older only). [17]

2. Midpalatal region of the growing patient, where the micro-implants can restrict the horizontal growth of the maxilla. [17]

3. In patients with systemic alteration in bone metabolism due to disease, medication, or heavy smoking. [17]

The absolute contraindications for their use include severe systemic disorder e.g. osteoporosis, psychiatric diseases, e.g. psychoses, dysmorphia, and alcoholic drug abuse; while the relative contraindications are insufficient bone volume, poor bone quality, patients undergoing radiation therapy, insulin-dependent diabetes, and heavy smokers.[17]

Patient selection

Case selection in the use of TADs like any other implant therapy will go a long way in determining the success of the implant system. Initially, the patient's medical history, and assessment of the oral cavity for the absence of gingival inflammation and periodontal diseases are done.
Informed consent should always be obtained from the patient or the parent. Alongside the usual orthodontic records, intraoral radiographs of the proposed miniscrew sites should be taken to assess the bone morphology and roots of adjacent teeth.[6,21] For further assessment of bone quality if required, a cone beam computed tomography (CBCT) may be taken for bone density values.

Site selection for placement of TADs

Selection of the location and placement of TADs is a technique-sensitive procedure.[18] The choice of mini-implant insertion sites should be based on

appropriate regions of soft tissues, such as the presence of attached gingiva, adequate amount of cortical bone, the angulation and size of the mini-implant, and foremost, the type of movement that is desired.[18]

In the maxilla, interradicular alveolar areas like the width of buccal cortical bone on the entire maxillary alveolar process arelimited (3mm to 4mm), so longer screws are needed.[11]

The sites most often utilized for miniscrew insertion in the maxilla include:

- Inter-radicular spaces, both buccal and lingual.
- Extraction spaces
- Inferior surface of the anterior nasal spine.[18]
- The palate
- The alveolar process, the infra-zygomatic crest, and the retromolar area.[3,19,22]

The best available position for a mini-screw is in the posterior maxilla, following a CBCT study by Deguchi et al,[23] are as follows:

1. Mesial or distal to the first molar
2. The best angulation is 30° apically to the long axis of the tooth, and
3. The safest length is 6mm of bone contact with a diameter of 1.3mm.[23]
4. Between the two central incisors, which is particularly good for intrusion
5. Infrazygomatic region – zygomatic buttress
6. Maxillary tuberosity region
7. Mid palatal area.[11]

Alternatively, the palate can be used with the clear benefits that the palatal cortical bone is of good quality and thickness,[11] and there is no interference with the roots of the teeth.[18]

In the mandible: inter-radicular alveolar area- as the cortical bone on the buccal area in the mandible is very dense, the screws are smaller in size, so the possibility of root contacts is remote.[11]

In the mandible, the commonest miniscrew placement sites are:

- Between the second premolar and the first permanent molar.
- Between the first and second permanent molars.
- Between the two central incisors
- Between the mandibular canine and premolar buccally.[11]
- Interradicular spaces, both buccal and lingual.
- Lateral to the mentalis symphysis
- Extraction spaces[18]
- In the alveolar process, the retromolar area, and the symphysis, an intraoral radiograph is required to determine the correct location.[19,22]

The mesiodistal widths of the interradicular space are more favourable between the mandibular permanent first and second molars at almost every level, starting from 2mm below the alveolar crest. The second-best location in the region is between the mandibular second premolar and first molar.[24]

In general, thin keratinized tissue is preferred over non-keratinized tissue, while placement in attached gingiva or at the mucogingival junction reduces tissue overgrowth,[20] ideally, 4-5mm interradicular bone stock.[25]

Sites to be avoided during placement of TADs include anatomic vital structures – the inferior alveolar nerve, artery, vein, mental foramen, maxillary sinus, and nasal cavity.[11] The diameter of the screw will depend on the site available. In the maxilla, a narrow implant can be selected if it is to be placed between the roots. If stability depends on the insertion into trabecular bone, a longer screw is needed, but if cortical bone will provide enough stability, a shorter screw can be chosen. The length of the transmucosal part of the neck of the implant should be selected after assessing the mucosal thickness of the implant site.[22]

Placement technique

The mini-screw implants can be either self-drilling or non-self-drilling. In the self-drilling, the pilot hole is not required, except where the cortex is thicker than 2mm, where dense bone can bend the tip of the

screw.[3, 22] They are newly designed osteosynthesis screws with specially formed tips and cutting flutes which are like a corkscrew and can be inserted into bone without pre-drilling.[3] In the non-self-drilling type, predrilling is required. With predrilling there are chances of damage to the nerves, tooth roots or tooth germs, thermal necrosis of the bone, and drill bit breakage.[3] The pilot drill should be 0.2 - 0.3mm thinner than the screw and should be inserted to a depth of no more than 2-3mm.[22] Pilot drilling should be done in a surgical environment, as with the placement of a dental implant, it should be preferably done by an oral surgeon.[3,22] The procedure is performed under a small amount of local anaesthesia. Soft tissue from the site is first removed using issue punch, then a pilot hole is drilled using a drill bit rotating at not more than 1000rpm. The implant is the placed using an appropriate screwdriver.[3] Tactile sensation is felt on contacting a tooth root when manual screwdriver is used for placement of the implant, thus resulting in minimal damage.[22]

The site will determine the diameter and length of the TAD to be used. Before insertion, the decision on whether or not to use the radiographic stent is made. An adjustable acrylic template or surgical guide, prior to the mini-screw implant placement, should be used.[3] The radiographic stents are used in the anterior region where interradicular placement of TADs can be particularly challenging because of the chairside vantage point and proximity of the roots to the facial cortical plate. In the posterior buccal region, the roots are diverged. If needed, TADs are placed using only panoramic evaluation.[25]

Proper angle of insertion is important for cortical anchorage, biomechanical control, and avoidance of root contact. In the posterior buccal region, the angle of insertion should be 30° to 45° to the occlusal plane, with the exception of posterior impaction cases or edentulous regions in which the angle of insertion should approximate 90° to the occlusal plane (parallel to the sinus floor). While angulations less than 45° increase cortical bone-implant contact[23] and minimize the likelihood of root perforation, it may increase the risk of TAD slippage.[25] In the maxilla, the insertion should be at an oblique angle, in an apical direction; in the mandible, the screw should be inserted as parallel to the roots as possible if the teeth are present.[22]

How to insert a TAD

Select carefully the area where the mini-implant will be placed, taking into cognizance the adjacent roots, the mental foramen, and the inferior-alveolar nerve. The use of a preprocedural antimicrobial mouth rinse is often recommended to reduce the bacterial load and risk of infection. Apply some numbing gel after which little topical lidocaine is injected in the area. Care should be taken so as not to over anaesthetize the area as the sensation of the adjacent root is needed in case the screw touches the roots. A fine explorer is used to place a small pinch mark on the site where the mini-implant will be placed. When ready, the mini-implant is held with the mini-implant handle, ensuring that the mini-implant head is locked in the handle. The placement procedure is begun by placing the mini-implant head perpendicular to the bone where the pinch mark was placed, inserting the implant gently in the clockwise direction to get some bone engagement. With the tip of the mini-implant engaged in the bone, tilt the mini-implant more apically and completely insert the mini-implant in the bone exposing only the head. This will help to get more bone engagement and minimize the chance of root encroachment. Take a simple X-ray to make sure the mini-implant is placed correctly.[22] After a successful insertion procedure, over-the-counter (OTC) analgesics can be prescribed for 1 to 2 days for discomfort.[25]

Implant maintenance

After the placement procedure, the surrounding soft tissues must be maintained to ensure the longevity of the implant. Plaque accumulation near the gingival margin can cause peri-mucositis, while prolonged inflammation leads to breakdown of bone around implants and peri-implantitis. Without proper management, this can lead to implant failure. Patient therefore must be instructed to follow daily plaque control at home and have periodic professional care, similar to regular periodontal care.[19]

Implant removal

On the completion of treatment, the implant is unscrewed using the screwdriver with or without the use of topical or local anaesthesia. In the event of its non-removal, it is advised to wait for 3-7 days as the induced microfractures can cause the screw to loosen.[3]

Advantages of TADs

1. TADs control anchorage as needed
2. Shorten treatment time
3. It helps to direct orthodontic forces in any given direction
4. It helps to provide extra retention in certain cases.
5. The provision of sufficient anchorage for tooth movement
6. Convenience of placement and removal
7. Low cost.[26]
8. Relatively comfortable and adaptable
9. Reduces the need for patient compliance
10. Makes certain oral surgeries unnecessary
11. Eliminates the risk of ocular damage associated with headgear use.
12. Good access to various placement sites
13. Minimal discomfort with no residual surgical defects
14. Versatile placement i.e. buccal or palatal.[11]
15. Immediate loading
16. Economic.[3]

Disadvantages of TADs

1. Different anatomic sites with different anatomical features
2. Rotational instability
3. Impairment of anchorage
4. Irritation of the mucous membrane
5. Injury to roots or neurovascular bundles.[27]
6. Fracture of the miniscrew
7. Need for surgery and high cost (for mini plates).[26]

Complications

Although the success rate was high with the use of TDAs, possible complications include pain, inflammation, and fracture of the device,[28] infection and tissue irritation of the surrounding tissues can occur, likewise injury to adjacent roots, periodontal ligament, nerves, blood vessels, failure when there is inadequate thickness of the cortical bone or fracture of the miniscrew implant during removal if the neck is too narrow.[3]

Conclusion

For the successful treatment of orthodontic cases, there is a need for absolute anchorage to prevent the undesired movement of teeth in the undesired direction. The introduction of temporary anchorage devices (TADs) in the orthodontist armamentarium with its versatility of use and most importantly its ability to provide maximum anchorage, which is independent of patient compliance, has greatly improved the outcome of orthodontic treatments.

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Combined Orthodontic and Periodontal Management in a case of Severe Maxillary Protrusion and Generalized Aggressive Periodontitis: A Case Report

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Abstract

The study reports the case of a 24-year-old Moroccan female who presented in the dental institution with aggressive periodontitis and associated severe bimaxillary dento-alveolar protrusion. Her face was convex, with a closed naso-labial angle; the lips were protruded with an everted lower lip. A mentalis strain and a skeletal class II malocclusion were also present. Before orthodontic treatment, the gingival inflammation was treated through continuous professional debridement, including scaling, root planning, and operation flap. Based on the loss of supporting periodontal tissues, continuous supportive periodontal treatment was needed to successfully keep the periodontal tissues healthy during orthodontic treatment. After the overall treatment, not only did the patient's aesthetics improve dramatically with the decrease in the biprotrusion, but the periodontal support also got better.

Keywords: Aggressive periodontitis, Bialveolar protrusion, Orthodontic treatment, Interdisciplinary approach.

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ORIGINAL ARTICLE

Introduction

Periodontal diseases are highly prevalent and can affect up to 90% of the world population.[1] While gingivitis does not affect the underlying supporting structures of the teeth and is reversible, periodontitis, on the other hand, can result in the loss of connective tissues and bone support, which is a major cause of tooth loss in adults.[2] According to the most recent classification of the American Academy of Periodontology,[3] Aggressive Periodontitis (AP) comprises a wide group of destructive periodontal diseases that affects adolescents and young adults, mostly without clinical evidence of systemic disease. It is characterized by a very rapid loss of periodontal tissues, in otherwise clinically healthy subjects.

In patients with advanced destruction of periodontal tissue, progression of periodontal disease causes movement of the teeth, and possibly malocclusions. [4] The incisors are likely to be flared out with the loss of arch integrity because of advanced bone loss in the anterior tooth regions. In addition, severe posterior bone loss potentially leads to loss of vertical occlusal dimension, which could further worsen the problems in the incisors. Moreover, if the patients originally had dental and/or skeletal orthodontic problems, the severe loss of periodontal tissues worsens or deleteriously affects such problems.[5]

There is no contra-indication to the orthodontic treatment of patients with periodontal disease, at least, as long as the disease has been brought under control. In modern clinical practice and for such cases, it is currently well established that the judicious contribution of each discipline is essential for a successful treatment, with optimized outcomes. However, if the bone loss is significant around the affected tooth, orthodontic goals and mechanisms should be appropriately adapted .[6]

This case report presents a periodontal-orthodontic approach in an adult woman presenting with a Class II bialveolar protrusion and advanced periodontal disease, on whom 4 first maxillary premolar extractions were performed after controlling the periodontal inflammation.

Case Report
Diagnosis and Aetiology

A 24-year-old Moroccan female complaining of inaesthetic appearance because of her protruding maxillary teeth (Figs 1-3) was referred from the periodontist to the orthodontic unit at the Casablanca University Dental Hospital.

On anamnesis, she reported that she continuously experienced bleeding and gingival swelling on waking and when brushing her teeth. She had no obvious medical histories and was not taking any medications.

Periodontal examination showed that the dental plaque and inflammation were not fully controlled, and several periodontal pockets were present, with probing depths ranging from 3 to 7 mm and bleeding on probing (Table 1).

Dental Radiographs taken before periodontal treatment demonstrated generalized horizontal bone loss, predominantly in the mandibular arch, and vertical bone defects in the maxillary incisors, second premolars, and first maxillary molar (Fig 4). Based on the age, attachment loss and bone defect, the patient was diagnosed as having Aggressive Periodontitis.

On orthodontic examination, the face was symmetrical, with a convex profile, a biprotrusion, a closed naso-labial angle, a hard labial occlusion, and a contracted chin in retrusive position and an increase in the lower part of the face (Fig 1).

Dental examination objected many features, which can be reported as follows (Fig 2):

- 5mm of overjet and 5mm of overbite
- class II canine and class I molar relationships
- severe bimaxillary protrusion
- deviation of the lower dental midline on the left side
- moderate crowding in the anterior lower segment
- distal diastema of the 22 and 33
- extrusion of the 17 and 38, and a corona-mesial tipping of the 48
- missing of the 47, 18, and 28

Cephalometric analysis showed a skeletal Class II jaw-base relationship (ANB angle= 7°), a dolichofacial pattern with an increased SN-GoGn angle (37°), protruded, extruded and labially inclined maxillary and mandibular incisors (Table 2, Fig 6)

Treatment Goals

The treatment goals were to induce a favourable periodontal response by a bone remodeling in order to stabilize the periodontal lesions, to improve the occlusion by establishing better occlusal contacts, anterior guidance, and to enhance the lips relationship repositioning of the anterior sector.

Treatment Plan and Progress

Because in this case the maxillary protrusion was caused by both severe maxillary dental protrusion and mild skeletal class II relationship, only one option was considered in order to achieve the treatment objectives. This only option was to extract both maxillary and mandibular premolars. This treatment choice will allow lingual retraction of the anterior teeth to resolve crowding and biprotrusion. On the mandibular arch, concerning the space between the 46 and 48, ideally the 48 must be extracted, considering its non-functional oblique axis, together with an implant in the site of the 47.

However, because of financial reasons, the patient could not undergo the treatment so the team opted to keep the molar relationship until she was financially ready for us to place the implant.

In addition, the key element before orthodontic management in this case, with aggressive periodontitis and periodontal complications, was to eliminate or reduce plaque accumulation and gingival inflammation. So, the patient underwent a periodontal therapy consisting of bucco-dental hygiene, subgingival scaling, root planning, and a 14 days course of empirical antibiotic therapy (Amoxicillin, 500mg /3 times per day; Metronidazole, 250mg/ 3 times per day).

Six weeks after this initial treatment, a re-evaluation of the gingival pockets was done, and the plaque and gingival index demonstrated the persistence of bleeding with deep pockets at the first upper-right molar and the first lower-left molar. So the periodontist proceeded to a healthier operation flap in order to eradicate the inflammation. This surgical procedure, consisting of a modified Widman flap, was done on the sites where inflammation was persistent with heavy bleeding during probing (ie, the upper-right first molar and lower-left first molar). It is an access flap allowing debridement surgery to regulate the overflow of the restoration on the 16, which was the maintenance element of inflammation at this level.

No bone regeneration protocol was considered as we

anticipated a good result as long as a good debridement was achieved and we got a stabilized blood clot with stitches.

After this, an observation period of 2 months was observed to make sure that the inflammatory process was adequately controlled and to allow healing after the periodontal treatment (Table 3).

The orthodontic treatment was then initiated, consisting on the following actions:

- Extraction of the 4 first premolars and of the 38.
- Placing of a standard maxillary and mandibular edgewise appliance with a .022x.028 –in slot.
- The leveling started with a .016-in NiTi archwire, followed by a .016x022-in heat-activated NiTi archwire.
- The retraction phase of maxillary and mandibular canines was achieved with a .016x.022-in stainless steel (SS) archwire with an elastic chain and mechanics releasing light forces that involved the area from the canine to the second molar.
- After maxillary and mandibular canine retraction, we used a .019x25-in NiTi archwire for alignment in order to allow passive insertion of the.019x.025-in SS archwire for incisors retraction (fig 7).
- The retraction of mandibular and maxillary incisors was done with a .019x.025-in stainless steel (SS) archwire with the mechanics excluding frictions, including light forces for incisors ingression and passive anterior torque.
- During the finishing stage, we used light class II intermaxillary mechanics by the means of elastics (3/16, 6oz), weared 12 hours per day. The active treatment lasted 20 months. All along the treatment period, the patient was very compliant and strictly followed the maintenance sessions (one every 2 months) with the periodontist.
- At the debond visit, the patient received an adhesive bonding retention from 12 to 22, with a vacuum-formed maxillary retainer, routinely used at night. On the mandibulary arch, just the adhesive bonding retention was applied from 33 to 43.

Treatment Results

Comparatively to the pretreatment aspect, one could note a righting of the profile, a better labial contact with relaxation of the chin contraction and a fair improvement of the smile (Fig 8). Occlusal results exhibited a canine and molar class I relationship in both sides, a reduction in the overjet, a good overbite and a coincidence of the medial incisors (Fig 9)

On the clinical periodontal view, we observed a significant decrease of both the periodontal pockets and bleeding in the probed sites of the 16, 26, 12, 22, 13, 23 and 36 when measured by the same periodontist compared to the beginning of treatment (Table 4).

Final panoramic and dental radiographs showed an increase in the root anchorage for the upper and lower incisors and bone remodeling of the interdental septa. No obvious sign of radicular or bone resorption was present (Fig 10,11).

Post-treatment cephalometric analysis was indicative of a sound righting in the profile with a fair ingression of the incisors, an anterior rotation of the mandible and associated improvement in the projection of the chin laterally (Fig.12,13, Table 1)

Table 1: Periodontal chart at the initial examination (pocket depth in mm)

Maxillary teeth	7	6	5	4	3	2	1	1	2	3	4	5	6	7
Pocket depth (labial)	534	736	533	326	423	543	334	233	335	754	325	333	755	525
Pocket depth (lingual)	534	436	534	323	522	524	323	323	555	553	523	333	624	735
Bleeding on probing	**	**	**	*	*	**			**	**	**	*	**	*
Mandibular teeth	7	6	5	4	3	2	1	1	2	3	4	5	6	7
Pocket depth (labial)		523	526	534	543	411	212	433	322	222	323	433	463	333
Bleeding on probing		**	**	**	**	*					*	**	*	
Pocket depth (lingual)		444	533	533	522	633	222	223	222	212	212	475	454	555
Bleeding on probing		***	**	**	**	**		*	*		*	**	**	**

Bleeding observed at *mesial, **middle, and ***distal probing points during 6-point probing methods.

Table 2: Cephalometric measurements

	Normal	Pre-treatment	*Post-treatment*
SNA (°)	82 ± 2	89	82
SNB (°)	80 ± 2	82	78
ANB (°)	2	7	4
SN-GoGn (°)	32	°37	38
Upper Incisor - PP (°)	113.6	128	114
Upper incisor to NA (°)	22.9	31	22
Upper incisor to NA (mm)	25	7	5
Lower incisor to NB (°)	28	41	32
Lower incisor to NB (mm)	6	11	6
FMIA (°)	63,07	47	54
FMA (°)	21.5	30	35
IMPA (°)	95.43	103	91
Nasolabial Angle (°)	94	100	94
E line: upper (mm)	−1.23	-2	-1,5
E line: lower (mm)	−0.04	+3	0

Table 3: Periodontal chart after the flap operation and before orthodontic treatment

Maxillary Teeth 7	6	5	4	3	2	1	1	2	3	4	5	6	7	
Pocket depth (labial)	222	323	411	321	112	321	332	222	224	323	323	333	334	333
Bleeding on probing			*	*							*		*	*
Pocket depth (lingual)	433	333	334	323	422	222	323	323	433	333	323	333	334	433
Bleeding on probing				*	*							*	*	*
Mandibular Teeth	7	6	5	4	3	2	1	1	2	3	4	5	6	7
Pocket depth (labial)		423	323	423	333	311	212	323	322	222	323	433	333	333
Bleeding on probing		*	*	*	*	*					*	*	*	
Pocket depth (lingual)		423	333	333	422	333	222	223	222	212	212	333	223	334
Bleeding on probing		*	*	*		*		*	*			*	*	*

Bleeding observed at *mesial, **middle, and ***distal probing points during 6-point probing methods.

Table 4: Periodontal chart after orthodontic treatment (pocket depth in mm)

Maxillary teeth	7	6	5	3	2	1	1	2	3	5	6	7
Pocket depth (labial)	222	323	311	112	321	222	212	212	323	333	323	333
Bleeding on probing												*
Pocket depth (lingual)	221	333	333	322	222	323	323	223	333	333	333	333
Bleeding on probing												*
Mandibular teeth	7	6	5	3	2	1	1	2	3	5	6	7
Pocket depth (labial)		323	323	333	311	212	323	322	222	433	333	333
Bleeding on probing		*		*						*		
Pocket depth (lingual)		323	333	322	333	222	223	222	212	333	322	333
Bleeding on probing			*									

Bleeding observed at *mesial, **middle, and ***distal probing points during the 6-point probing methods.

Fig 1: Pre-treatment facial photographs.

Fig 2: Pre-treatment intraoral photographs.

Fig 3: Pre-treatment dental casts.

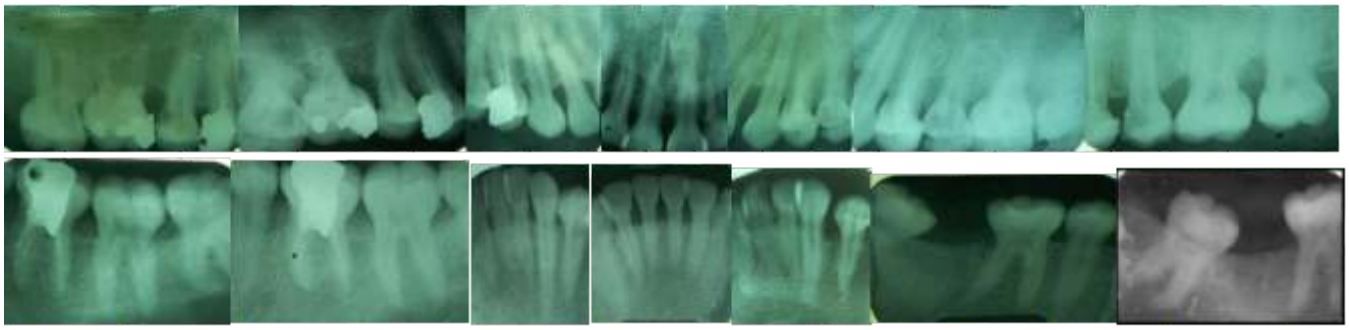

Fig 4: Pre-treatment periapical radiographs.

Fig 5: Pre-treatment panoramic radiograph.

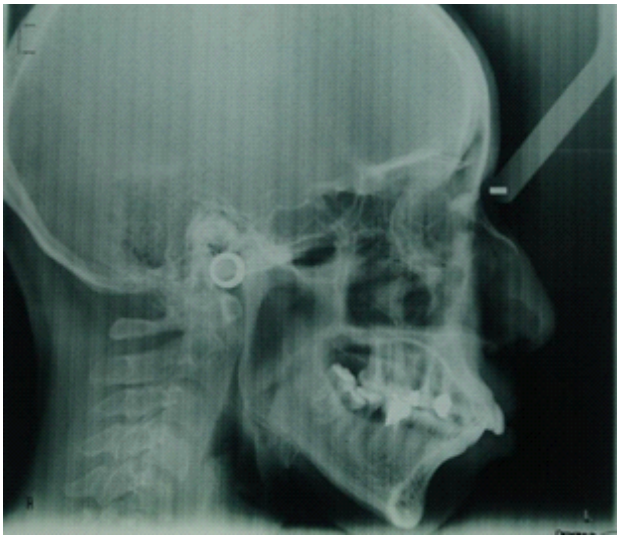

Fig 6: Pre-treatment cephalometric radiograph.

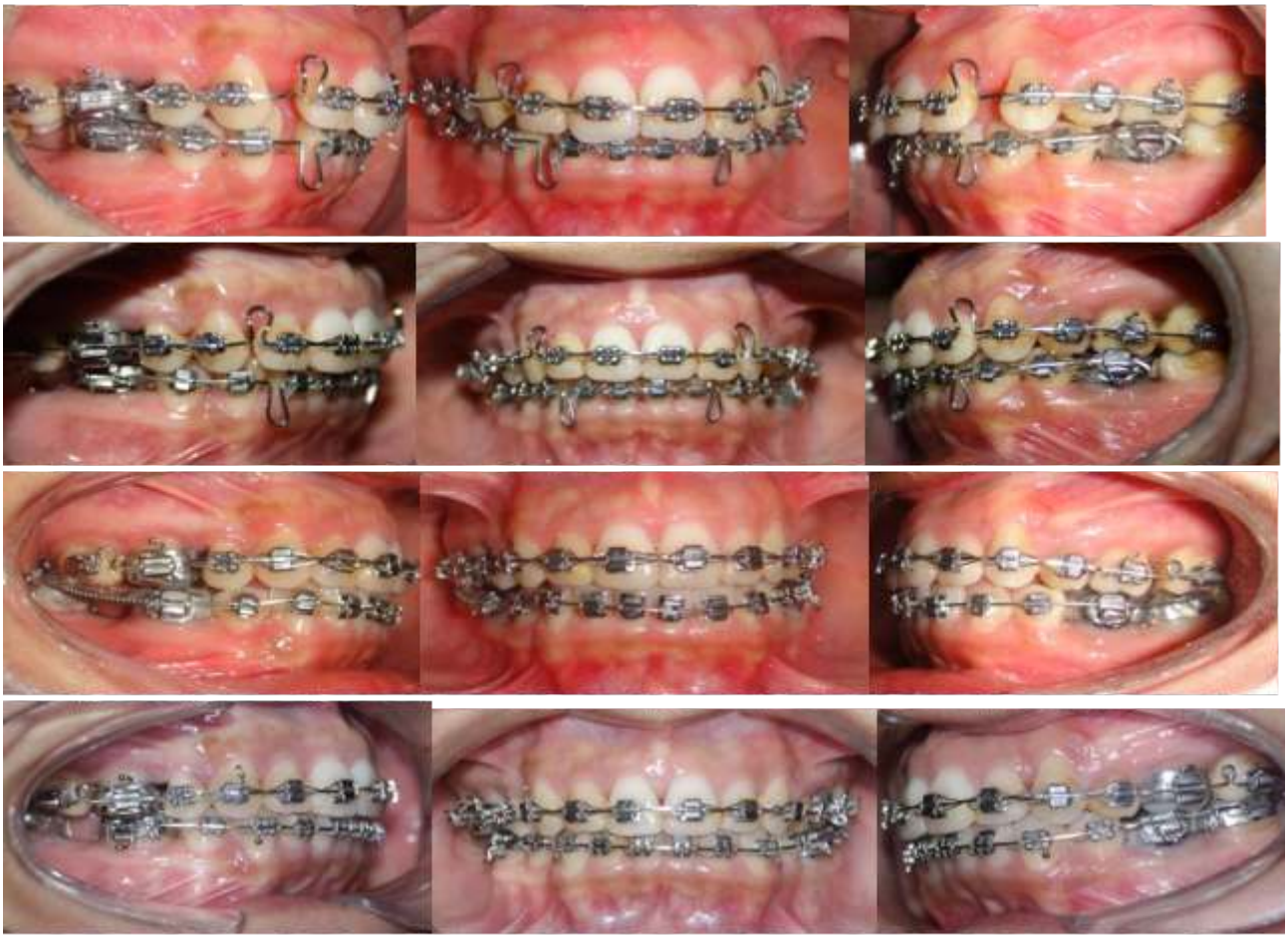

Fig 7: Intraoral photographs during treatment

Fig 8: Post-treatment facial photographs.

Fig 9: Post-treatment intraoral photographs.

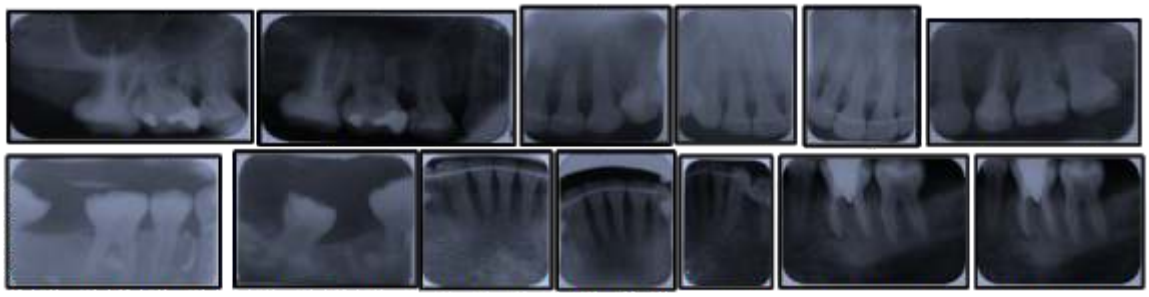

Fig 10: Post-treatment periapical radiographs.

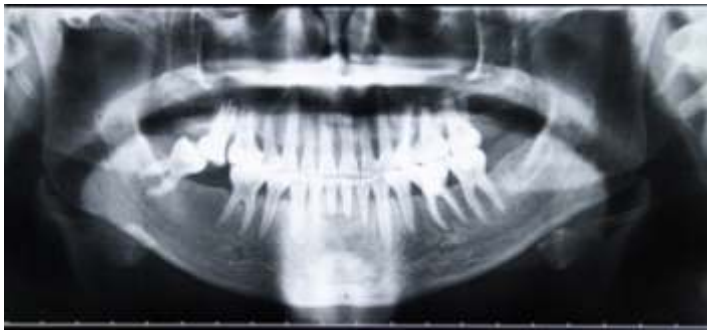

Fig 11: Post-treatment panoramic radiograph.

Fig 12: Post-treatment cephalometric radiograph.

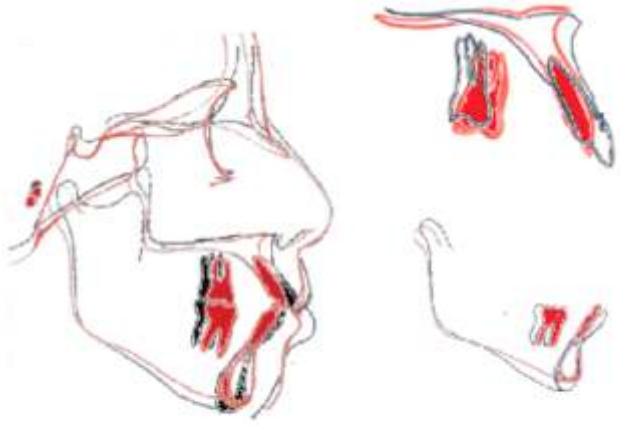

Fig 13: Pre-treatment and post treatment super-imposition.

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Manuscripts should meet the following criteria: original material, clear writing, appropriate study methods, valid data, and reasonable conclusions supported by the data, in short, they should contain important information on topic of general orthodontic interest.

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Manuscripts should be prepared in accordance with the Uniform Requirements for Manuscripts submitted to Biomedical Journals. 2 A summary of technical requirements for preparing the manuscript is provided below:

- Three copies of the manuscript should be submitted.
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- All manuscripts should be accompanied by a signed statement by all authors regarding authorship, responsibility, financial disclosure and
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The page should contain (i) the title of the article: which should be concise but informative (simpler the title the better; preferably it should contain all the key words to help electronic retrieval reliably); (ii) a short running title of less than 40 characters placed at the foot end of the title page; (iii) initials and surname of each author with the highest academic degree(s) and designation at the time when the work was done; (iv) details of the contribution of each author; (v) name of department(s) and institution(s) to which the work should be attributed; (vi) disclaimers, if any; (vii) name, address, telephone, fax, email address of the corresponding author, (viii) source(s) of support in the form of grants, equipment, drugs or all of these; and (ix) declaration on competing interests.

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Competing interest for a given manuscript exists when the author has ties to activities that could inappropriately influence his or her judgment, whether or not judgment is in fact affected. Financial relationships with industry for example, through employment, consultancies, stock ownership, honoraria, expert testimony, either directly or through immediate family, are usually considered to be the most important competing interests. However, conflicts can

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Original articles should report original research relevant to basic and clinical orthodontics including randomized trials, intervention studies, studies of screening and diagnostic tests, cohort studies, cost effectiveness analyses and case control studies. While reporting randomized controlled trials (RCT), authors must attempt to be in conformity with the consolidated standards of reporting trial.

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Each manuscript should be accompanied with a structured abstract (divided into background, methods, results and conclusions) in no more than 250 words. Four to five key words to facilitate indexing should be provided in alphabetical order along with the abstract. The text should be divided in sections on introduction, methods, results, discussion and conclusion.

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Short accounts of original studies are published as brief reports. The text should be divided into sections, i.e., abstract, introduction, methods, results and discussion.

Abstract should be of 100-150 words highlighting the aims, methods and main results along with 3-4 key words.

The text should contain no more than 1500 words, 3 illustrations or tables and up to 20 references, preferably recent publications.

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The typical length for review articles is 2000-3000 words, excluding tables, figures, and references.

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Clinical cases highlighting uncommon malocclusion condition, orthodontic treatment techniques are published as case reports. Single case reports are usually not accepted, unless some new or unusual aspect regarding aetiopathogenesis, diagnosis or management is brought out that adds to the existing body of knowledge. The text should not exceed 1000 words and is divided into sections, i.e., abstract, introduction, case report and discussion. The number of tables/figures should be limited to 2. Ten recent references are acceptable. A maximum of 3 or 1 author is permitted from the principle and each of the associated departments respectively. Thus, case reports from only one investigative department can have a maximum of 3 authors.

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Letters commenting upon a recent article in the West African Journal of Orthodontics are welcome.

Such letters should be received within 6 months of the article's publication. At the editorial board's discretion, a letter may be sent to authors! experts for comments and both letter and reply may be published together. Letters may also relate to other topics of interest to orthodontists and others, and/or useful clinical observations. Letters should not be more than 400 words. The number of authors should not exceed 2, including the authors' reply in response to a letter commenting upon an article published in this journal.

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A short text of about 150 words depicting the condition with color photographs (vide infra) is needed.

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Such articles are published on topical orthodontic issues including social aspects. It is expected that the authors have sufficient credible experience on the subject for giving viewpoints. These should not exceed 1500 words.

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occur for other reasons, such as personal relationships, academic competition and intellectual passion. If any of the authors have accepted reimbursement for attending symposium, a fee for speaking, fee for organizing educational reach, funds for a member of the staff of consultation fees from an organization that may in: way gain or lose financially from the result of the study, review, editorial or letter, a competing interest would be deemed to exist. If any of the authors had been employed by an organization that may in any way gain or lose financially from the publication, or if any of them hold stocks or shares in such an organization, competing interest would be deemed to exist. If competing interest exists, the author(s) must disclose them while submitting the manuscript.

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Introduction

The introduction must clearly state the question that the author(s) tried to answer in the study. It may be necessary to briefly review the relevant literature.

Only cite those references that are essential to justify the proposed study.

Materials and Methods

The methods section should describe, in a logical sequence, how the study was designed (e.g., how randomization was done), carried out (e.g., how subjects were chosen or excluded, ethical considerations, accurate details of materials used, exact drug dosage and form of treatment, etc.) and data were analyzed (e.g., an estimate of the power of the study, exact test used for statistical analysis, etc.).

For standard methods, appropriate references are sufficient, but if standard methods are modified these should be clearly brought out.

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Ethics

When reporting experiments on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1964, as revised in 2000.

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Authors should describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results. When possible, they meet to quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Actual P values are provided rather than stating as just <0.05 or >0.05 etc. References for the design of the study and statistical methods should be to standard works when possible (with pages stated) rather than to papers in which the designs or methods were originally reported. Any general-use computer programs used should be specified and statistical terms, abbreviations, and most symbols be defined.

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This section should include only relevant, representative data and not all information collected during the study. Major findings should be presented clearly and concisely. Text, tables, and illustrations should be used sensibly while avoiding repeating in the text all the data depicted in the tables or illustrations and emphasizing or summarizing only important observations. Tables and figures should be restricted to those needed to explain the argument of the paper and to assess its support. It is necessary to cite the tables in the text and type them on separate sheets. It may also be useful to mention what the study did not find.

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Discussion ordinarily should not be more than one third of the total length of the manuscript. This section should include a summary of the major findings, their relationship to other similar studies, limitations of methods and implications of these findings in future research. Conclusions should be linked to the goals of the study. Unqualified statements and conclusions which are not completely supported by the data should be avoided. Authors should also refrain from making statements on economic benefits and costs unless their manuscript includes economic data and analyses.

Acknowledgements

In acknowledgements section, it is suitable to list all contributors who do not meet the criteria for authorship, such as a person who provided purely technical help, writing assistance, or a department head who provided only general support. Financial and material support should also be acknowledged.

Groups of persons who have contributed materially to the paper but whose contributions do not justify authorship may be listed under a heading such as "clinical investigators" or "participating investigators", and their function or contribution should be described, for example, "served as scientific advisers", "critically reviewed the study proposal", "collected data", or "provided and cared for study patients". A written consent is required from all the persons acknowledged, indicating their acceptance for the same.

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The references must be verified by the author against the original documents. The Uniform Requirements style (the Vancouver style) is based largely on an American National Standards Institute (ANSI) standard style adapted by the NLM for its databases.

Journal Article

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Tables

Each table should be typed in double-space on a separate sheet of paper. Tables not submitted as photographs must be numbered consecutively (Arabic numerals) in the order of their first citation in the text, with a brief but self explanatory title for each.
Each column should have a short or abbreviated heading.
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Appendix 1:

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