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College of Dentistry

The Adverse Effect Of Orthodontic Treatment (Review)

A Project Submitted to
The College of Dentistry, University of Baghdad, department of Orthodontics
in Partial Fulfillment for the Bachelor of Dental Surgery

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بسم الله الرحمن الرحيم
ٱللَّهُ لَآ إِلَٰهَ إِلَّا هُوَ ٱلْحَىُّ ٱلْقَيُّومُ
لَا تَأْخُذُهُۥ سِنَةٌ وَلَا نَوْمٌ لَّهُۥ مَا فِى ٱلسَّمَٰوَٰتِ وَمَا فِى ٱلْأَرْضِ
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وَسِعَ كُرْسِيُّهُ ٱلسَّمَٰوَٰتِ وَٱلْأَرْضَ وَلَا يَـُٔودُهُۥ حِفْظُهُمَا
وَهُوَ ٱلْعَلِىُّ ٱلْعَظِيمُ ٢٥٥
صدق الله العظيم

Certification of the Supervisor

I certify that this project entilted "The effect of orthodontic treatment on the patientś daily activities" was prepared by fifth-years student **Hadiyah Ali Jasim** under supervision at the College of Dentistry/ University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor degree in Dentistry.

Supervisor's name:
Assistant Lecturer.Dina Hamid obaid
Date:

Dedication

The most beautiful moment is to achieve what I have been patient and tired for. I would like to dedicate my graduation to my first and last love, my father who lit my way and the lamp whose light never went out and who made efforts over the years to climb the ladders of success, and to the greatest woman in the world my beloved mother who showered me with her love, tenderness, fear, concern and prayer until I reached who I am, l thanks my second father who supported me in my life and was with me in every step of my life, may God protect you. I would like to thank my support in the life brother and sisters and in particular, I would like to thank my older sister, my beloved, who stood with me and worked hard and supported my academic career until I reached this stage of my life. and I do not forget the most beautiful thing that happened in my life, Dima, my love,my daughter, and my friend I love u.

I am proud of the most beautiful family in the world.

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List of Abbreviations

Abbreviations	Meaning
QoL	Quality of Life.
OHRQo	Oral Health–Related Quality of Life
mm	millimetre
TMD	Temporo-Mandibular Disorders
%	Percentage
NRS	Numerical Rating Scale
VAS	Visual Analogue Scale
NSAIDs	Non-Steroidal Anti-Inflammatory Drug
mg	milligram

INTRODUCTION

Introduction

Orthodontic treatment has its shortcomings.These perceived shortcomings are not restricted to a lack of ability to treat certain malocclusions but to the possibility of actual tissue damage during the actual course of treatment, an increased susceptibility to dental disease and dysfunction following completion of treatment, and partial or complete failure to accomplish the goals of treatment. The detrimental effects of orthodontic treatment cannot be segregated from the shortcomings in the implementation of the treatment per se. Only part of the treatment is in the hands of the clinician. From the perspective of an ideal treatment plan the patient's cooperation **(singh,2007).**

Fixed orthodontic appliance therapy is a regular orthodontic treatment to correct variations from an arbitrary normal (align the teeth or correct other irregularities) **(O'Brien *et al.*,1998)**, which may cause functional restrictions, discomfort and pain **(Doll *et al.*,2000),** but traditional orthodontic studies have only included clinician-based outcome measures. Since Cohen and Jago **(Cohen *et al.*,1976)** advocated development of social-dental indicators, there has been considerable subjective patient-base measurement results leading to further understanding about psychosocial well-being and/or dental health **(Shaw *et al* .,1980).** Hence, Oral Health–Related Quality of Life (OHRQoL) is defined as 'the absence of negative impact of oral conditions on social life and a positive sense of dentofacial self-confidence". Thus, studying the OHRQoLindex may provide information that will help clinicians and public health planners improve the quality of orthodontic care **(Liu *et al* .,2009).** With regard to fixed orthodontic appliance therapy, understanding the consequences and discomforts during orthodontic procedures affords patients more realistic expectations regarding orthodontic treatment and may increase adherence to treatment **(Chen *et al.*,2010).** Although

many specific OHRQoL measures have been developed to analyses the impact of wearing a fixed appliances **(Allen ,2003)**, there is still a paucity of systematic appraisal of the consequences of orthodontics on Quality of Life (QoL)**.** QoL is important in providing an understanding of the importance of, and priority for orthodontic care within the healthcare spectrum.

Aims of the study

The aim of this review was to the literature related to the impact of orthodontic treatment and orthodontic care on QoL (Quality of Life) , OHRQoL (Oral Health–Related Quality of Life.)

Chapter one
Review of literature

Chapter one
Review of Literature

1.1 What is orthodontics?

Orthodontics is the area of dentistry concerned with study of the craniofacial growth, development of the dentition and occlusion, and with the diagnosis, interception, and treatment of dentofacial anomalies **(Yew, 2011).**

1.2 Classification of orthodontic appliances

The simplest classification is probably based on the patient's ability to remove the orthodontic appliance. Based on this premise the appliances can be classified as: removable, semi-fixed or fixed **(Singh, 2007).**

1.2.1 Removable Appliance

As the name suggests, these are appliances that can be removed by the patient without any supervision by the orthodontist **(Singh, 2007),** As Hawleyś retainer **(Fig.1.1).**

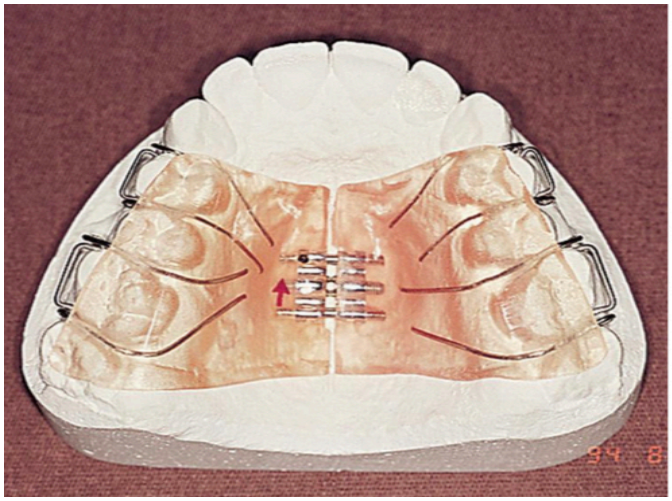

Figure 1.1: Removable orthodontic appliance **(Mitchell, 2019).**

1.2.1.1 Advantages of removable appliance (Singh, 2007).

1. The patient can continue with routine oral hygiene procedures without any hindrance.
2. Most forms of tipping movement can be carried out successfully.
3. These appliances are less conspicuous than fixed appliances and hence, generally more acceptable to the patients.
4. Since these are relatively simple appliances, they can be delivered and monitored by the general dentist.
5. Appliance fabrication is done in specialized labs and hence the chair side time for appliance delivery is considerably less as compared to the fixed appliances.
6. Since only a few movements are carried out simultaneously with these appliances the time required by the clinician to activate an appliance is less. This allows the clinicians to see more patients in a lesser time.
7-These appliances are relatively cheap as compared to the fixed appliances.

1.2.1.2 Disadvantages of removable Appliance (Littlewood *et al*., 2001; Locks *et al*., 2002; Singh, 2007).

1. Patient cooperation is the key word in removable appliance therapy. The duration for which the appliance is worn is the duration for which the appliance is able to act. Hence, the treatment can become prolonged depending on patient compliance.
2. These appliances are capable of only certain types of movements, they do not give three-dimensional control over the teeth to be moved. This limits their utility.
3. Multiple movements are difficult, if not impossible to carry out. Since all corrections cannot be carried out simultaneously the treatment time may be increased considerably.
4. The patient has to have a certain amount of dexterity and skill to be able to remove and replace the appliance for successful treatment to be possible.

5. The chance of appliance loss and/or breakage is more.

6-lower removable appliances generally these are more difficult to tolerate due to encroachment on the tongue space. Retention of the appliance can also be a problem as the lingual inclination of the molars makes clasping difficult. Consequently, lower removable appliances are generally not recommended.

1.2.2 Semi-fixed appliance

Semi-fixed orthodontic appliances have some part of the appliance fixed on to the tooth surfaces which the patient cannot remove but the rest of the appliance can be removed **(Singh, 2007),** As lip bumper **(Fig.1.2).**

Figure. 1.2: The lip-bumper appliance is a semi-fixed appliance; the molar bands are 'fixed' whereas the bumper can be removed **(Singh, 2007)**

1.2.3 Fixed appliance

As the name suggests, fixed orthodontic appliances include orthodontic devices, which have attachments that are fixed on to the tooth surface, and forces are exerted via these attachments using archwires and/ or other auxiliaries. The

appliances cannot and should not be adjusted or removed by the patient **(Mandall *et al.,* 2002; Singh, 2007),** As pre-adjusted edgewise appliance **(Fig.1.3).**

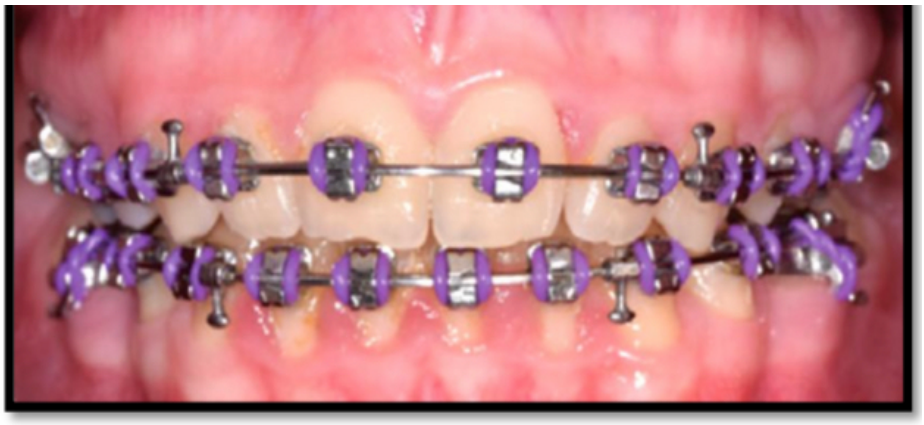

Figure 1.3: Fixed orthodontic appliance (**Mitchell, 2019).**

1.2.3.1 Advantages of fixed appliance(Mandall *et al*., 2002; Singh, 2007).

1. Precise tooth control is possible. The movement achieved is precise and makes it possible to move individual teeth in the three planes of space to achieve perfect alignment of teeth both inter and intra arch.
2. Multiple tooth movements are possible. Individual teeth can be moved in all the three planes of space simultaneously
3. Patient cooperation is reduced in comparison to removable appliance wear, but cannot be dispensed with completely.

1.2.3.2 Disadvantages of fixed appliance (Mandall *et al*., 2002; Singh, 2007).

1. Oral hygiene requirement ,Oral hygiene maintenance becomes more difficult. Food debris tend to accumulate around the attachments and their removal becomes difficult.
2. Esthetics Fixed appliances are generally made of metal that might not be esthetically acceptable to the patient.

3. Special training for operator ,only orthodontists are trained to handle and monitor these appliances. Special training is a must to achieve acceptable results.

4. Increased cost of treatment Fixed orthodontic appliances are costly as compared to removable appliances.

5. Increased chair side time since the appliance is fixed, and cannot be removed from the patient's mouth, hence, all adjustments have to be made in the patient's mouth by the operator. This increases the chair side time.

6. Anchorage control is more difficult as compared to removable appliances.

1.3 The effects of orthodontic treatment on quality of life

1.3.1 Speech

Speech is a complex neuromuscular process involving respiration, phonation, articulation, and resonance. Articulation is the formation of different sounds through variable contact of the tongue with surrounding structures, including the palate, lips, alveolar ridge, and dentition. It is unlikely that orthodontic treatment will significantly change speech in most cases, as speech patterns are formed early in life before the permanent dentition is present and the teeth are only one component in the complex system. However, where patients cannot attain contact between the incisors anteriorly, this may contribute to the production of a lisp (interdental sigmatism). In these cases correcting the incisor relationship and reducing interdental spacing may reduce lisping and improve confidence to talk in public **(Mitchell, 2019).**

Orthodontic appliances often fit against the palate and the surface of the teeth, which affects the movement of the tongue and the space of the oral cavity, resulting in the distortion of some specific sounds. In addition, it has been reported that various types of orthodontic appliances that effect on speech such as labial and lingual fixed appliance, tongue thrusts, palatal expander, and Hawley retainer **(Araujo *et al*, 2011; Rai *et al*., 2014; Atik *et al.*, 2016).**

1.3.2 Psychosocial well-being

There are few studies focusing on changes in psychosocial dental impact while patients are undergoing treatment.During the orthodontic treatment, the psychosocial dental impact decreases, probably related to the aesthetic improvement perceived by the patient in the alignment of the anterior teeth **(Zheng *et al* .,2015).** This improvement has been observed at least 6 months after the beginning of treatment.At the end of the orthodontic treatment, the patient's perception of psychosocial dental impact in the dimensions such as dental confidence, social impact, psychological impact and aesthetic concern improves **(Rappaport *et al* .,2010).**

The development of psychosocial impact could be influenced by patient personality variables, some of which have been widely studied in health-disease processes. orthodontist cloud forecast the constraints that the patient will undergo through treatment and based on that, improve the quality and effectiveness of patient care. On the other hand, the patient could benefit from this information to improve the adaptation process to treatment, as well as to increase active cooperation with the professional in achieving better treatment results (**Aikins *et al* .,2014).**

1.3.3 Root resorption

Root resorption is the most common sequela of the orthodontic treatment. It is an inflammatory process that leads to an ischemic necrosis localized in the periodontal ligament when the orthodontic force is applied **(Fig.1.4).** The onset and progression of root resorption are associated with risk factors related to the orthodontic treatment such as the duration of treatment, the magnitude of the force applied, the direction of the tooth movement, the method of force application (continuous versus intermittent), the orthodontic movement . While, the risk factors that are patient-related are the individual susceptibility on a genetic basis, some systemic diseases, anomalies in root morphology, dental trauma, and previous

endodontic treatment. The prevention of root resorption during the orthodontic treatment may be performed controlling the risk factors. The periodic radiographic control during the treatment is necessary in order to detect the occurrence of root damages and quickly reassess the treatment goals **(Pizzo *et al*., 2007). Mitchell in 2019** stated that during the course of a conventional 2 years fixed-appliance treatment around 1 mm of root length will be lost (this amount is not clinically significant).

Relationship between the change in overjet and severity of root resorption was observed. The greater the overjet during the orthodontic treatment, the greater the root resorption for maxillary anterior teeth, because greater tooth movement is necessary in order to decrease overjet **(Sameshima and Sinclair, 2001).**

Malocclusion in vertical plane does not influence the occurrence of increased root resorption **(Sameshima and Sinclair, 2001).**

Increased overbite may correlate with more root resorption of maxillary lateral incisors. It was established that the deeper is overbite, the greater is root resorption of a maxillary permanent first molar distal root and maxillary incisor **(Travess *et al*., 2004).**

Specific tooth vulnerability to root resorption. Some teeth are more susceptible to root resorption, others less. According to the research data teeth of the maxillary teeth are more sensitive to root resorption than the mandibular teeth **(Travess *et al*., 2004)**. Anterior teeth are more susceptible to root resorption relative to posterior teeth **(Jiang *et al*., 2003).**

The most resorbed tooth in the lower arch is the canine;they are followed by lateral and central incisors Root resorption of molars and premolars is very low (less than 1mm) .The most resorbed teeth are the maxillary lateral, maxillary central, lower incisors, maxillary canine, distal root of the first molar, lower second premolar and maxillary second premolar **(Sameshima and Sinclair, 2001).**

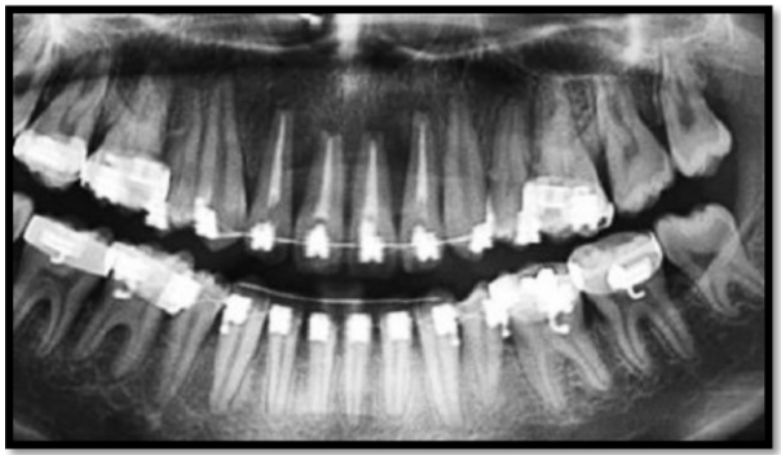

Figure 1.4: Radiograph showing orthodontic-induced root resorption **(Syed *et al*., 2015).**

1.3.4 Tmj disorder

Temporo-Mandibular Disorder (TMD) is the main cause of pain of non-dental origin in the orofacial region including head, face and related structure. The etiology and management of TMD has caused considerable controversy in all branches of dentistry. TMD comprises a group of related disorders with multifactorial etiology including psychological, hormonal, genetic, traumatic, and occlusal factors. **(DiBiase and Sandler, 2001).**

When orthodontic treatment lasts around 2 years, orthodontic patients may complain about TMD during or after treatment and orthodontists may be blamed for causing TMD by unsatisfied patients **(Michelotti and lodice, 2010).**

1.3.5 Demineralization

Demineralized white lesions are an early, reversible stage in the development of dental caries, which occur when a cariogenic plaque accumulates in association with a high -sugar diet. It is a common and frequent well-known side-effect of orthodontic treatment **(Fig.1.5).** If white spot lesions are not managed early and effectively they can cause permanent damage and even progress to frank caries. The presence of a fixed appliance predisposes to plaque accumulation, as tooth cleaning

around the components of the appliance is more difficult. Demineralization during treatment with fixed appliances is a real risk, with a reported prevalence of between 2% and 96%. Although there is evidence to show that the lesions regress following removal of the appliance, patients may still be left with permanent scarring of the enamel **(Armstrong *et al*., 2011).**

For the management, teach patient concerning oral hygiene instruction and dietary counseling again daily rinsing with 0.05% fluoride mouth rinse or apply topical fluoride to help in remineralization if patient is not cooperative and not committed to maintain good oral hygiene, warn the patient. May need to ask patient to stop wearing appliance to prevent further damage to teeth and gingivae due to Poor oral hygiene. Fluoride varnishes should be considered for use as a preventive adjunct to reduce enamel demineralization adjacent to orthodontic brackets, particularly in patients who exhibit poor compliance with oral hygiene and home fluoride use **(Todd *et al.*, 1999).**

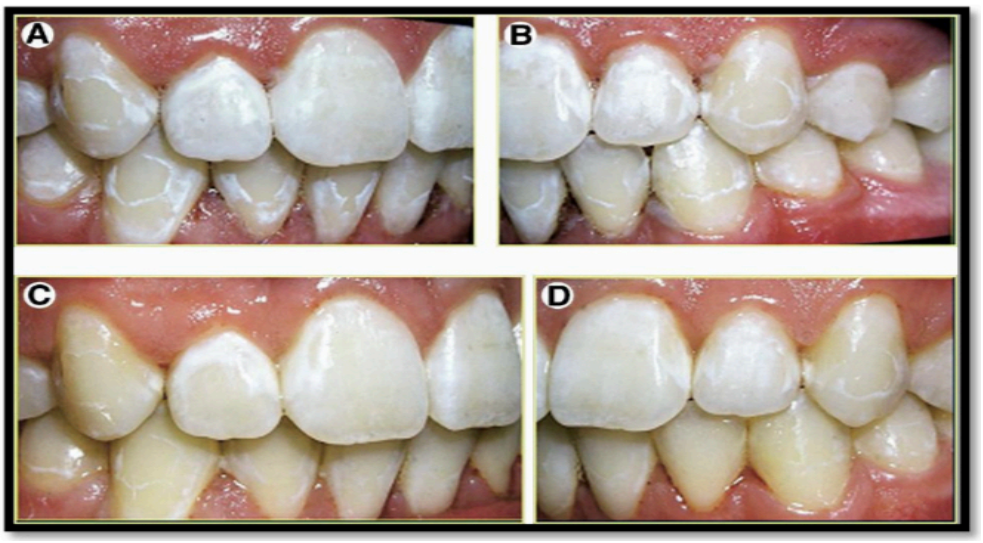

Figure 1.5: (A-D) Case illustrating the remineralization that could occur a few weeks following the completion of orthodontic treatment (A and B). The remineralization is the result of improved oral hygiene and from the available minerals in saliva, fluoridated toothpaste, and so forth (C and D) **(Bishara and Ostby, 2008).**

1.3.6 Gingivitis

Gingival recession and loss of alveolar bone have been reported as a result of teeth being moved in the presence of inflammation **(Fig.1.6).** plaque retention is increased with appliances and plaque composition may also be altered. There is an increase in anaerobic organisms and a reduction in facultative anaerobes around bands, which are therefore perio-pathogenic**.** Therefore, the Treatment/Management of gingivitis include; oral hygiene instruction, using interproximal brush (for fixed orthodontics), scaling and prophylaxis **(Yew, 2011).**

Removable appliances may also be associated with gingival inflammation, particularly of the palatal tissues, in the presence of poor oral hygiene (**Michelle, 2019)**

Figure 1.6: Gingival inflammation caused by orthodontic brackets **(Syed et al.,2015).**

1.3.7 Effects on the soft tissues

Mucosal soft tissues of the mouth include the upper and lower lips, inner part of the cheek, palate, floor of the mouth and tongue. Traumatic effects on the soft tissue mucosa may occur as ulcers. This may be due to over -extended ends of the archwire, brackets on the labial surface of the teeth, and orthodontic bands on the molar teeth **(McGuinness, 1992).**

Ulceration can occur during treatment a result of direct trauma from both fixed and removable appliances, although it is more commonly seen in association with fixed components as well as a removable appliance is usually removed. Lesions generally heal within a few days without lasting effect **(Dunlop *et al.*, 1989).**

1.3.8 Candida infections

The presence of appliances in the oral cavity increases the prevalence of people with candida, specifically the species Candida Albicans is the most frequently isolated. The balance between the clearance of the microorganism, the colonization and the state of candidiasis depends both on the virulence of the fungus, and the competence of the host immune system **(Farronato *et al*., 2013).**

1.3.9 Loss of periodontal support

An increase in gingival inflammation is commonly seen following the placement of fixed appliances as a result of reduced access for cleaning and if oral hygiene is consistently poor, gingival hyperplasia may develop. This normally reduces or resolves following removal of the appliance, but some apical migration of periodontal attachment and alveolar bony support is usual during a 2-year course of orthodontic treatment. In most patients this is minimal but in individuals who are susceptible to periodontal disease, more marked loss may occur **(Michelle, 2019).**

Orthodontic movement of teeth outside the envelope of alveolar bone can result in loss of buccal or less commonly lingual bone, increasing the risk of bony dehiscence and gingival recession **(Fig.1.7).** The risk is higher in patients with a narrow alveolus, thin gingival biotype, or existing crowding where teeth have been pushed outside the alveolar bone Therefore, for the management this condition; it is important to maintain a high level of oral hygiene and avoid moving teeth outside of alveolar bone **(Mitchell, 2019).**

Figure 1.7:Mandibular central incisor with localized gingival recession that developed during orthodontic treatment. Note the lack of keratinized and attached tissue apical to the recession defect**(Kasaj, 2018).**

1.3.10 Pulpal injury

Excessive apical root movement can lead to a reduction in blood supply to the pulp and even pulpal death. Teeth which have undergone a previous episode of trauma appear to be particularly susceptible, probably because the pulpal tissues are already compromised. Any teeth that have previously suffered trauma or that are judged to be at risk of pulpal injury require thorough examination prior to orthodontic treatment, and any orthodontic treatment should be delivered with light force and careful monitoring **(Mitchell, 2019).**

1.3.11 Pain

Patients experience pain and discomfort during active orthodontic treatment with fixed appliances. Pain is considered a subjective response to noxious stimuli. It can vary from person to person and is influenced by certain factors such as age, gender, previous pain experiences, stress or anxiety, and type of appliance. The orthodontic treatments such as separation, placement of the arch wire, activation of the fix or removable appliances and debonding cause some degree of pain for the

patient. In a prospective study 95% of the patients reported pain experience during orthodontic treatment. Pain relatively starts within four hours, increases over the next 24 hours, and decreases within seven days after initial bonding and placement of separators. The main cause of pain and discomfort in orthodontic treatment is due to multiple factors such as pressure, ischemia, inflammation, and edema related to tooth movement. The most common method of measuring pain intensity is the Numerical Rating Scale (NRS) and Visual Analogue Scale (VAS) **(Koritsánszky *et al.*,2011).**

Pain intensity can also be affected by the type of appliance. Patients with fixed appliances report significantly greater pain intensity than those with removable ones **(Sergl *et al.,* 1998).**

The Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are the preferred over the counter medications for orthodontic pain. While, high doses of NSAIDs have been reported to disrupt tooth movement, over-the-counter doses have not been shown to affect tooth movement **(Gameiro *et al.,* 2007).**

According to **Pozzi and Gallelli (2011);** no statistically significant difference was found between ibuprofen and paracetamol (acetaminophen) administration in relieving pain, but, they described the role of ibuprofen in orthodontic pain management and the authors concluded that ibuprofen 400mg, if taken one hour before, three hours after, and seven hours postoperatively, significantly reduced pain.

Preoperative analgesics were found to be effective in reducing pain and discomfort after intervention in patients with dental anxiety and fear **(Ashley *et al*., 2012).** Administration of piroxicam 20 mg one hour before separator placement was recommended **(Kohli and Kohli, 2011).** The authors concluded that the use of a single dose of medication (lumiracoxib 400 mg but doesn't use always in pain management.

Other more nontraditional methods of pain relief include low-level laser therapy **(Huang *et al*., 2015),** transcutaneous electrical nerve stimulation, vibratory stimulation, and analgesic gum **(Proffit, 2019).**

Some patients might suffer from underlying orofacial pain so the orthodontists must collaborate with the orofacial specialists when encountering these patients in their practice **(Romero-Reyes and Uyanik, 2014).**

1.3.12 Change profile

Some authors have expressed concern over detrimental effects to the facial profile as a result of orthodontics, particularly retraction of anterior teeth in conjunction with extractions. While a number of studies have shown little difference in profile between extraction and non-extraction treatment, it is important that when treatment planning to correct malocclusion, the impact on overall facial appearance is considered **(Mitchell, 2019).**

1.3.13 Allergic reaction

Contact dermatitis is reported in approximately 1% of the population and allergic reactions may be seen on facial skin in response to components of appliances, usually nickel. This may be managed by covering metal components with tape to prevent contact, or alternative treatment methods may be sought depending on the severity of the reaction **(Mitchell, 2019).**

Soft tissue allergy due to orthodontic components containing nickel and iron is not common **(Fig.1.8).** About 5-12 times more of nickel concentration is needed to have an allergic effect on the oral soft tissue than on the skin (**Dunlap *et al*., 1989).** Nevertheless, closer attention should be given to those who have had previous allergy to nickel. Soft tissue allergy may also occur due to 'latex' (rubber) in the elastomeric components or gloves used by the operator **(Mitchell, 2019).**

Figures 1.8: A patient with nickel allergy showed an improvement after changing to the nickel free one **(Marques *et al*., 2012).**

1.3.14 Palatal inflammation

This can occur for two reasons: **(Mitchell, 2019).**

1.Poor oral hygiene. In the majority of cases, the extent of the inflammation exactly matches the coverage of the appliance and is caused by a mixed fungal and bacterial infection **(Fig.1.9).** This may occur in conjunction with angular cheilitis. Management of this condition must address the underlying problem, which is usually poor oral hygiene. However, in marked cases it may be wise to supplement this with an antifungal agent (e.g. nystatin, amphotericin, or miconazole gel) which is applied to the fitting surface of the appliance four times daily. If associated with angular cheilitis, miconazole cream is needed.

2. Entrapment of the gingiva between the acrylic and the teeth being moved.

Figure 1.9: Inflammation of the palate corresponding to the removable appliance **(Mitchell, 2019).**

Chapter two
Discussion/comments

2.1 Discussion

Quality of Life is a multidimensional concept that includes subjectively perceived physical, psychological, and social functions, as well as a sense of subjective well-being. The orthodontic treatment for malocclusion may result in a poor quality of life, specifically the treatment with the fixed orthodontic appliance that may result in functional limitation, physical pain, psychological discomfort, psychological disability, and social disability that demonstrated almost at the first month of the treatment and decreased with time.

Apart from the benefits of orthodontic treatment like improvement in general and oral health, function, appearance, individual comfort and self-esteem, the risks associated with its treatment are a reality. The complications associated with orthodontic treatment are a result of multifactorial process, with the patient, orthodontist, orthodontic appliances, and procedures that playing a vital role.

Chapter three
conclusion and suggestions

3.1 Conclusion

The orthodontic treatment has advantages and disadvantages, but its advantages is more than the disadvantages; as sometimes the orthodontic treatment become a life changing treatment that make a huge difference to the face and function, and most of the disadvantages is temporary and become less with time.

Therefore, before starting the treatment, we must tell the patients about the possible problems that patients may face during the treatment.

3.2 Suggestions

1-Learn about the side effects of orthodontic treatment and try to avoid them through future orthodontic treatments.

2- There is a need for more studies on the effect of orthodontics on speech and the role of the speech therapist in changing the patient's speech.

3- There is a need for more studies on a relationship between TMD and orthodotic treatment.

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