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Frequency of orthodontic adult patients attending Baghdad Dental Hospital

The College of Dentistry, University of Baghdad,
Department of Orthodontics in Partial Fulfillment for
the Bachelor of Dental Surgery

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Certification of the Supervisor

I certify that this project entitled “**Frequency of orthodontic adult patients attending Baghdad Dental Hospital**” was prepared by **Mina Rafid Kadhim** under my 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

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Date: /4/2022

Dedication

To my father for his support,

**To my kind mother for her
patience,**

**To my brothers and sisters for
their encouragement.**

Acknowledgment

First, "**Alhamdulillah**," for giving me the strength and patience to accomplish this work, and I pray that His blessings on me will last the rest of my life.

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Abstract

Introduction: The demand for adult orthodontic treatment has increased during the last two decades. The reasons are most likely an improvement in the availability and accessibility of orthodontic services as well as an increased patient awareness. The reasons for this increase in orthodontic treatment demands may be due to aesthetic reasons and as adjunctive treatment to a restorative and/ or periodontal treatment plans.

Aims: The aims of this project are to point out the prevalence of adult patients attending orthodontic postgraduate clinic in the Dental Hospital of School of Dentistry University of Baghdad and the gender difference of the attending patients also the phenotype of the malocclusion of the attending patients and the orthodontic modalities utilized for the treatment of those patients.

Materials and methods: A cross-sectional study was done using the case sheets of patients attending Postgraduate Orthodontic Clinic at the College of Dentistry University of Baghdad. The case sheet were collected randomly from MSc and PhD Degrees students. Case sheets of total 148 patients were surveyed to determine the frequency of adult patients seeking orthodontic treatment. Data were processed using Microsoft excel (version 2021). Data were illustrated using the graphs (Pie charts and bar graphs).

Results: The frequency of adults seeking orthodontic treatment compared to total subjects was studied. Total patients were 148 of which 64 (43%) were younger than 18, while adults were 84 (57%). Out of 84 adult subjects, 56 (66.6%) were females and 28 (33.3%) were males. However, 82 subjects (97.6%) were young adults (18-30 years old) and 2 subjects (2.4%) were old adult (>30 years old). The most common

malocclusion of adult patients was Angle`s Class I malocclusion (52 patients) with different traits such as spacing, crowding, anterior/posterior cross bite. However, 28 patients were with Class II (24 patients Class II div1 and 4 with Class II div2) and only 4 patients with Class III malocclusion. All patients were treated with metal fixed orthodontic appliance.

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REM	Rapid maxillary expansion
TADs	Temporary anchorage devices
CAD	Computer-aided design
CAM	Computer-aided manufacturing

Introduction

The demand for adult orthodontic treatment has increased during the last two decades. The reasons are most likely an improvement in the availability and accessibility of orthodontic services as well as an increased patient awareness. It has been reported in the USA that up to 25% of orthodontic patients are adults. A Swedish survey by **Salonen et al. (1992)** showed that the prevalence of malocclusion, in the 920 surveyed adults aged more than 20 years, ranged from 17–53%. However, only 5% requested orthodontic treatment. Another study, in Holland, reported similar findings. In the UK, the major orthodontic traits in adults seeking treatment were mal-alignment of the lower/upper arch and Class III malocclusion while 90% of adult orthodontic treatments were provided using fixed appliances (**Almuzian, 2014**).

Adult orthodontics is essentially same as adolescent orthodontics for tissue changes related with tooth development, phases of treatment and objective of treatment. Yet, there are sure contrasts in a few angles in particular psychosocial, mechanical and biological angles where adults need exceptional thought for social and clinical administration (**Vanarsdall and Musich, 2005**).

More people are keeping their teeth longer owing to the improvement of the dental health services and awareness leading to an increase in the demand for orthodontic treatment for aesthetic reasons and also as adjunctive treatment to a restorative and/ or periodontal treatment plans. Another reason for the increase in demand for adult orthodontics is recent advances in the treatment modalities. These advances include (**Almuzian, 2014**):

- Transparent or tooth-coloured bracket systems;
- Aesthetic or tooth-coloured wires and ligatures;

- Clear plastic aligner systems;
- Lingual appliances.

The aims of this project are to point out:

1. The prevalence of adult patients attending orthodontic postgraduate clinic in the School of Dentistry University of Baghdad
2. The gender difference of the attending patients
3. The phenotype of the malocclusion of the attending patients
4. The orthodontic modalities utilized for the treatment of the those patients

Chapter one: Review of literature

1.1 Types of Malocclusion

A century ago, Edward Angle published his “Classification of Malocclusion” in 1899. As described by Angle, in Class I molar relation, the mesiobuccal cusp of upper first permanent molar occludes with mesiobuccal groove of the lower first permanent molar. The distobuccal cusp of upper first permanent molar occludes with the mesiobuccal groove of the lower first permanent molar in the Class II and, in a Class III molar relation, the lower first permanent molar lies mesial to upper first permanent molar by a premolar width or a cuspal width. The original classification had Class II as a full premolar width distoclusion and Class III as a full premolar-width mesioclusion. Assuming an average premolar width of 7.5 mm, then Class I ranged from 7 mm mesioclusion to 7 mm distoclusion, for a total range of Class I of 14 mm. This range was far too wide, and so in 1907, Angle revised his definition, making Class II more than half a cusp distoclusion and Class III more than half a cusp mesioclusion. That modification reduced the range from 14 mm to a 7 mm range. However, 7 mm is still too wide a range to act as a treatment goal if an orthodontist has to treat with precision (**Yadav et al., 2014**).

1.2 Indications for orthodontic treatment in adults

Adults seeking orthodontic treatment for several reasons. According to **Bagga (2015)**, summary of the indications for orthodontic treatment in adults may include the following:

- Addressing aesthetic and/or functional concerns;

- Re-treating previously failed orthodontic treatment;
- Adjunctive to periodontal, restorative or prosthetic rehabilitation;
- Combined orthodontic/surgical treatment;
- Treatment of snoring and obstructive sleep apnea (**Johal et al., 2005**).

1.3 Goals of adult orthodontic treatment

Extra treatment destinations are resolved to encourage what's more, improve adequacy of perio restorative treatment by:

- Improving axial inclination of teeth (to have adequate bone between roots for good vascular supply and good contact region)
- Achieving parallelism of abutment teeth (to limit tooth cutting and appropriately estimated substitution for creation of prosthesis)
- Most positive appropriation of abutment teeth (to get prosthesis)
- Uprighting and extrusion of posterior teeth with occlusal equilibration once in a while followed by endodontic treatment (to improve vertical crown-root proportion)
- Forced extrusion of those teeth which get damaged up to 33% of cervical line (to improve availability) (**Subhiksha, 2020**)

1.4 Considerations that may arise when treating adults

There are some considerations that may arise when treating adults as follows:

1- Relevant medical history

In general, the medical conditions that might affect orthodontic treatment are relatively few, although their prevalence is likely to increase with the age of the patient. Among these are pregnancy, diabetes mellitus,

juvenile idiopathic arthritis or Still's disease, renal problems and osteoporosis. The uses of certain drugs have a bearing on orthodontic treatment, for example, history of treatment with bisphosphonates and their associated side effects, especially with high dose and long period of intake **(Krieger et al., 2013)**.

2- Previous orthodontics

Teeth may have root resorption associated with previous orthodontic treatment. The rate of root resorption with repeat treatment is reported to double. The resorbed teeth need to be monitored carefully during treatment or the plan modified accordingly. Previous decalcification need not preclude further treatment assuming the dietary and oral hygiene problems have been addressed. However, close monitoring and daily sodium fluoride mouthwash would be advisable to prevent further decalcification **(Benson et al., 2005)**.

3- Psychological considerations

It is reported that nearly 50% of adult patients will be dissatisfied with the final outcome of orthodontic treatment. Body dysmorphic disorder is as common as 7.5% in adults; such patients may benefit from psychological counselling regarding their expectations before commencing any orthodontic treatment **(Hepburn and Cunningham, 2006)**.

4- Treatment motivation and co-operation

Treatment discontinuation has been shown to be age related, with a discontinuation rate of 20.2% in patients aged 10–14 years and 42.7% in patients older than 18 years, respectively. This may be explained by adults being self-determinant in comparison to adolescents who may have external

motivation from parents or a dental professional to continue their treatment **(Hayes, 2008)**.

5- Biological difference

Ageing is associated with decrease in the tissue's blood supply/cell turnover and may lead to slower tooth movement. This philosophy has been investigated in experimental and human studies **(Misawa Kageyama et al., 2007)**. A study using clear aligners, showed that orthodontic movement in males has more linear correlation with age than in females. Moreover, a lower risk of orthodontically induced iatrogenic root resorption is expected in a child or adolescent than adults. It is claimed that partially formed roots with open apices, as in the child or adolescent, may be less susceptible to orthodontic root resorption **(Chisari et al., 2014)**.

6- Growth modification appliances

Growth modification is not generally used in the adult patient for obvious reasons, although recent randomized controlled studies have suggested that the skeletal influence of functional appliances is limited. Moreover, the presence of growth during the orthodontic treatment of adolescents often enhances the dento-alveolar effect of the functional appliance, with faster overbite reduction, maxillary expansion, space closure, occlusal settling and even distalization of posterior teeth. A non-surgical attempt to address a Class II skeletal discrepancy found no dento-alveolar differences in the use of a Herbst appliance in the treatment of moderate skeletal II malocclusions between adults and teenagers. However, where there is a moderate to severe skeletal discrepancy and where the patient has concerns about facial aesthetics, the status either has to be accepted or treated surgically **(Tulloch et al., 2004; O'Brien et al., 2009)**.

7- The mid-palatal suture

The mid-palatal suture is essentially fused in adulthood and precludes any skeletal expansion of the maxillary arch without surgery, while rapid maxillary expansion (RME) in adolescents is normally achievable without surgically splitting the midline suture (**Baccetti et al., 2010**).

8- Periodontal considerations

Periodontal tissue destruction in adolescents is relatively mild and localized to certain teeth; there is, however, increasing loss of periodontal support with ageing. The periodontium is one of the factors involved in the equilibrium theory. Periodontal inflammation can cause destruction of the periodontal fibres and loss of alveolar bone. This then alters the equilibrium, leading to drifting, tilting or rotation of teeth.

As an adjunct to periodontal treatment, successful orthodontic treatment can provide a more easily cleansable dentition for the patient. Intrusion of teeth in conjunction with periodontal treatment has been shown to improve periodontal conditions. However, orthodontic treatment might further jeopardize the unstable and compromised periodontal condition.

A common clinical observation in many adults on completion of fixed appliance therapy is the presence of unsightly triangular spaces in the interproximal region of the maxillary or mandibular anterior teeth near the cervical constriction (**Zachrisson et al., 2004**). The prevalence in an average adult orthodontic population is about 38%, while the causes include poor tooth positioning, loss and apical migration of the gingivae, as well as more incisally positioned contact points. This can be addressed by:

- Offset bonding of the bracket
- Second order bends in the finishing archwire
- Interproximal enamel reduction
- Restorative camouflage
- A combination of the above (**Kurth and Kokich, 2001**).

As a general rule, the periodontal condition should be fully evaluated and recorded before treatment, and any periodontal disease should be controlled and stabilized before orthodontic intervention. On occasion, adjunctive periodontal treatment should be performed before orthodontic treatment; for example, a gingival graft may be performed where thin gingival biofilm might lead to gingival recession during orthodontic tooth movement. Additionally, optimal oral hygiene and regular periodontal monitoring during orthodontic treatment should be undertaken. As a method of ligation, the steel ligatures are considered more hygienic than elastics and one study, which looks at the bacterial load, favoured wire ligation and showed less bleeding on probing when compared to elastomeric ligation (**Türkkahraman et al., 2005**).

9- Restorative considerations

The presence of restorations may cause difficulty when placing an orthodontic appliance. It is possible to bond brackets to gold, amalgam or porcelain by sandblasting the surface of the restoration. In addition, bond strengths to porcelain may be increased by etching with 9.6% hydrofluoric acid or 1.23% acidulated phosphate fluoride gel, together with silane primers and highly filled composite resin. Alternatively, teeth can be temporarily

restored with composite, which makes bonding easier, or by simply using a band (Sebbar et al., 2015).

10- **Timing and Sequence of Treatment**

In the development of any orthodontic treatment plan, the first step is control of any active dental disease (Figure 1). Before any tooth movement, active caries and pulpal pathology must be eliminated by using extractions, restorative procedures, and pulpal or apical treatment as necessary. Endodontically treated teeth respond normally to orthodontic force, if all residual chronic inflammation has been eliminated. Before orthodontics, teeth should be restored with well-placed amalgams or composite resins. Restorations requiring detailed occlusal anatomy should not be placed until any adjunctive orthodontic treatment has been completed because the occlusion inevitably will be changed. This could necessitate remaking crowns, bridges, or removable partial dentures. Poorly controlled periodontal health can lead to rapid and irreversible breakdown of the periodontal support apparatus. Scaling, curettage (by open flap procedures, if necessary), and gingival grafts should be undertaken as appropriate. Surgical pocket elimination and osseous surgical procedures should be delayed until completion of the orthodontic phase of treatment because significant soft tissue and bony recontouring occurs during orthodontic tooth movement. Clinical studies have shown that orthodontic treatment of adults with both normal and compromised periodontal tissues can be completed without loss of attachment, if there is good periodontal therapy both initially and during tooth movement (Proffit and White, 2003).

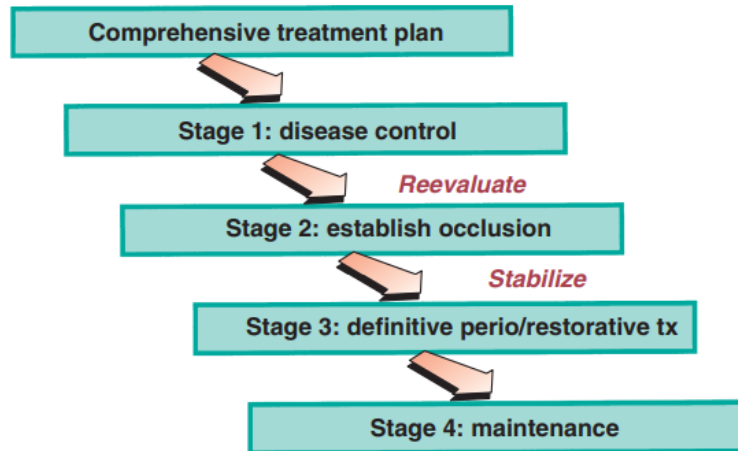


Figure 1: The sequence of steps in the treatment of patients requiring adjunctive orthodontics (Proffit, 2019)

During this preparatory phase, the patient's enthusiasm for treatment and ability to maintain good overall oral hygiene should be carefully monitored. Adjunctive orthodontics has the potential to do more harm than good in patients who cannot or will not maintain good oral hygiene. If disease can be controlled, however, adjunctive orthodontics can significantly improve the final restorative and periodontal procedures.

11- **Aesthetic considerations**

The use of ceramic brackets may overcome the problem of aesthetic concerns of the metallic appliances but have the potential for producing further problems. Other alternatives are lingual orthodontic appliances or clear aligners, although the latter have limitations on what they can achieve (Malik et al., 2013).

12- **Treatment mechanics**

The orthodontic forces used in the treatment of adult patients should be as low as possible with careful control of tooth movement. The loss of alveolar and periodontal support can result in teeth tipping easily, due to an altered moment-to-force ratio, and may reduce the anchorage value of

affected teeth. It is recommended (not evidence-based) to use thermo-elastic Nickel Titanium archwires in order to apply a gentle force to the periodontally compromised teeth (**Chung et al., 2009**).

Headgear is not favoured by adults for social reasons but it may be necessary to reinforce the anchorage by other means, such as palatal arches or TADs (**Chung et al., 2009**). The time required to wear Class II elastics is reported to be significantly longer in adults than adolescents who undergo similar orthodontic treatment to achieve the same effect (**Choo et al., 2011**).

In addition, space closure may respond more slowly in adults than in a growing patient, especially in the lower arch when the extraction is historical and the alveolus is ‘necked’. Some reports recommend surgical assisted space closure or an accelerated osteogenic orthodontics technique (**Wilcko et al., 2009**). However, it might be preferable to consider prosthetic replacement for larger spaces or restorative camouflage of a small space as an alternative to space closure (**Choo et al., 2011**).

1.5 New technologies in adult treatment

There have been several new advances, which have made a significant impact on adult orthodontic treatment. The introduction of digital three-dimensional treatment planning tools, application of skeletal anchorage devices and more importantly the advances in invisible treatment techniques such as aligner treatments and lingual orthodontics have made adult orthodontic treatment much more streamlined and accessible (**Tarraf, 2015**).

Most adults will have some pre-existing restorations in addition to various wear facets that resulted from functioning with a malocclusion for a long period of time. Others are actually referred for orthodontic treatment in order to facilitate restorative treatment. It is therefore important to communicate to

them why restorative treatment is required post orthodontic treatment to insure an aesthetic and functional result. In addition, it is important for the restoring dentists to communicate to the orthodontists the desired final tooth positions to facilitate the best restorative outcomes. A variety of new 3D planning tools can now aid clinicians in both interdisciplinary planning as well as in explaining treatment requirements to patients. Digital diagnostic setups are invaluable in predicting treatment outcomes and communicating to the patients why there will be a need to have restorative work after orthodontics for example in the presence of extensive wear (Figure 2). Not only does it allow the patient to understand the treatment but also enables them to budget appropriately for it. The digital set-ups also allow the orthodontist to evaluate the type of tooth movement required to achieve the desired results and thus makes them able to select appropriately between fixed lingual appliances and/or aligner treatments. It also makes it possible to assess whether additional temporary anchorage devices (TADs) will be needed (Figure 2).

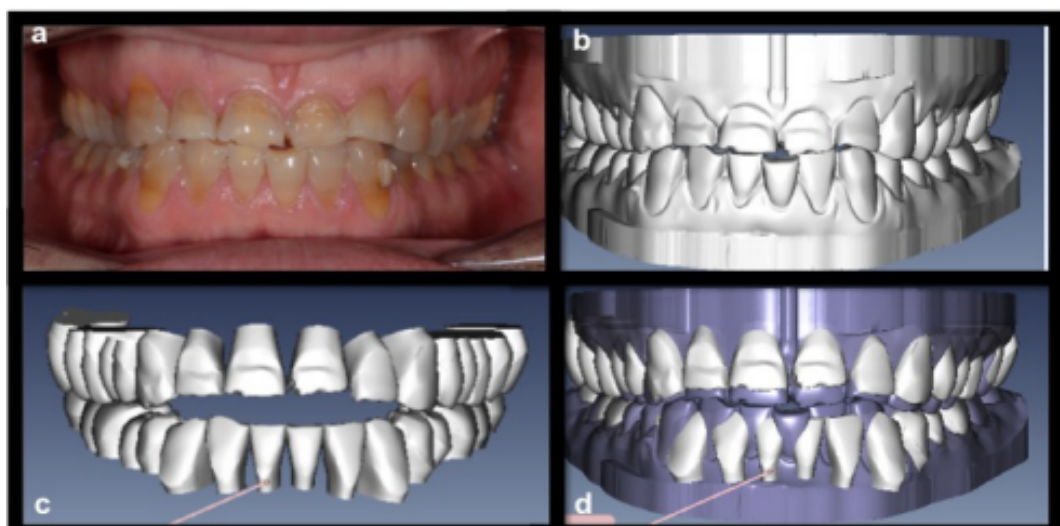


Figure 2: a) severely worn anterior teeth due to an edge to edge occlusion, b) digital malocclusion model, c) digital setup of tooth position required for restoration of lost tooth structure, d) digital model and setup superimposed to allow visualization of tooth movement required Images using TMP software (Tarraf, 2015).

Cope in 2007 defined them as: “(TAD) or a temporary anchorage device is a device that is temporarily fixed to bone for the purpose of enhancing orthodontic anchorage by supporting the teeth of the reactive unit or by obviating the need for the reactive unit altogether and which is subsequently removed after use”. The introduction of TADs (**Cope, 2007**) has made it possible to provide treatment for adults with no or minimal posterior anchorage with reliable outcomes (Figure 3). It has also allowed tooth movements which were not possible with conventional appliances such as predictable molar intrusion in cases where molars have over erupted into long standing extraction spaces (**Yao et al., 2005**).



Figure 3: a) Palatal TADs being used to control the anterior segment in a patient lacking sufficient posterior teeth, b) palatal TADs being used as anchorage to move a second molar mesially to substitute an extracted first molar (Tarraf, 2015).

But it is perhaps the introduction of invisible treatment options that have been the most significant factor in revolutionizing adult treatment. Even though it is a lot more acceptable for adults nowadays to be wearing “braces” most adult patients - if given the choice - will prefer an invisible treatment option. Today’s orthodontists have at the disposal two main appliance systems that will be considered invisible. Lingual fixed appliances and aligner treatments.

Lingual orthodontic appliances have been around since the late 1970s but their popularity decreased somewhat in the 1990s. There were many reasons

for that but technical difficulty and patient discomfort were some of the more commonly cited reasons. However, the technique remained popular in Japan and Europe and there has been a rapid worldwide resurgence in the use of lingual appliances in the last decade (Keim, 2012). This is mainly due to the introduction of a new generation of customized lingual appliances, which have overcome many of the limitations of previous generations by dramatically improving patient comfort and providing precision, predictability and versatility equivalent to that of labial appliances. For example, in the Incognito® system (3M-Unitek, Monrovia, Calif) laboratory technicians fabricate a digital setup model according to the orthodontist's prescription (Figure 4). Brackets and wires are CAD/CAM customized on a digital model of the patient's final setup prior to the beginning of treatment (Ludwig et al., 2012).

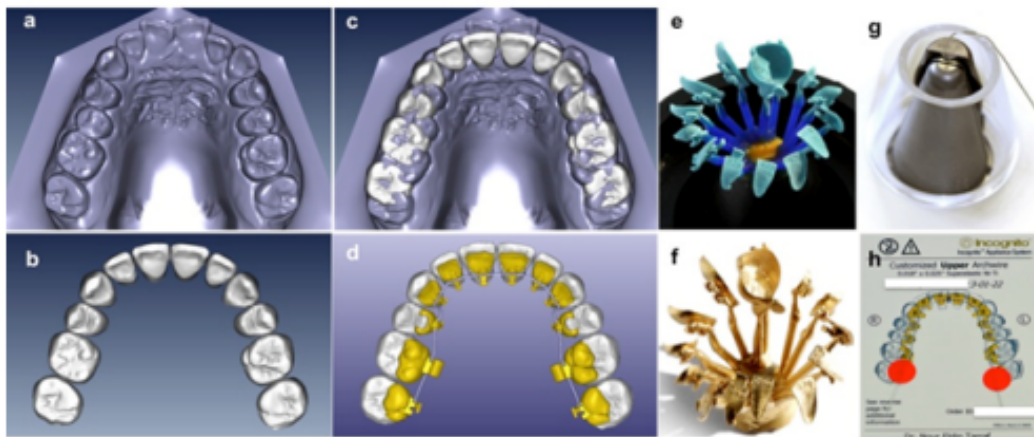


Figure 4: The steps in manufacturing of the customized lingual appliance Incognito® (3M-Unitek, Monrovia, Calif) a) digital malocclusion model, b) set-up model based on orthodontist's prescription, c) set-up model and malocclusion model superimposed allows visualization of the required tooth movement. d) Virtual brackets designed with customized virtual wire as close as possible to the tooth surface to minimize appliance profile. e) Brackets are printed in wax, f) brackets casted in gold, g) wire-bending robot manufacturing the custom wires, h) custom wire individual to the patient (Tarraf, 2015).

These models are used as a template to design virtual brackets and wires. The virtual brackets are then printed through a high-end 3D printer in wax and then cast in a hard gold alloy. The arch wires are then custom-formed by a wire-bending robot. By providing a casted appliance that is made to mimic the individual anatomy of the patient's lingual surfaces the profile of the appliances is greatly reduced and the robotically bent wires insure accurate expression of the prescription (Figure 5). This has made the appliance much more comfortable as well as very precise (**Grauer and Proffit, 2011**) as shown by recent studies. In addition, the Lingual appliances can now be used in combination with TADs, functional appliances and orthognathic surgery making them as versatile as labial fixed appliances (**Pauls, 2008; Wiechmann et al., 2008**). In addition, when compared to labial fixed appliances the Incognito® appliance (3M-Unitek, Monrovia, Calif) has been shown to cause less white spot lesions and enamel decalcification (**Vander Veen et al., 2010**).

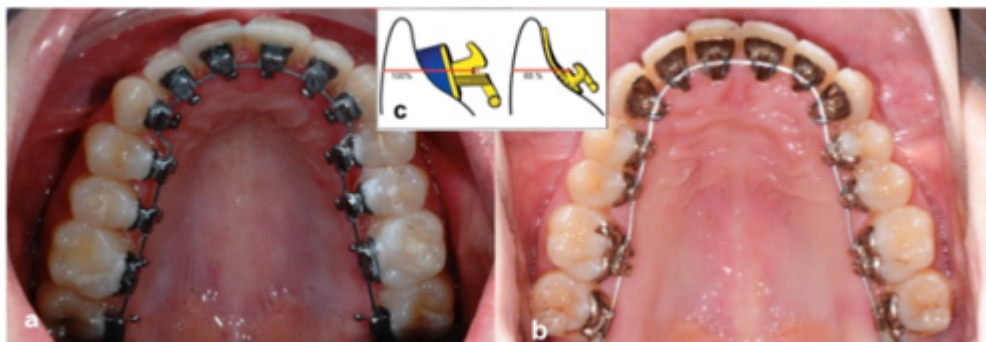


Figure 5: Comparison between a conventional lingual bracket with composite pads (Figure 5a) and casted custom made (Figure 5b) Incognito® appliance (3M-Unitek, Monrovia, Calif). c) The custom appliance is around 35% smaller in profile thus less obtrusive to the tongue (Tarraf, 2015).

Aligner treatment is the more widely used option for adult treatment with Invisalign® being the leading system in that field. Invisalign® introduced by Align Technology in 1997 was initially aimed at adult patients. The system

allows for digital laboratory set-ups to be prepared by laboratory technicians and then the orthodontists can review the set-up through the ClinCheck® software and make any necessary changes. Then a series of plastic aligners is manufactured to sequentially move the teeth to the desired position throughout the course of the treatment (**Vicens and Russo, 2010**).

Chapter two: Materials and methods

2.1 Sample

A cross-sectional study was done using the case sheets of patients attending Postgraduate Orthodontic Clinic at the College of Dentistry University of Baghdad, were collected randomly from Master and PhD degrees students. Case sheets of total 148 patients were surveyed to determine the frequency of adult patients seeking orthodontic treatment. Age and gender were extracted from the cases sheets. The type of malocclusion and the modalities utilized to treat these conditions were also tabulated. Inclusion criteria were:

- 1- Patients presenting with malocclusion requiring orthodontic treatment.
- 2- Young adults are aged 18 to 30 and old adults are >30 (**Whitesides et al., 2008; Vanessa et al., 2016**).
- 3- Patient were not previously undergoing orthodontic treatment
- 4- Patients were not previously undergone orthognathic surgery

2.2 Data Analysis

Data were processed using Microsoft excel (version 2021) Data were illustrated using the graphs (bar charts). Analyzing the percentage of females and males, young adults and old adults and percentages of adults to total participants were compared using Pie charts.

Chapter three: Results

The patients ages and genders were extracted and formulated in figures below

- 1. The frequency of adults seeking orthodontic treatment compared to total subjects:** Total patients were 148 of which 64 (43%) were younger than 18 and adults were 84 (57%)

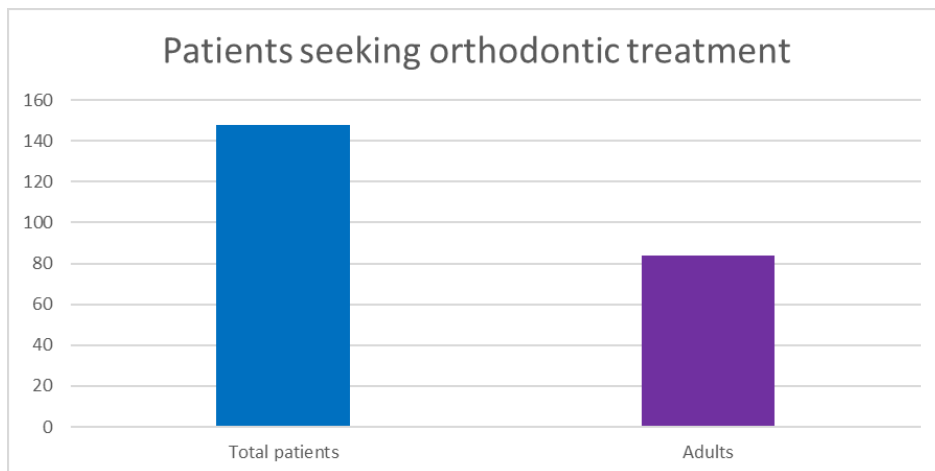


Figure 6: frequency of adults seeking orthodontic treatment

- 2. Frequency of visits of males seeking orthodontic treatment compared to females:** out of 84 subjects, 56 (66.6%) were females and 28 (33.3%) were males

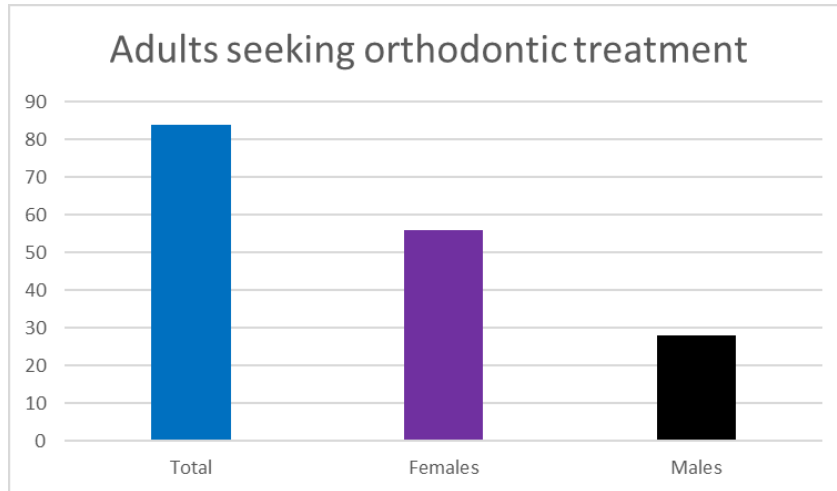


Figure 7: Frequency of males and females seeking orthodontic treatment

3. Frequency of young adults to old adults was compared: 82 subjects (97.6%) were young adults and 2 subjects (2.4%) were old adults

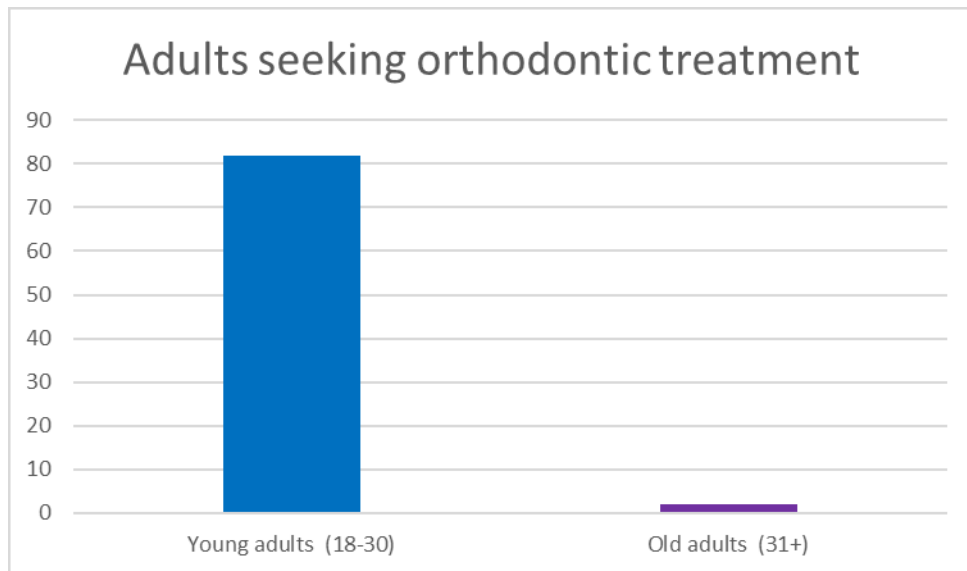


Figure 8: Frequency of young and old adults seeking treatment

4. Type of the malocclusion of the attending adult patients: 52 patients (62%) had Class I , However, 28 (33.3%) patients were with Class II (24 patients Class II div1 and 4 with Class II div2) and only 4 patients (4.7%) with Class III malocclusion.

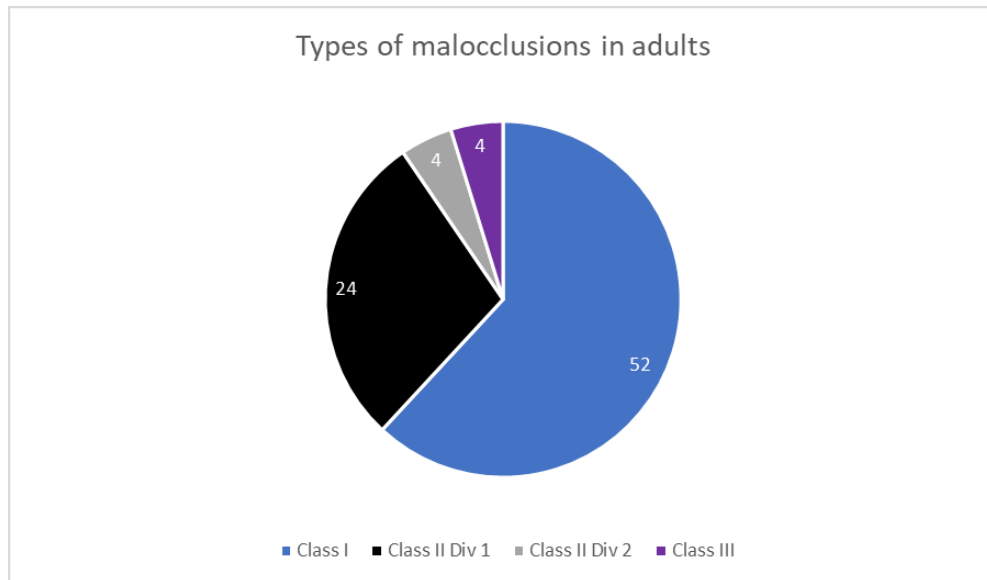


Figure 9: Type of malocclusions the patients were suffering from

5. Orthodontic modalities used for the treatment: All patients (82) were treated with metal fixed orthodontic appliance.

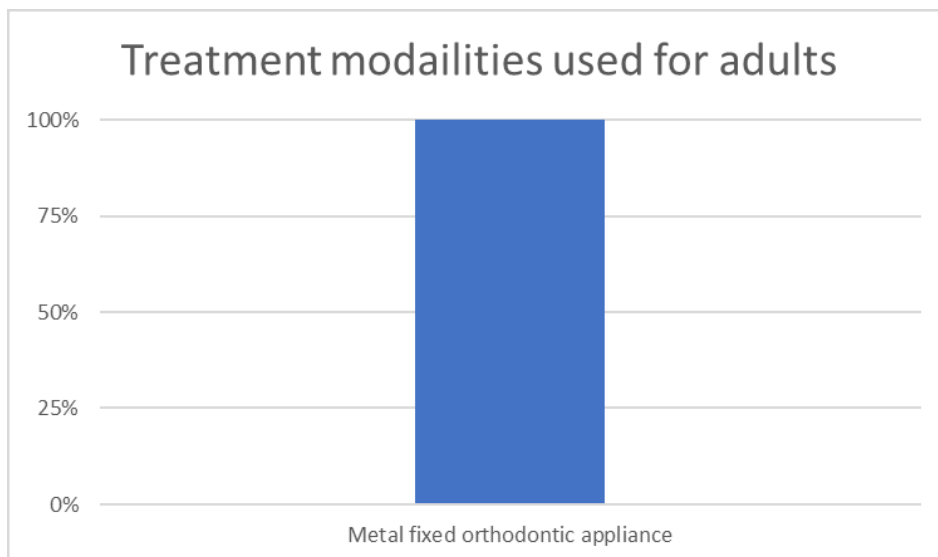


Figure 10: Orthodontic modalities used for treatment

Chapter four: Discussion

The increase in demand for orthodontic treatment in adults is justified, especially by the increasing preventive perspective of modern dentistry, esthetic appeal of society, longevity, increased access to information, technological advances of orthodontics, and psychosocial variations (**Pabari et al., 2011; Barbosa et al., 2012; Kolawole et al., 2012**). Moreover, the perception of malocclusion differs between professionals and patients (**Sardenberg et al., 2011**). Some people with severe malocclusion do not report a negative impact, while others with mild irregularities cited major impacts on their quality of life (**Palomares et al., 2011**). Esthetic reasons alone justify treatment, not only because it almost always results in a better patient self-image (**Sardenberg et al., 2011**), but also because patients value esthetic and psychological benefits more than functional and dental health improvements (**Liu et al., 2009**).

Women are more concerned with beauty and have a better perception of treatment need as well as esthetic results (**Gazit-Rappaport et al., 2010; Barbosa et al., 2012; de Souza et al., 2013**). This fact explains why, even in random samples such as in our study, there is a prevalence of females (**Gazit-Rappaport et al., 2010; Pabari et al., 2011**).

In this study, it was found, by assessing the case sheets that young adults seek for orthodontic treatment more than old adults and adults represented (51.3%) of total patients attending orthodontic clinic this is in accordance to many studies that demonstrate that there is an increase in demand for adult orthodontics (**Barbosa et al., 2012; Kolawole et al., 2012**).

The types of malocclusions are consistent with that of general population as a recent cross-sectional study found that most common malocclusion were angle's Class I (49.4%). Followed by angle's class II (42.5%) then angle's

Class III was the least prevalent among them which is (8%) (**Mohammad et al., 2022**).

In growing adolescents, many malocclusion traits are corrected by attempting to influence physiological growth with orthopedic appliances. Adult patients do not exhibit growth potential, and they are thus treated with other fixed appliances, which usually focus on dentoalveolar compensation. (**Abbing et al., 2020**)

Chapter five: Conclusions and Suggestions

There is an increasingly tendency nowadays for adult patients to seek orthodontic treatment, especially those needing oral rehabilitation. Esthetics are important in people's lives, and facial appearance has a profound influence on personal attractiveness and self-esteem because it affects health and reverberates in social, affective, and professional relationships.

Adult treatment demands an interdisciplinary approach, since periodontal disease increases with age and tooth and bone loss cause migration of teeth and malocclusion. Treatment time is one of the main concerns of adult patients, solving patient's complains with an individualized approach to reduce treatment time, should be the focus of orthodontic treatment.

We concluded that young adults have much higher demand for orthodontic treatment compared to old adults and females represent the majority of the adults because of their esthetics concerns.

References

1. Abbing, Bahare RS, Ganguly S, Choowongkomon K, Seetaha S. Synthesis, HIV-1 RT inhibitory, antibacterial, antifungal and binding mode studies of some novel N-substituted 5-benzylidene-2, 4-thiazolidinediones. *DARU Journal of Pharmaceutical Sciences*. 2015 Dec;23(1):1-5.
2. Almuzian M, Gardner A. Adult orthodontics part 1: special considerations in treatment. *Orthodontic Update*. 2014 Jul 2;7(3):89-92.
3. Almuzian, Mohammed. Adult Orthodontics Part 2: Advances in Treatment. *orthodontic update*. 7. 10.12968/ortu.2014.7.4.114.
4. Baccetti T, Franchi L, Cameron CG, McNamara Jr JA. Treatment timing for rapid maxillary expansion. *The Angle Orthodontist*. 2001 Oct;71(5):343-50.
5. Bagga DK. Adult orthodontics versus adolescent orthodontics: an overview. *J Oral Health Comm Dent*. 2010;4(2):42-7.
6. Barbosa VS, Bossolan APC, Casati MZ, Nociti JFH, Sallum EA, Silvério KG. Clinical considerations for orthodontic treatment in periodontal patients. *PerioNews*. 2012;6:635–641.
7. Benson PE, Shah AA, Millett DT, Dyer F, Parkin N, Vine RS. Fluorides, orthodontics and demineralization: a systematic review. *Journal of orthodontics*. 2005 Jun;32(2):102-14.
8. Chisari JR, McGorray SP, Nair M, Wheeler TT. Variables affecting orthodontic tooth movement with clear aligners. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2014 Apr 1;145(4):S82-91.

9. Choo H, Heo HA, Yoon HJ, Chung KR, Kim SH. Treatment outcome analysis of speedy surgical orthodontics for adults with maxillary protrusion. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2011 Dec 1;140(6):e251-62.
10. Chung KR, Kim SH, Lee BS. Speedy surgical-orthodontic treatment with temporary anchorage devices as an alternative to orthognathic surgery. *American journal of orthodontics and dentofacial orthopedics*. 2009 Jun 1;135(6):787-98.
11. Cope JB. *OrthoTADs: The clinical guide and atlas*. Under Dog Media; 2007.
12. de Couto Nascimento V, de Castro Ferreira Conti AC, de Almeida Cardoso M, Valarelli DP, de Almeida-Pedrin RR. Impact of orthodontic treatment on self-esteem and quality of life of adult patients requiring oral rehabilitation. *The Angle Orthodontist*. 2016 Sep;86(5):839-45.
13. de Souza RA, de Oliveira AF, Pinheiro SM, Cardoso JP, Magnani MB. Expectations of orthodontic treatment in adults: the conduct in orthodontist/patient relationship. *Dent Press J Orthod*. 2013;18:88–94.
14. Gazit-Rappaport T, Haisraeli-Shalish M, Gazit E. Psychosocial reward of orthodontic treatment in adult patients. *Eur J Orthod*. 2010;32:441–446.
15. Grauer D, Proffit WR. Accuracy in tooth positioning with a fully customized lingual orthodontic appliance. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2011 Sep 1;140(3):433-43.
16. Hayes JL. Economic and ethics of two-phase treatment. *Journal of clinical orthodontics: JCO*. 2008 Jul 1;42(7):393-4.
17. Hepburn S, Cunningham S. Body dysmorphic disorder in adult orthodontic patients. *American journal of orthodontics and dentofacial orthopedics*. 2006 Nov 1;130(5):569-74.

18. Johal A, Arya D, Winchester LJ, Venn PJ, Brooks H. The effect of a mandibular advancement splint in subjects with sleep-related breathing disorders. *British dental journal*. 2005 Nov;199(9):591-6.
19. Keim RG The resurgence of lingual orthodontics. *J Clin Orthod* 46:197- 198. 2012.
20. Kolawole KA, Ayeni OO, Osiatuma VI. Evaluation of self-perceived dental aesthetics and orthodontic treatment need among young adults. *Archives of Oral Research*. 2012 Nov 28;8(2).
21. Krieger E, Jacobs C, Walter C, Wehrbein H. Current state of orthodontic patients under bisphosphonate therapy. *Head & Face Medicine*. 2013 Dec;9(1):1-6.
22. Kurth JR, Kokich VG. Open gingival embrasures after orthodontic treatment in adults: prevalence and etiology. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2001 Aug 1;120(2):116-23.
23. Liu Z, McGrath C, Hägg U. The impact of malocclusion/orthodontic treatment need on the quality of life: a systematic review. *The Angle Orthodontist*. 2009 May;79(3):585-91.
24. Ludwig B, Alexander JC, Cacciafesta V Lingual orthodontics. Part 1. 2012 *J Clin Orthod* 46: 203-217.
25. Malik OH, McMullin A, Waring DT. Invisible orthodontics part 1: invisalign. *Dental update*. 2013 Apr 2;40(3):203-15.
26. Misawa Kageyama Y, Kageyama T, Moriyama K, Kurihara S, Yagasaki H, Deguchi T, Ozawa H, Sahara N. Histomorphometric study on the effects of age on orthodontic tooth movement and alveolar bone turnover in rats. *European journal of oral sciences*. 2007 Apr;115(2):124-30.
27. Mohammad BH, Abdul Jabbar MF, Mohammed MH. Prevalence of angle's classification of malocclusion among patients Attending

- Orthodontic Department in College of Dentistry retrospective cross sectional study. *Erbil Dental Journal (EDJ)*. 2021;4(2):111-7.
- 28.O'Brien K, Wright J, Conboy F, Appelbe P, Davies L, Connolly I, Mitchell L, Littlewood S, Mandall N, Lewis D, Sandler J. Early treatment for Class II Division 1 malocclusion with the Twin-block appliance: a multi-center, randomized, controlled trial. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2009 May 1;135(5):573-9.
- 29.Pabari S, Moles DR, Cunningham SJ. Assessment of motivation and psychological characteristics of adult orthodontic patients. *Am J Orthod Dentofacial Orthop*. 2011;140:e263–e272.
- 30.Palomares NB, Celeste RK, de Oliveira BH, Miguel JA. How does orthodontic treatment affect young adults' oral health-related quality of life?. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012 Jun 1;141(6):751-8.
- 31.Park HS. A miniscrew-assisted transpalatal arch for use in lingual orthodontics. *Journal of Clinical Orthodontics: JCO*. 2006 Jan 1;40(1):12-6.
- 32.Pauls HJ. Lingual orthodontics with orthognathic surgery in a severe class II, division 2 case. *Journal of Orofacial Orthopedics/Fortschritte der Kieferorthopädie*. 2008 Mar;69(2):135-45.
- 33.Proffit WR, Fields HW, Sarver DM. *Contemporary orthodontics* 4th ed. Philadelphia: Mosby. 1999.
- 34.Proffit WR, White RP, Sarver DM. *Contemporary treatment of dentofacial deformity*. St. Louis: Mosby; 2003 Jan 1.
- 35.Salonen L, Mohlin B, Goetzlinger B, Helldén L. Need and demand for orthodontic treatment in an adult Swedish population. *Eur J Orthod* 1992; 14(5): 359–368

36. Sardenberg F, Oliveira AC, Paiva SM, Auad SM, Vale MP. Validity and reliability of the Brazilian version of the psychosocial impact of dental aesthetics questionnaire. *Eur J Orthod.* 2011;33:270–275.
37. Sebbar M, Fatene N, El Mabrak A, Laslami N, Abidine Z, Bentahar Z. Specificities of Adult Orthodontics. In *Issues in Contemporary Orthodontics 2015 Sep 3.* IntechOpen.
38. Subhiksha KC. Limitations of adult orthodontics-a review. *European Journal of Molecular & Clinical Medicine.* 2020;7(4):2020.
39. Tarraf NE. The Adult Orthodontic Patient: More Options than Ever Before!. *Dentistry.* 2015 Jan 1;5(2):1.
40. Tulloch JC, Proffit WR, Phillips C. Outcomes in a 2-phase randomized clinical trial of early Class II treatment. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2004 Jun 1;125(6):657-67.
41. Türkkahraman H, Sayın M, Bozkurt FY, Yetkin Z, Kaya S, Önal S. Archwire ligation techniques, microbial colonization, and periodontal status in orthodontically treated patients. *The Angle Orthodontist.* 2005 Mar;75(2):231-6.
42. Van Der Veen MH, Attin R, Schwestka Polly R, Wiechmann D. Caries outcomes after orthodontic treatment with fixed appliances: do lingual brackets make a difference?. *European Journal of Oral Sciences.* 2010 Jun;118(3):298-303.
43. Vanarsdall RL, Musich DR. Adult orthodontics: diagnosis and treatment. *Orthodontics: current principles and techniques.* St. Louis: CV Mosby. 1985:791.
44. Vicéns J, Russo A. Comparative use of invisalign® by orthodontists and general practitioners. *Angle Orthodontist.* 2010 May;80(3):425-34.
45. Whitesides J, Pajewski NM, Bradley TG, Iacopino AM, Okunseri C. Socio-demographics of adult orthodontic visits in the United States.

- American Journal of Orthodontics and Dentofacial Orthopedics. 2008 Apr 1;133(4):489-e9.
46. Wiechmann D, Schwestka-Polly R, Hohoff A. Herbst appliance in lingual orthodontics. American journal of orthodontics and dentofacial orthopedics. 2008 Sep 1;134(3):439-46.
47. Wilcko MT, Wilcko WM, Pulver JJ, Bissada NF, Bouquot JE. Accelerated osteogenic orthodontics technique: a 1-stage surgically facilitated rapid orthodontic technique with alveolar augmentation. Journal of oral and maxillofacial surgery. 2009 Oct 1;67(10):2149-59.
48. Yadav D, Rani MS, Shailaja AM, Anand D, Sood N, Gothi R. Angle's molar classification revisited. Journal of Indian Orthodontic Society. 2014 Oct;48(4_suppl2):382-7.
49. Yao CC, Lee JJ, Chen HY, Chang ZC, Chang HF, Chen YJ. Maxillary molar intrusion with fixed appliances and mini-implant anchorage studied in three dimensions. The Angle Orthodontist. 2005 Sep;75(5):754-60.
50. Zachrisson BU. Interdental papilla reconstruction in adult orthodontics. World J Orthod. 2004 Jan 1;5(1):67-73.