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Ministry of Higher Education
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University of Baghdad
College of Dentistry

IATROGENIC EFFECT OF ORTHODONTIC APPLIANCES

A project submitted to the Scientific Committee of the Department of Orthodontic, College of Dentistry /University of Baghdad, in partial fulfillment of requirements for the BDS Degree

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سُورَةُ العَلَقِ
بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ
اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ﴿١﴾ خَلَقَ الْإِنسَانَ مِنْ عَلَقٍ ﴿٢﴾ اقْرَأْ
وَرَبُّكَ الْأَكْرَمُ ﴿٣﴾ الَّذِي عَلَّمَ بِالْقَلَمِ ﴿٤﴾ عَلَّمَ الْإِنسَانَ
مَا لَمْ يَعْلَمْ ﴿٥﴾ كَلَّا إِنَّ الْإِنسَانَ لَيَطْغَىٰ ﴿٦﴾ أَن رَّآهُ اسْتَغْنَىٰ
﴿٧﴾ إِنَّ إِلَىٰ رَبِّكَ الرُّجْعَىٰ ﴿٨﴾

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INTRODUCTION:

The advantages that orthodontic treatment offers should outweigh the risks any possible damage it may cause. It is important to assess the risks of treatment as well as the benefits and balance these aspects of treatment before deciding to treat a malocclusion. Patient selection plays an important role in minimising risks of treatment and the clinician should assess every aspect of the patient and their malocclusion. However, clinically there are a number of areas of concern for risk management. These are discussed in detail under the broad categories of intra-oral, extra-oral and systemic risks.

Orthodontics can cause damage to hard and soft tissues. For the purpose of this review, iatrogenic effects have been classified as intra-oral and extra-oral effects. Intra -oral effects can be divided into risks affecting teeth, periodontium, and soft tissues. Extra-oral effects commonly involve TMJD, allergies and burns to the face and neck area from chemical agents used during bonding an orthodontic appliance. Common as well as less common risks are discussed here with suggestions on how to minimise these risks and avoid them. Root resorption is a common complication during orthodontic treatment but there is some evidence that once appliances are removed this resorption stops. Soft tissue damage includes that caused by archwires but there is also potential for headgears to cause injury to the eyes. Damage to the pulp as well as enamel has been reported during orthodontic treatment. Although rare, allergy to the nickel in fixed appliances has been found.

Types of 0rthodontic appliances :

1:fixed appliance

2:removable appliance

3:combined:fixed and removable

The side-effects of orthodontic appliance can be:

1. Intra oral (inside the mouth)
2. Extra oral (outside the mouth)
3. Systemic (the whole body)

1:INTRA-ORAL EFFECTS:

1.1:Effects on the teeth

1.2:Effects on the periodontium (gum tissues)

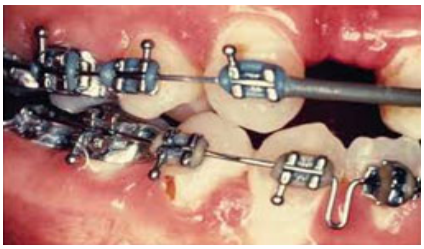
1.3:Effects on the soft tissues

1.1:Effects on the teeth

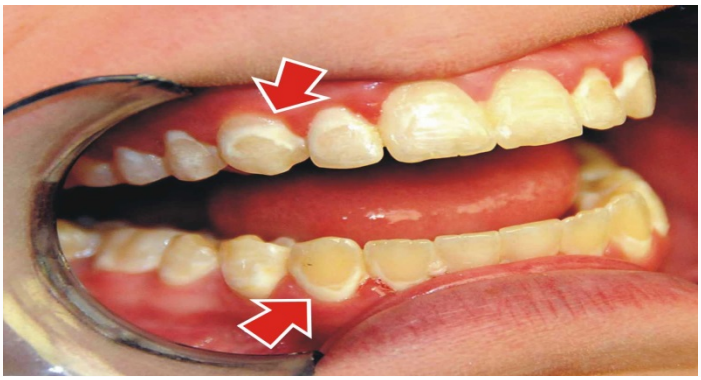
a. Crowns:
    1. Decalcification
    2. Enamel trauma
    3. Enamel wear and erosion

1:Decalcification and caries associated with orthodontic treatment:

15 year old patient presents for follow-up. Upon examination: generalized anterior decalcification is diagnosed. Patient reports he had not brushed his teeth for at least 2 weeks.



Decalcification of enamel (white spots) is a common adverse effect of orthodontic treatment. Decalcification is considered to be the first step toward cavitation. Decalcification of enamel occurs in 50% of orthodontic patients and the most affected teeth are the maxillary incisors[(1)]. Additionally, these lesions can develop within four weeks, which is the typical time span for orthodontic follow-up[(2)].teeth most commonly affected are maxillary lateral incisors, maxillary canines and mandibular premolars[(3)]. However, any tooth in the mouth can be affected,



. **Decalcification on labial surfaces of numerous teeth**

Cavitation at the gingival margin of the lower right canine and first premolar requiring restoration

Gorelick *et al*[4], in a study on white spot formation in children treated with fixed appliances, found that half of their patients had at least one white spot after treatment, most commonly on maxillary lateral incisors. The length of treatment did not affect the incidence or number of white spot formations, although O'Reilly and Featherstone[5]. and Oggard *et al* [6] found that demineralization can occur rapidly, within the first month of fixed appliance treatment. This has obvious

aesthetic implications and highlights the need for caries rate assessment at the beginning of treatment. Interestingly, Gorelick *et al* [(4)] *found* no incidence of white spot formation associated with lingual bonded retainers, which would suggest salivary buffering capacity, and flow rate have a role in protection against acid attack.

The dominant hand may also influence the area of decalcification as brushing is more difficult on the side of the dominant hand. Whilst good oral hygiene is vital, dietary control of sugar intake is also needed in order to minimize the risk of decalcification. Fluoride mouthwashes used throughout treatment can prevent white spot formation[7]surprisingly, compliance with this is low (13%). Other fluoride release mechanisms include fluorid releasing bonding agents, elastic ligatures containing fluoride, and depot devices on upper molar bands[(8)].

The prevention:

- ✓ Through brushing of the teeth with fluoridated tooth paste.
- ✓ Daily rinsing with a 0.02% or 0.05% sodium fluoride solution can also minimize decalcification of enamel.
- ✓ Fluoridated solutions may delay the progression of lesions
- ✓ Application of fluoride varnish twice a year or a combination of antibacterial and fluoride varnish may reduce the incidence of decalcification .

2:Enamel Trauma:

One of the risks of orthodontic treatment with fixed appliances is damage to enamel which can be caused by the following:

1. Debonding burs to remove the composite
2. Careless use of band seater [(9)]
3. Ceramic brackets on lower teeth can cause abrasion to upper teeth[10]. It is recommended to use stainless steel brackets on the lower teeth to avoid abrasion of the upper incisors caused by ceramic brackets[12]
4. Stainless steel brackets on lower 3s can damage upper 3s cusps during canine retraction[(11)]

5. Ceramic brackets bond strongly to enamel which can cause damage to enamel on debond[9]

The ideal method for debonding metal brackets is to apply a force that peels the bracket base from the enamel surface without damaging the enamel. A good debonding technique is to squeeze the bracket at the base so that the bracket comes off leaving some residual composite at the enamel surface, which can be cleaned up later with a carbide debonding bur. The cleaning procedure may be time consuming, but it is better than encountering the risk of enamel cracks and fractures

Debonding ceramic brackets is comparatively more complex, due to the higher bond strength as a result of both mechanical and chemical retention of the bracket base to the tooth which is likely to cause enamel fractures. Mechanical debonding involves gripping the enamel - adhesive interface with sharp edged plier blades and applying a controlled slow force until the bracket is removed.

Debonding bracket can provide stagnation areas for the development of caries, cause partial tooth fracture, or may cause unaesthetic discoloration. Higher prevalence of cracks in debonded teeth is found compared to untreated teeth[12]. This can be a avoided to a large extent by adhering to a proper debonding technique. diamond burs are not advisable for cleanup because they usually leave a rough surface, which is not easily removed by polishing, resulting in increased plaque retention.

3) Enamel wear and erosion:

This can occur when cusp tips occlude against metal or ceramic brackets – this leads to wear of the cusp tip, and is most often associated with upper canine cusp tips; moreover, the incisal edges of upper anterior teeth and buccal cusps of posterior teeth are most often implicated. Ceramic brackets are very abrasive and are therefore not recommended for lower anterior bracketing. Erosion is also a risk factor during orthodontic treatment; therefore, dietary instructions should be part of the instructions given to patients: for example, carbonated beverages and pure juices are associated with tooth erosion and should be avoided in patients with fixed appliance

Upper canine tip showing abrasion from the lower canine metal bracket

B:PULP:

Pulpal changes during orthodontic treatment:

Some degree of pulpitis is expected with orthodontic tooth movement which is usually reversible or transient. Rarely it leads to loss of vitality.Light forces are advocated with traumatised teeth as well as baseline monitoring of vitality which should be repeated three monthly. Transient pulpitis may also be seen with electrothermal debonding of ceramic brackets and composite removal at debond with slow-speed handpieces .

Prevention:

1.Monitor base-line vitality of the teeth every three months

2.Monitor previously root-canal-treated teeth with radiographs

3.Keep forces light

4. Do not overheat teeth when removing composite

C:ROOTS

Root resorption:

Some degree of external root resorption is inevitably associated with fixed appliance treatment, although the extent is unpredictable[-] Resorption may occur on the apical and lateral surface of the roots, but radiographs only show apical resorption to a certain degree. Many cases will not show any clinically significant resorption but, microscopic changes are likely to have occurred on surfaces which are not visualised with routine radiographs. Resorption however rarely compromises the longevity of the teeth.

The mechanism of tooth resorption is unclear. Theories include excessive force and hyalinization of the periodontal ligament resulting in excessive cementoclast and osteoclast activity. The risk factors which are associated with cases with severe resorption. These can be summarised as:

1:Blunt and pipette shaped roots show a greater amount of resorption than other root forms.

2:Short roots are more at risk of resorption than average length roots.

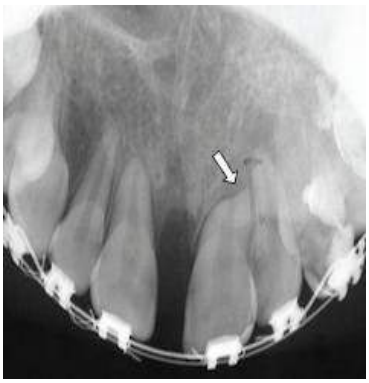
3:Teeth previously traumatised, have an increased risk of further resorption.

4:Non vital teeth and root treated teeth have an increased risk of resorption.

5:Heavy forces are associated with resorption, as well as the use of rectangular wires, Class II traction, the distance a tooth is moved and the type of tooth movement undertaken**.**

Treatment of ectopic canines may induce resorption of the adjacent teeth because of the length of treatment time and the distance the canine is moved. Tooth intrusion is also associated with increased risk as well as movement of root apices against cortical bone. Above the age of 11 years the risk of resorption with treatment seems to increase. Adults have shorter roots at the outset and the potential for resorption is increased.

Opinion is divided on whether treatment length is associated with increased resorption. Some find no correlation with treatment time, whereas others find that there is increased resorption with increased treatment time. In a few patients systemic causes may contribute, for example hyperthyroidism, but for the most part no underlying cause is isolated other than individual susceptibility. Familial risk is also known.Awide range in the degree of resorption is seen, highlighting the role of individual susceptibility over and above the risk factors identified., and patients should be warned at the outset of treatment that such a risk exists. Recognition of specific risk factors, accurate radiographs and interpretation of radiographs at the outset of treatment are important if root resorption is to be minimized. Once resorption is recognized clinically during treatment, light forces must be used, root length monitored six monthly with radiographs and treatment aims reconsidered to maximise the longevity of the dentition[13][14].



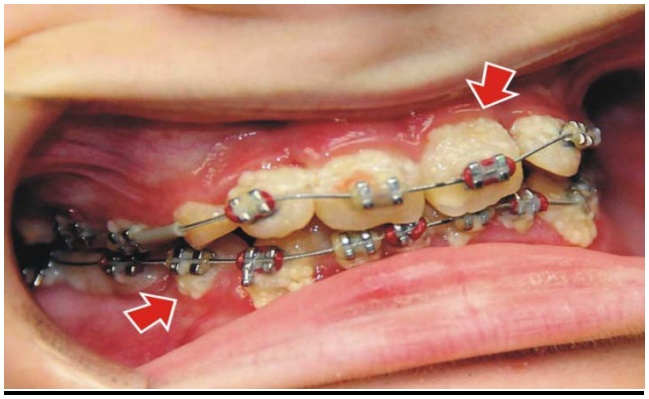
1.2:Effects on the periodontium (gum tissues):

Plaque retention is increased with fixed 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 periopathogenic. Periodontal disease includes gingivitis, alveolar bone loss (periodontitis), and loss of attached gingival support[15]. The periodontal reaction toward orthodontic appliances depends on multiple factors, such as host resistance, the presence of systemic conditions, and the amount and composition of dental plaque. Lifestyle factors, including smoking, can also compromise periodontal support.Additionally, the negative effects of uncontrolled diabetes on periodontal support are well

established[16].Orthodontic treatment in uncontrolled diabetic individuals is contraindicated.

Bacteria present in dental plaque are the primary causative agent of periodontal disease[17]. Orthodontic treatment with fixed appliances is known to induce an increase in the volume of dental plaque. However, fixed orthodontic appliances cause a shift in the type of bacteria [18]. Therefore, fixed orthodontic treatment may result in localized gingivitis, which rarely progresses to periodontitis[19].

The factor that determines the condition of the periodontium during orthodontic treatment is the level of oral hygiene. Therefore, oral hygiene instructions should be given before the initiation of orthodontic treatment and reinforced during every visit. Regularly brushing the teeth is the first line of defense in controlling dental plaque. The use of electrical and ultrasonic tooth brushes has been shown to be superior to manual brushing in controlling bacterial plaque on the buccal surfaces and reducing gingival inflammation[20]. The use of an interproximal brush in addition to the orthodontic brush is necessary[21]. The fluoride concentration in the toothpaste used for brushing should not be less than 0.1%. The use of toothpaste with stannous fluoride produced a higher inhibitory effect on dental plaque and gingivitis development[22]. The use of fluoride and chlorohexidine varnishes reduces the levels of bacterial plaque[23].Orthodontic treatment of patients with active periodontal disease is contraindicated as the risk for further periodontal breakdown is markedly increased[24]. Complete evaluation of the periodontal status, especially in adult patients, is required and control of the periodontal status is necessary prior to initiation of orthodontic treatment.



Chronic lack of oral hygiene showing accumulation of plaque gingivally and around the brackets

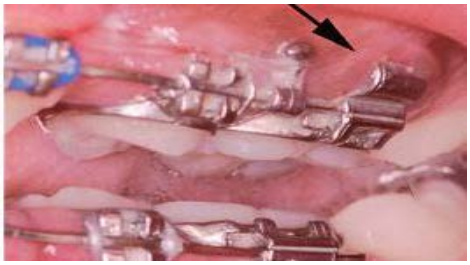
a:Gingivitis

Plaque can irritate the gingivae and cause them to swell and bleed when brushing. Removing plaque thoroughly every day will prevent this.Orthodontic molar bands are found to cause more gingival inflammation and hyperplasia than molar tube.

Gingivitis

b:Periodontitis:

Nearly all orthodontic patients will get gingivitis which will rarely progress to attachment loss. A referral to a specialist periodontist for clinical and radiographic examination is important. Regular periodontal examination should be carried out if there is attachment loss



Severe Gingivitis from poor OH

Gingival Recession following orthodontics

The patient's role in oral hygiene during orthodontic treatment:

A high standard of oral hygiene is essential for all patients undergoing orthodontic treatment. The Orthodontist has an obligation to advise the patient about methods of plaque control and, at routine visits, to monitor the effectiveness of the oral hygiene regime[25].

All Orthodontists should give oral hygiene instructions including Tooth-brushing and Flossing, Dietary advice, Fluoride mouth-rinses.

Although many Orthodontists promote appropriate oral hygiene measures, the efficacy is largely determined by the patient's motivation.

The correct method of holding the tooth-brush

1.3:Effects on the soft tissues:

The most common risk of orthodontic treatment is soft tissue damage[25]. Mucosal trauma is fairly common during the orthodontic treatment and can be caused by many factors including ulceration by the brackets and the protruding archwires near the molar region, chemical burns from the acid-etchant and clumsy instrumentation

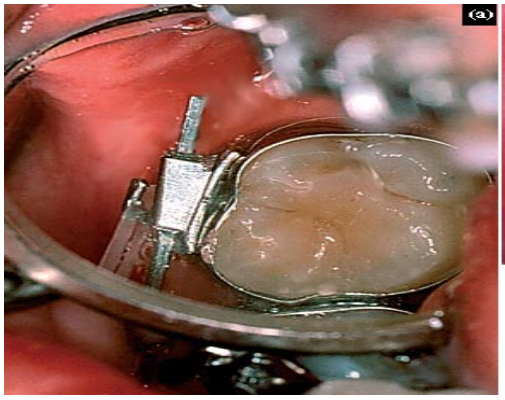


long span of archwire

a.Trauma from appliance:

Lacerations and trauma to the gingiva and oral mucosa may often occur during the course of orthodontic treatment due to rubbing of the lips and cheeks on the archwire, brackets, bands and hooks, especially where long unsupported stretches of wire rest against the lips[26] The oral mucosa quickly keratinises and gets accustomed to the new appliance relatively fast and the use of dental wax over the bracket and rubber tubing on the unsupported archwire may serve to reduce the initial trauma and discomfort.

Occasionally, palatal or lingual arches may cause trauma to the palate or tongue. This can be avoided by taking proper care during their fabrication, ensuring that there are no sharp margins in the fabricated appliance. Care must be taken to ensure that the distal ends of the archwire are cut off flush with the molar tube or cinched toward the tooth to avoid mucosal trauma.



Prevention:

1:Cinch archwires or trim flash with the distal tubes[26]

2:Give the patient wax to use on the appliance where it's rubbing against the mucosa

3:Full care instructions

4:Sleeving arch wire in long spans

Using wax on the brackets for patient's comfort

b:Allergy:

Allergy to orthodontic components intra-orally is exceedingly rare.Nickel present in orthodontic appliances like brackets, bands, and archwires is responsible for causing allergic reactions in some patients[27].Latex present in gloves, elastics, and elastomeric ligatures may also cause reactions in a few patients allergic to latex. The reactions might range from ulceration, erythematous lesions, or even anaphylactic shock, depending on the extent of hypersensitivity.

Management: once suspected, the patient should be referred for allergic reactions investigations (patch test).

C:Burns:

soft tissues acid burn from etch can happen. Careful handling during the use of etch can prevent such incidents

burns from etching

Pain associated with orthodontic treatment:

Pain and discomfort is a common adverse effect associated with orthodontic treatment[28].Previous studies have shown that 70–95% of orthodontic patients experience pain[29].This pain could be a reason for discontinuing treatment; previous studies have indicated that 8% and even upto 30% of orthodontic patients discontinue treatment because of pain [30].The pain and discomfort associated with orthodontic treatment is characterized by pressure, tension, or soreness of the teeth[31]. Pain in the anterior teeth is greater than the posterior teeth[32]. Pain has been reported to begin 4 h after the placement of separators or orthodontic wire, and the worst pain was found to occur on the second day of treatment. Usually, pain lasts for seven days[33]. clinicians are recommended to prescribe Ibuprofen or acetaminophen analgesics preoperatively and for a short duration after the placement of separators and initial wires[34].Several studies have pointed out that pain associated with orthodontic treatment has a potential impact on daily life, primarily as psychological discomfort.Moreover, swallowing, speech, and jaw function can be altered during orthodontic treatment.Chewing hard food can be difficult, and reduced masticatory ability is reported 24 hours after fixed appliance insertion

Instructions for the patient:

At the start of orthodontic treatment, it's fairly common to feel some small scratches and ulcers on the inside of patient mouth, especially if the patient wearing a fitted device such as braces. This will usually only happen for a couple of days, until the mouth gets used to the shape of the braces.

However this can be easily solved using orthodontic wax, which is an easy and immediate way to protect your mouth during this initial phase.

EXTRA-ORAL EFFECTS

- TMD

  Temporo-mandibular dysfunction can be defined as a multifactorial disturbance of masticatory system.

a.signs and symptoms:

1. Limited mandibular opening less than 35-40mm
2. Joint noise and pain
3. Tender muscles of mastication
4. Headaches
5. Tinnitus of the ears

b.Aetiology

Multifactorial:

1. Inflammatory
2. Degenerative
3. dysfunctional
4. idiopathic

Summary:

Orthodontics does not cause TMD nor cure it[35][36] Some occlusal problems may predispose to TMD but the evidence is weak. No evidence linking orthodontics with the incidence of TMD[36]. No greater prevalence of TMD symptoms in extraction cases. No evidence that occlusal adjustments treat or prevent TMD

- BURNS:

Burns, either thermal or chemical are possible both intra- and extra-orally with inadvertent use of chemicals or instruments. Acid etch, electrothermal debonding instruments and sterilised instruments which have not cooled down all have the potential to burn and care should be taken in their use.

chemical burn from etch

Chemical burn from acid etch during bonding of the orthodontic appliance

Nickel Allergy from head-gear whiskers

SYSTEMIC EFFECTS:

1. Allergy to nickel and / or latex
2. Cytotoxity
3. Bacterial Endocarditis
4. Cross infection
    a. operator to patient
    b. patient to operator
    c. patient to patient
    d. any source to 3rd party
5. Radiation risks

1:Allergy to nickel and / or latex (Also discussed under Intra-oral and Extra-Oral effects):

In some orthodontic patients, an oral inflammatory response is induced by corrosion of orthodontic appliances and subsequent nickel release.This inflammatory response is manifested as stomatitis (nickel-induced allergic contact stomatitis [NiACS]).

Young patients, especially females with a history of allergic reactions, had a greater predisposition to NiACS clinical manifestations; time of exposure to orthodontic appliances was not a significant factor. A previous allergic reaction should be considered a predictive factor of NiACS clinical manifestations and should be noted in the patient's medical history[37].

2:CYTOTOXITY:

In orthodontic therapy, different materials are used and subjected to a damp oral environment, which can modify their properties. In order to evaluate the biocompatibility of metallic and non-metallic orthodontic appliances their in vitro

Cytotoxicity has been measured.
The studies showed the non- cytotoxicity of the materials. The metallic and non-metallic materials were similar in terms of cytotoxicity. the orthodontic materials can be considered as non cytotoxic. However, the practitioner should pay attention to the composition and the polish of soldering silver-based alloys containing copper and zinc in order to limit cytotoxic ion release[38].

3.Bacterial Endocarditis:

Endocarditis (BE) is well documented[39] [40][41]. Over 45% of microbiologically confirmed cases of endocarditis are caused by oral streptococci[42]
The most recent classification comprises over 16 species of oral streptococci .The mouth, as the origin of these organisms, is not in doubt .Recent work has demonstrated the presence of a bacteraemia following a large number of dento-gingival manipulative procedures. These include tooth-brushing, intra-ligamental local anaesthetic injections, conservative dentistry procedures, single and multiple extractions and muco-periosteal surgery [42] 43]. In recent years, there has been increasing concern that non-surgical manipulations, such as orthodontic procedures may cause a bacteraemia .The likelihood for orthodontic treatment to be associated with BE is extremely low. Indeed, so low that the need for antibiotic prophylaxis, other than for extractions, needs to be questioned. Nevertheless, there is much that can be done for ‘at risk’ patients. In particular, there is the need to attain and maintain a very high standard of oral hygiene during appliance therapy.

4:CROSS INFECTION:

a. patient to operator
b. Patient to patient
c. Another source to 3rd party

Patient with infectious disease can transmit to the dentist either directly by air in cases of TB, or indirectly by instrument. Also in the same way can transmit to another patient.

5:RADIATION RISKS:

Cephalometry involves a quantity of radiation sufficient to create genetic and tissue damage if not properly controlled. A single head exposure may require less radiation than a single dental film due to the use of high-speed film, sensitive intensifying screens, and high kilo-voltages with extremely short exposure times[44].

OTHER EFFECTS:

1. Relapse
2. Argument about flattening the profile
3. Psychological and social effect

RELAPSE:

Relapse is officially defined (by the British Standards Institute) as the return, following correction, of the features of the original malocclusion.

However, for patients, relapse is perhaps better described as any change from the final tooth position at the end of treatment. This may be a return towards the original malocclusion. but may also be movement caused by age changes and unrelated to the orthodontic treatment[45] [46]

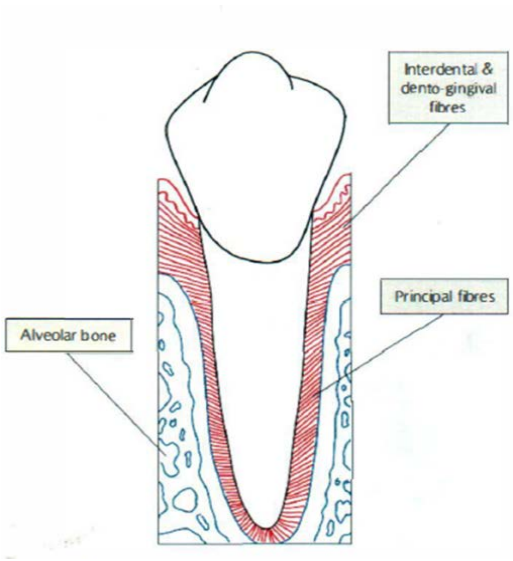
Aetiology of relapse:

There are five main reasons as to why relapse can occur following adequate orthodontic treatment[46]:

a. Periodontal or gingival factors
b. Alveolar bone
c. Occlusal factors
d. Soft tissue factors
e. Growth

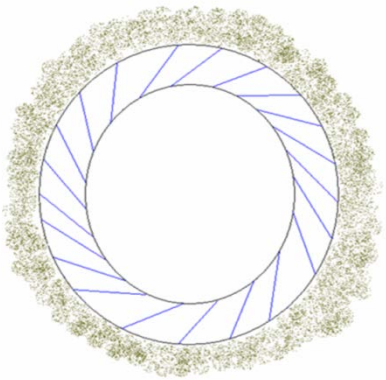
A.gingival and periodontal factors:

When teeth are moved, the periodontal ligament and associated alveolar bone remodels. Until the periodontium adapts to the new position, there is a tendency for the stretched periodontal fibres to pull the tooth back to its original position. Different parts of the periodontal ligament complex remodel at different rates. The alveolar bone remodels within a month. the principal fibres rearrange in 3-4 months and the collagen fibres in the gingiva reorganize after 4-6 months[46].



Longitudinal section showing the periodontium

However, elastic fibres in the dento-gingival and interdental fibres can take more than 8 months to remodel. Until the fibres have remodelled there is a tendency for the tooth to be pulled back to its original position. This is particularly true when teeth are rotated[(46)].



Cross section in the tooth and periodontium before orthodontic treatment

B.Alveolar bone factor:

Bone is the basic support to the tooth, and the PDL fibres co-ordinate the more intricate support to the teeth. As the tooth moves within the jaw, the bone remodels to accommodate the new tooth position. If the tooth position is not retained, the bone will not remodel to the desired extent, and relapse occurs via the effect given from PDL. Bone remodelling takes about 1 month to complete

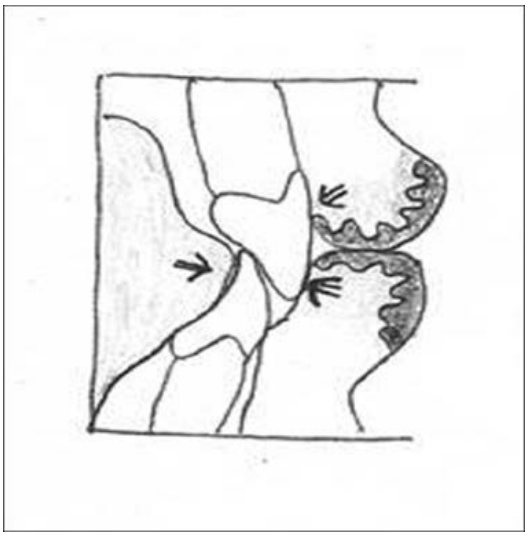
Diastema relapse after orthodontic treatment

C.Occlusal Factors:

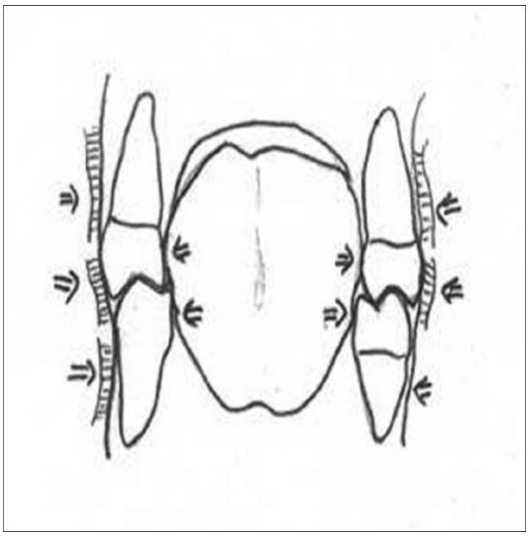
The way the teeth occlude at the end of treatment may affect stability. It has been suggested that if the teeth interdigitate well at the end of treatment then the result is likely to be more stable[(45)].

D.Soft Tissues:

The teeth lie in an area of balance between the tongue on the lingual aspect and the cheeks and lips on the buccal and labial aspect. This theoretical area of balance is known as the neutral zone. the forces from the tongue are greater than those from the lips and cheeks, but providing the periodontal ligament is healthy, the teeth will be maintained in a position of equilibrium. It is felt that teeth should be in this neutral zone at the end of treatment to increase the chances of stability[(45)].



Neutral zone role of tongue and lips



Neutral zone role of tongue and check

If the teeth are moved out of the neutral zone, then the chances of relapse are increased. This is particularly true for the lower labial segment. If this is either proclined or retroclined excessively, relapse is more likely. In the same way, if the archform (overall shape of the arch) is markedly changed it is more likely to relapse due to soft tissue pressures. Although the theory about placing the teeth in the neutral zone is useful, practically there are two major problems for the clinician. Firstly, we do not know exactly where the neutral zone is and how big it is. Secondly, it is likely that due to changes in muscle tone with age, the neutral zone changes as the patient gets older[(45)].

Potential risks and side effects of removable appliance:

removable appliances carry with them the risk of tissue impingement by the wire components (retentive clasps, springs, canine retractors etc.). Undercuts should be carefully evaluated in the plaster model and blocked out prior to acrylisation and care taken to avoid any sharp edges in the appliance to avoid trauma during the insertion and removal of the appliance. Patients should be recalled a few days after appliance delivery to check for any tissue impingement or trauma.When one of these appliances is fitted it may feel strange because the acrylic plate occupies space in palate, which can make speech a little difficult but the patient will soon get used to it if the patient persevere. The mouth also tends to produce more

saliva than usual because the brain interprets the presence of the appliance as food, this can take one or two days to settle down. Some people experience some irritation of the cheek, gum or tongue. If this happens call the doctor to adjust the appliance to make it more comfortable.

The effect of removable appliances on microbial accumulation:

The placement of orthodontic appliances creates a favorable environment for the accumulation of microbiota and food residues, which, in time, may cause caries or exacerbate any pre-existing periodontal disease[47].

The appliances may interfere with oral hygiene practice and cover considerable parts of the tooth surfaces, so an increase of the total microbial population as well as an altered microflora have been reported in relation to orthodontic treatment[48].Patients need to understand and be aware of the implications for their oral health, when accept recommended orthodontic treatment. On the other hand, accepting removable appliance orthodontic therapy has important implications for patients' home care. Acceptance of orthodontic treatment means patient commitment to a regimen of increased attention to oral hygiene and oral health[49].

The effects of orthodontic appliances on *Candida* in the human mouth:

The limited amount of literature demonstrated that the density of *Candida* increases; the most common *Candida* species isolated in the orthodontic patients was *C. albicans*; and that there seems to be a direct relationship between the presence of a removable appliance, *Candida*, and low salivary pH levels. No healthy patients developed *Candida* infection from the orthodontic appliances. However, there seems to be a trend that some non-*Candida* carriers converted to *Candida* carriers following the insertion of th e appliances by unknown mechanism. This may indicate a more cautious approach when providing orthodontic treatments to immunocompromised children concerning the possible increased risk of candidal infection[50].

The average number of *Candida* colonies isolated from saliva in patients with fixed orthodontic was more than patients with removable appliance .Also frequency of non albicans *Candida* species was higher in patients with fixed orthodontic appliances in compare with fixed appliance.

CONCLUSIONS:

Clearly there are a number of sources of potential iatrogenic damage to the patient during orthodontic treatment. However, severe damage is rare. Severe malocclusions have more to benefit from treatment than less severe malocclusions, and motivation between such groups may vary. Before proceeding with orthodontic treatment, both the patient and the orthodontist should reflect on the risks and the benefits of the proposed treatment. Most of the adverse effects of orthodontic treatment can be easily avoided by undertaking certain precautions during the treatment. Patient's attitude is also an important factor in ensuring predictable and successful treatment outcomes.

Good clinical practice, careful patient selection and information on a patient's responsibility are essential to minimise tissue damage. Continual attention and care by the whole dental team and care in daily clinical routines can prevent most accidental injuries. The most important aspect of orthodontic care is to have an extremely high standard of oral hygiene before and during orthodontic treatment. It is also necessary that any carious lesions are treated before any active treatment starts.

treatment of malocclusions using removable appliances may prepare new stagnant areas susceptible for colonization and retention of Candida species.Patients should be motivated each visit for oral hygiene during their orthodontic therapy.

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