From Braces to Scars - Long Term Effects on Hard and Soft Tissues: A Review

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Abstract: Orthodontic therapy offers significant benefits in terms of improved alignment and overall dental health. However, like any medical treatment, it does come with potential risks and limitations. These risks, though minimal, should be carefully considered by both the patient and the orthodontist when deciding to undergo treatment. Some of the potential complications include soft and hard tissue damage, such as enamel decalcification, lacerations, ulcerations, and temporomandibular joint (TMJ) disorders. In some cases, treatment failure can also occur if the desired outcome is not achieved. Despite these risks, the benefits of correcting malocclusions often outweigh the potential for harm. Ensuring the success of orthodontic treatment involves addressing these risks proactively through preventive measures. This includes monitoring and managing hard as well as soft tissue condition throughout the treatment process. It is essential for the orthodontist to remain vigilant and prudent, regularly assessing the condition of these tissues at every stage to ensure a successful and healthy outcome. Proper care and attention to detail during and after treatment can help minimize risks and lead to a positive result for the patient.

Key words: Enamel defects, Gingival lesions, Orthodontic Scars, Root Resorption, Periodontal lesions

Introduction: The primary goal of orthodontic treatment is to achieve functional efficiency, structural balance, and aesthetic harmony. In addition, with enhancing aesthetics, orthodontics significantly improves the function, appearance, good dental health and improves confidence. However, orthodontic treatment does carry some risks and limitations, particularly related to potential tissue damage during or after treatment. Fortunately, such risks are minimal and occur infrequently in orthodontics.[1]

Most soft tissue damage caused by orthodontic treatment is temporary and reversible. However, injuries to hard tissues can be permanent, often requiring additional treatment after the completion of orthodontic therapy, as seen with enamel decalcification and white spot lesions. Any such lesion should be identified at any early stage and managed. Non orthodontic practitioners should be aware of these possible hazards. Therefore, it is the responsibility of the orthodontist to conduct a comprehensive examination of the patient's oral cavity at the start of treatment and at every follow-up visit to locate and treat any orthodontic issues, preventing long-term damage and ensuring a successful outcome. Additionally, it is crucial to inform patients of these potential risks before starting treatment.[2]

Orthodontic scars: Soft/ hard tissue lesions which are reversible or irreversible, present intra orally or extra orally, caused due to orthodontic treatment either during or after it.

Classification of orthodontic scars:

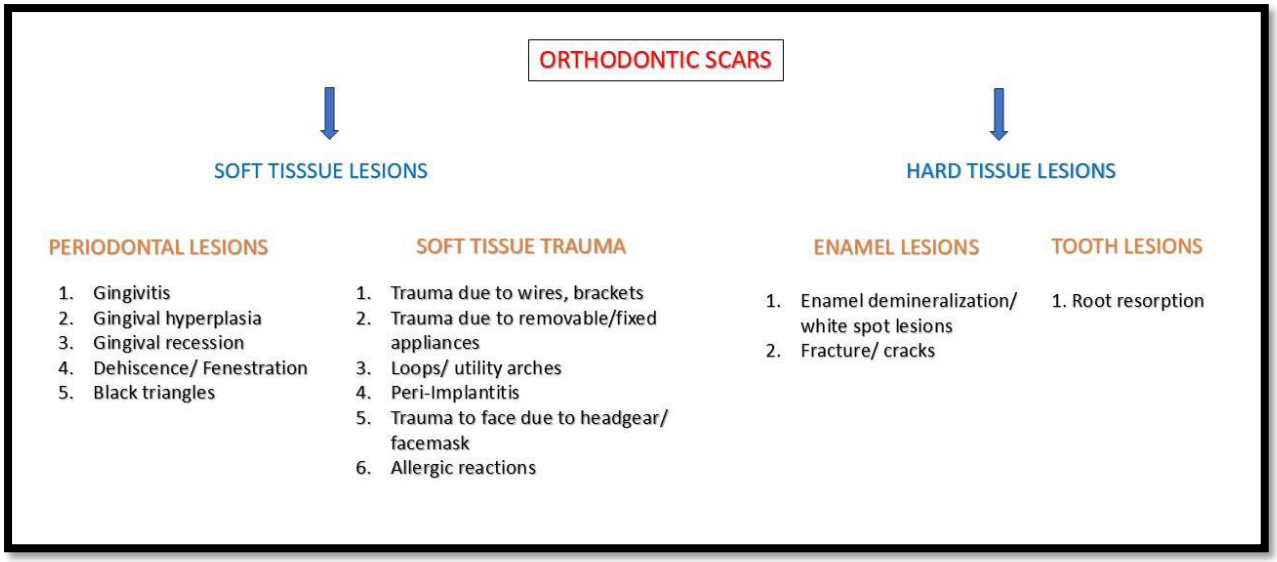

FIG 1: Classification of Orthodontic Scars

1. **Gingivitis/ gingival enlargement**: Orthodontic treatment aims at improving oral hygiene by treating the misaligned teeth which makes brushing easy. But the close placement of such appliances to the sulcus, along with the accumulation of plaque and the challenges created for sustaining good oral health, make it more difficult to provide effective and healthy orthodontic care.[3]
   Within weeks after beginning of treatment, the first clinical response seen is the gingivitis and sometimes enlargement of gingiva. This is transient in nature and usually subsides after the treatment is completed. Pseudo pocket formation is seen which is maintained by good oral hygiene.[4] (Fig 2)

Adult patients are more prone to gingival breakdown. Greater attachment loss and alveolar bone loss of 2-3mm is seen in adults.

Oral hygiene is to be maintained. Light forces are recommended for adults. Systemic diseases should be recorded before the treatment as certain drugs such as Phenytoin can cause gingival hyperplasia. Appliances which carry out more of the crown movement than root movement are preferred such as the "Tip Edge" appliance are recommended. Fixed retention is advised in adult patients.[5]

FIG 2: Gingival Hyperplasia

2. **Gingival recession:** The movement of gingiva in apical direction is termed as gingival recession. (Fig 3)

   Aetiology of gingival recession:

a. Long- lasting trauma: mainly due to improper brushing habit.
b. Chronic inflammatory periodontal disease: due to enzymatic digestion of the underlying connective tissue as a result of bone resorption eventually leads to the loss of gingival tissue.
c. Periodontal treatment: Following surgical procedures like curettage and other surgeries, as the healing process progresses, the gingival thickness decreases, leading to more root surface exposure.
d. Occlusal trauma: initially there is pain due to uneven occlusal contacts followed by loosening of teeth. Due to increased functional demand PDL space widens ad there is alveolar bone loss. Gingiva follows the bone and there is gingival recession seen.
e. High frenum attachment: the cervical region of gingiva can move apically due to labial or lingual frenum attached to its surface.[6]

Bonding is more preferable over banding as later can lead to more plaque accumulation around its surface and below the gingival margin. This plaque can lead to inflammation of the gingiva as compared to the bonding with composite resins. When tooth moves in presence of inflammation, recession occurs. Mucogingival surgery such assub epithelial connective tissue graft is a reliable method for the treatment of gingival recession.[7]

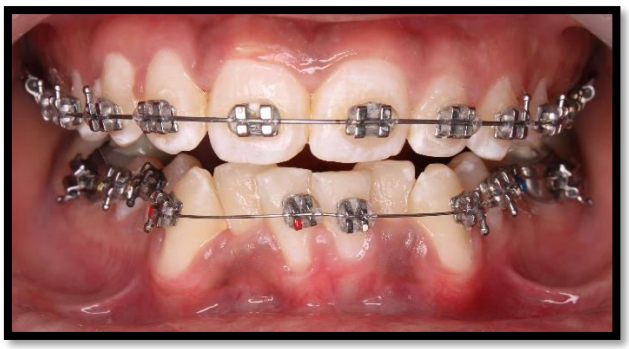

FIG 3: Gingival recession with lower anterior teeth

3. **Black traingles:** Burke et al. reviewed 500 orthodontic records and found that when crowded anterior teeth are corrected, the interdental papilla may stretch as a result of root separation, leading to an increased presence of gingival black triangles (GBTs) between the incisors. (Fig 4) The authors also expressed concern about moving the roots of adjacent teeth too close to one another, which can compromise the interdental bone and papilla due to insufficient embrasure space. The risk is becoming more common due to proximal stripping techniques.[8]

FIG 4: Black Triangle Visible Between Central Incisors

However, it is important to avoid altering the proportional relationships of the teeth, particularly their embrasures and connectors. The existing and potential black triangles should be carefully observed during the clinical diagnosis, and the patient is informed about the possibility of reshaping the teeth later to minimize any aesthetic concerns. Restorative procedures with veneers and laminates can be carried out.

4. **Dehiscence/fenestration**: Etiological factors of dehiscence include:

a. **Thin Buccal Bone**: Naturally thin cortical plates, especially in the lower incisors and maxillary canines.

b. **Excessive Labial/Buccal Tooth Movement:** Proclination of incisors in non-extraction cases frequently leads to dehiscence.

c. **Uncontrolled Expansion**: Rapid palatal expansion and uncontrolled transverse movements can cause fenestrations, particularly in posterior teeth.
d. **High Orthodontic Forces**: Heavy forces increase bone resorption and disrupt remodelling. (Fig 5)
Clinically CBCT should be used to evaluate the bone morphology. Also, light continuous forces are recommended. Controlled proclination and expansion should be performed.[9]

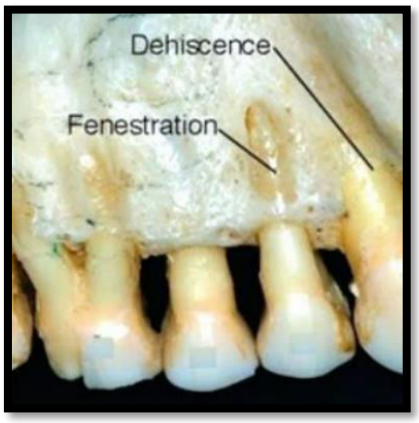

FIG 5: Dehiscence and Fenestration

5. Soft tissue trauma

a. **Fixed appliances:** Lacerations and ulcerations can occur during initial stages of treatment due to wire impingement on cheek mucosa, bracket and hook interferences with lips and cheek mucosa and soft tissue injury after placement of bands. Long wires between two brackets can cause hyper plastic growth of gingiva. (Fig 6) Lingual appliances can cause injury to tongue. Trans palatal arch and lingual arch can sometimes damage the palatal mucosa and lingual sulcus.

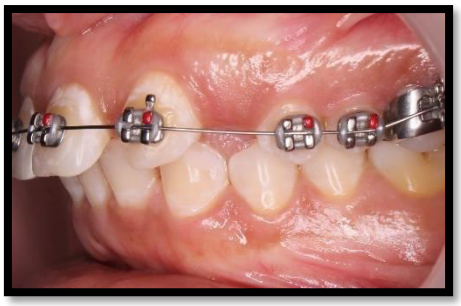

FIG 6: Long Extensions of Wire between Two Brackets

Management includes:

- Carefully using the instruments in mouth.
- The distal end of wire should be either cut or cinched properly.
- Using wire sleeve on long spans of wire.
- Wax should be provided to patient to prevent mucosal injuries.

b. **Removable appliances**: Removable retainers given after completion of treatment, or the anterior of posterior bite plates during the treatment can cause trauma due to acrylic component extensions on soft tissues. Also, the wire components like clasps and labial bows, canine retractors can affect the tissues if not properly fabricated.
Management of injuries due to removable appliances includes fabrication of appliance by blocking the undercut areas for easy placement and removal by patient. Recall of patient within two seven days for checking traumatic injuries and they should be corrected.[9]

6. **Headgear injuries**: Samuels and Jones classified the types of headgear injuries based on percentage occurrences: [10]

- Accidental disengagement of the head strap while playing. (27%)
- Incorrect handling (27%)
- Disengagement by another child (19%)
- Disengagement while a sleep (27%)

Patients should be instructed properly about the correct technique of placement and removal and headgear. Also, the parents should be demonstrated about the method. Eye injury should be prevented by first loosening the strap followed by removing the bows.

7. **Loops/ utility arches**: The extensions of the loops into the vestibular space can cause impingement into soft tissue and injuring it. (Fig 7)
The loops and utility arches should be fabricated according to the vestibular depth of the patients. Also, they should be kept slightly away from the soft tissues to prevent embedding into the soft tissues.[11]

FIG 7: Loops Can Impinge on the Soft Tissues

8. **Allergic reactions**: The symptoms include Gingivitis in the absence of plaque Gingival hyperplasia Labial desquamation, Burning sensation in the mouth, Metallic taste, Angular cheilitis, numbness/tingling sensation, labial swelling, soreness of the side of the tongue. Extra-oral signs and symptoms can include localised dermatitis.[12]

   Nickel free brackets: Ceramic brackets, Polycarbonate brackets, Titanium brackets, Gold brackets Plastic aligners
   Nickel free archwires: Titanium Molybdenum alloy (TMA) archwires, Fibre-reinforced composite archwires, Pure Titanium archwires, Gold plated archwires

9. **Temporary anchorage devices:**

- **Placement injuries:** the position of TAD's if not placed correctly has to be changed. This changing the position can cause soft tissue tear at previous site. The pilot drill used to determine the insertion site damages the soft tissue while removing it.
  A self-drilling implant is recommended.
- **Damage from adjuncts:** coil springs and elastomeric chains when used with TAD's should be taken care of because they are more sensitive to impingement into retromolar pad area, tuberosity, vestibule.
- **Implantitis:** chronic inflammation around implant can cause periodontal damage and eventually implant failure. Care should be taken to maintain good hygiene around implant. (Fig 8)
- **Root damage:** impingement of root while placement is serious if it involves the pulp. Tooth has to extracted in such cases. If cementum and PDL is affected, healing can take place.[13]

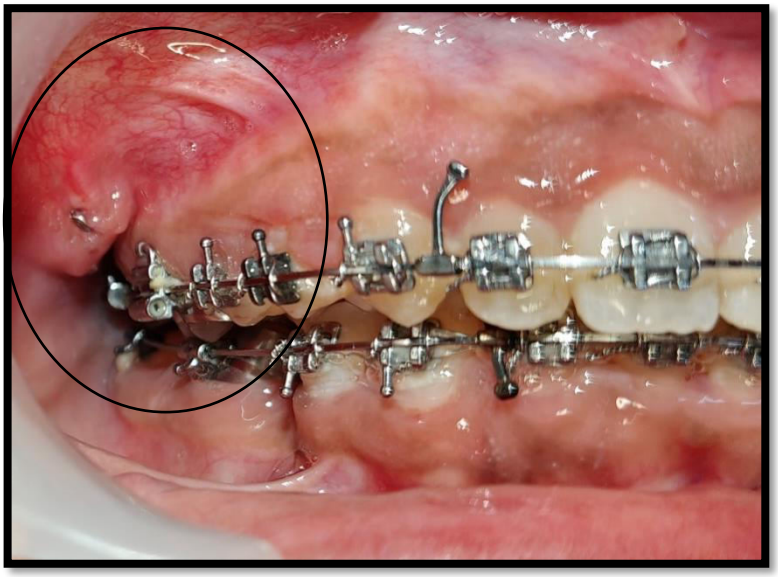

FIG 8: Implantitis After IZC Placement

Management:

- A bulk of composite is placed around the implant to prevent the tongue and soft tissue trauma and overgrowth.
- Placement of TADs in "safe" zone
- In case of root trauma immediate actions are to taken.
- Avoid placing implants in zone of inflammation.

10. **White spot lesions/ demineralisation of enamel:** Oral hygiene following orthodontic treatment is not properly maintained. (Fig 9) The food lodgement around the brackets and bands increases plaque formation and is the major reason for causing white spot lesions. The plaque formation decreases the ph of oral environment. The bacteria specially Streptococcus Mutants increases rapidly around the brackets. The ph drops further exceeding the threshold of remineralisation of enamel. Thus, demineralisation of the enamel takes place which clinically appears as white spot lesion. if not treated, WSL can cause carious lesions.[14]

FIG 9: White Spot Lesions

(Picture reference taken from the article: White Spot Lesions: Formation, Prevention and Treatment *Samir E. Bishara and Adam W. Ostby)*

Management of white spot lesions:

- Good oral hygiene maintenance
- Topical fluoride application initially
- Dentrifices containing Sodium fluoride, Monoflurophosphate, Stannous fluoride, Amine fluoride or a combination of these.
- Resin Modifies Glass Ionomer Cement (RMGI)
- Teeth whitening procedures
- Prosthetic correction with the help of veneers, laminates.

11. **Enamel cracks/ fractures**: Enamel cracks are associated after bonding and debonding procedure. The ceramic brackets bond chemically to the enamel surface as compared to the metallic brackets which bond mechanically. Thus, ceramic brackets are more prone

to cause enamel fractures. The central incisors and canines are more commonly affected.[15]

The enamel-adhesive interface causes more enamel cracks as compared to the bracket - adhesive interface. (Fig 10)

Pretreatment examination for any cracks should be done and patients and parents should be informed about it.[16]

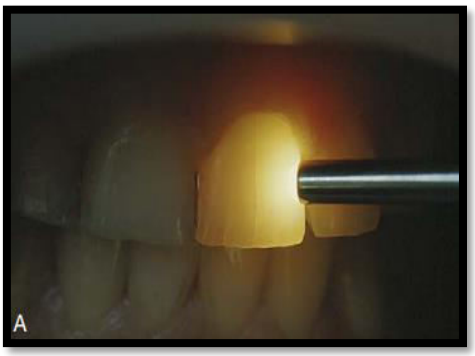

FIG 10: Enamel Cracks Seen After Debonding Brackets
(Picture reference taken from textbook: Orthodontics Current Principles and Techniques)

Removal of metal brackets: the bracket should be gently squeezed between the plier beaks in mesio-distal direction and lifting it from the surface.

Removal of ceramic brackets: grinding the ceramic bracket surface with a hand piece and water coolant to remove it completely. The patient is asked to bite on a cotton piece while removing the brackets.[16]

12. **Root resorption:** Root resorption in orthodontics is a type of pathological root resorption. It occurs when orthodontic forces are applied to the teeth, leading to the removal of hyalinized areas in the periodontal ligament. (Fig 11) This process involves the breakdown of the root structure due to inflammation caused by the mechanical forces exerted during orthodontic treatment.The root resorption can be

a. Internal: pulpal infection
b. External: Dental trauma, Bleaching procedures, Periodontal procedure, Impacted teeth, Orthodontic treatment

Root resorption is caused due to patient related factors such as systemic disease, genetics, hormonal irregularities, parafunctional habits. Orthodontically it is caused due to increased magnitude of forces, type of forces applied, mechanics used, previous endodontic treatment.[17]

Immediately orthodontic forces should be removed. Root resorption continues upto 4 weeks after forces are removed. After 4 weeks light orthodontic forces can be applied and also a retention phase of 4 weeks should be given.

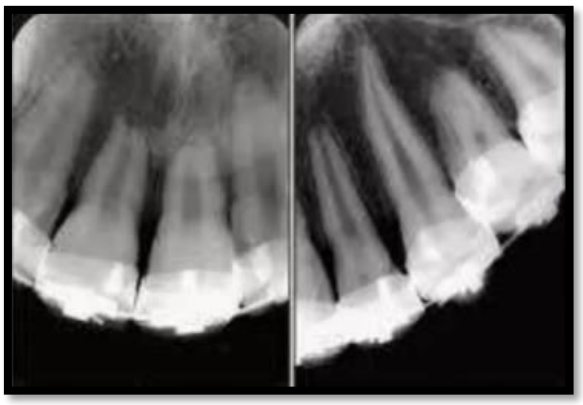

FIG 10: Root Resorption Seen Radiographically
(Picture reference taken from article: Root Resorption in Orthodontics, Furkan Dindaroglu, Servet Dogan)

Conclusion: Most of the orthodontic scars are transient and reversible in nature except a few hard tissue lesions such as fractures and demineralisation. These lesions are to be noticed precisely by the orthodontist on every visit and it may cause discomfort to the patient. Also, if lest untreated, it may cause pain and infections. The orthodontist should motivate the patient on every visit to maintain good oral hygiene as it is the key to a successful treatment. On every recall visit proper examination is required to identify any lesions so that they can be treated soon before they worsen.

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