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Review Article

Orthodontic Treatment Adverse Effects: A Comprehensive Review

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ABSTRACT:
Orthodontic treatment is like any other treatment that can be associated with unfavorable side effects. Knowledge of these side effects is essential to the orthodontist and the patient willing to have orthodontic treatment. Obtaining an informed consent from the patient is as important as executing the treatment plan. Hence; in the present review, we aim to summarize some of the important aspects of adverse events associated with orthodontic treatment.
Key words: Orthodontic treatment, Adverse, Events.

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Introduction

Malocclusion is a common problem of the maxillofacial region and has a global distribution. It can negatively affect the quality of life of a person by compromising aesthetics and function. Patients with malocclusion can benefit from either removable or fixed orthodontic treatment, but treatment duration can range from months up to 2–3 years in case of comprehensive treatment and is a matter of concern for the patient. Patient compliance to follow up orthodontic appointments decreases by 23% for every 6-month increase in treatment duration. Also, longer treatment durations can increase the chances of iatrogenic damage like root resorption, white spot lesions, and periodontal problems. Different non-surgical and surgical interventions have been used over the years to decrease the duration of orthodontic treatment. Non-surgical techniques include modification of biomechanics by customization in brackets and archwires, biological methods which include injection of different cell mediators, and device-assisted methods, which include vibrational stimulation, pulsed electromagnetic fields, low-level laser therapy, electric currents, and static magnetic field. Surgical techniques include osteotomy or corticotomy procedures, interseptal alveolar surgery, micro-osteoperforations, corticision, discision, piezocision, and piezopuncture.[1-3]

Pain, which includes sensations evoked by, and reactions to, noxious stimuli, is a complex experience and often accompanies orthodontic appointments. This, among the most cited negative effects of orthodontic treatment, is of major concern to patients as well as clinicians and is evident in recent publications. Surveys performed to determine the experience of orthodontic pain have rated it as a key deterrent to orthodontic therapy and a major reason for discontinuing treatment. One survey rated pain as the greatest dislike during treatment and fourth among major fears and apprehensions prior to orthodontic treatment.[4, 5]

Pain

It is clear from the existing literature that all orthodontic procedures such as separator placement, archwire placement and activations, application of orthopaedic forces and debonding produce pain in patients. It is also clear that fixed appliances produce

more pain than removable or functional appliances and there exists little correlation between applied force magnitude and pain experienced. The various discomforts experienced by patients after appliance placement are often described by them as feelings of pressure, tension, soreness of the teeth, and pain as such. Clinicians usually respond to the most frequently asked question 'Will it hurt?' with the answer 'There may be some discomfort associated with all orthodontic procedures such as placement of separators, archwire placement and activations, elastic wear and debonding'. The two most important parts of orthodontic pain—its duration and intensity are often ignored.[6, 7]

It is known that the above-mentioned procedures will cause pain but what is not known is 'why they cause pain?' It is reported that orthodontic procedures will reduce the proprioceptive and discriminating abilities of the patients for up to 4 days, which result in lowering of the pain threshold and disruption of normal mechanisms associated with proprioception input from nerve endings in the periodontal ligament. At the same time, there will be pressure, ischaemia, inflammation, and oedema in the PDL space.[8, 9]

Decalcification

Shannon recognized orthodontic patients to be at a higher risk of decalcification or caries. An orthodontic appliance could not, within itself, be a cause of caries. However, oral hygiene problems do occur when fixed appliances are worn. Meticulous attention to oral hygiene is mandatory during the entire treatment period to avoid the risk of enamel decalcification. Banded or bonded teeth, exhibited significantly more white spot lesions compared to the controls without braces. Ogaard noticed that even 5 years after completing the treatment, orthodontic patients had a significantly higher incidence of enamel opacities than untreated controls.[1- 3]

Patients undergoing orthodontic treatment have significant changes in the oral environment, including an increase in Streptococcus mutans counts, low salivary pH, and increased retention of food particles on the appliance as well as teeth. This may lead to post-orthodontic treatment decalcification in certain patients in the absence of adequate oral hygiene. Fluoride is an anticariogenic agent and various studies showed fluoride to be highly effective in remineralization of incipient lesions and preventing white spot lesions. Fluoride controls plaque activity by blocking bacterial enzyme systems. Daily administration of topical fluoride and the use of fluoridated toothpaste and mouth rinses is an effective protection against white spot formation. Mouth rinses containing 0.05% sodium fluoride and stannous fluoride can be used as a daily regimen during the treatment period. Fluoride varnishes and fluoride gels are also highly effective in preventing enamel demineralization.[4- 6]

Pulpal changes during orthodontic treatment

Pulpal reaction to orthodontic forces is minimal. This reaction is in the form of transient mild inflammatory response, which has no long term significance. The possibility of pulp vitality loss during orthodontic treatment does exist. The risk factors for loss of pulp vitality include a history of trauma associated with the teeth. Pre-treatment peri-apical radiographs of previously traumatized teeth are essential for comparative purposes. Additionally, the use of heavy uncontrolled, continuous forces by the orthodontist or round tripping of the teeth may lead to loss of pulp vitality. Therefore, orthodontist should use optimal light forces during their treatment.[10- 12]

External root resorption in orthodontic therapy

External apical root resorption is a common phenomenon associated with orthodontic treatment. The factors relevant to root resorption can be divided into biological and mechanical factors. Some mechanical and biological factors might be associated with an increased or decreased risk of root resorption during orthodontic treatment. For mechanical factors, the extensive tooth movement, root torque and intrusive forces, movement type, orthodontic force magnitude, duration and type of force are involved. Orthodontic therapy of patients with increased risk of root resorption should be carefully planned. Medical history, medication intake, family history, tooth agenesis, root morphology, oral health and habits must be considerate if we do not want jeopardize our patients by severe root resorption. To monitor apical root resorption the standard procedure is a radiographic examination after 6 months of treatment. In teeth with enhanced risk, a 3-month radiographic follow-up is recommended. The administration of anti-inflammatory drugs might suppress root resorption induced by orthodontic therapy, although none study was enough conclusive to indicate a protocol for patients with enhanced risk.[13- 16]

Allergies

Nickel leaching from orthodontic bands, brackets, stainless steel or Ni–Ti archwires has been shown in vitro to occur within the first week and then decline thereafter. It is suggested that a threshold concentration of approximately 30 ppm of nickel may be sufficient to elicit a cytotoxic response. Scientific evidence suggests that orthodontic treatment is not associated with increase of Ni hypersensitivity, unless patients have a history of previous exposure to Ni. People with cutaneous piercing are considered a significant risk factor for Ni allergy. However, oral exposure to nickel through dental braces prior to ear piercing reduces the risk of developing nickel allergy. Previous allergic response after wearing earrings or a metal watchstrap, appearance of allergy symptoms shortly after the initial insertion of orthodontic components containing Nickel and confined extraoral

rash adjacent to headgear studs should raise alarm to clinician concerning nickel allergy.[17- 22]

Carious complications

As the orthodontic technique developed, concerns regarding tooth damage by carious lesions during treatment increased, this being seen today as one of the most frequent unwanted side effect associated with this particular medical intervention. Decay damage associated with orthodontic technique presents some specific particularities. They appear with increased frequency on the tooth's surface where the bracket is bonded, adjacent to its base, they usually have low severity (most of the times are encountered as white spot lesions, more frequently gingival and distal to the bracket's base than mesial or occlusal). Evidence shows that the prevalence of this unwanted side effect is nearby 70% for white spot lesions and less than 5% for cavities. According to Chapman's study more than 30% of the maxillary incisors, teeth with the greatest esthetic values, present decalcifications after orthodontic intervention.[22- 25]

Periodontal complications

Periodontal complications are one of the most actual side effects linked to the orthodontics, not rarely being the reason for malpractice complaints. It can be found in various forms, from gingivitis to periodontitis, dehiscence, fenestrations, interdental fold, gingival recession or overgrowth, black triangles. Severe damage can considerably interfere with the teeth prognosis. Etiopathogeny is complex, involving factors related to the patient (e.g., previous condition present, increased susceptibility, poor oral hygiene) and to orthodontic technique. Gingivitis usually occurs due to the incorrect maintenance of the oral hygiene, in the presence of the orthodontic appliance, that seems to favor plaque accumulation. Their frequency is increased in some particular situations, like in the presence of orthodontic bands that usually are placed subgingival, accompanied sometime by the solubilisation of luting agent, favoring the gingival overgrowth by mechanical trauma and existence of retention space for plaque accumulation. This is why, in order to ensure a safer medical care, bondable tubes are more indicated than bands. Even so, research has shown that during orthodontic therapy gingival enlargement occurs, but approximately 3 month after the removal of the appliance, in most cases, the gingiva presents a similar aspect as before treatment.[20- 23]

Temporomandibular joint disorders

Postorthodontically temoporomandibular disorders are usually part of the craniomandibular dysfunction, which includes beside joint modifications also muscle and dental impairments. By the current research knowledge, it isn't clearly elucidated the relation between temporomandibular alterations and orthodontic intervention, usually being found contradictory opinions, explication varying. Some sustain that, by the state of morphofunctional equilibrium present after orthodontic intervention, optimal conditions for this side effects prevention are created. Other believe that, because of the premature occlusal contacts present during therapy, there is a greater risk for this complication to appear.[20- 23]

Speech Problems

Orthodontic appliances may affect speech directly by impeding the articulation of sounds or indirectly by affecting the physical and mental health of a person. Although the potential for orthodontic appliances to hinder speech has been of research interest for over 60 years, professional orthodontic associations do not always address this topic in their public education campaigns regarding the risks of orthodontic treatment. The effect of orthodontic appliances on speech is primarily an issue when the lingual space is encroached upon. Hence, patients report that removable appliances affect speech more than fixed labial appliances. The speech recovery time for bonded palatal expanders and Hawley retainers tends to be approximately 1 week. This is similar to the adaptation time for full upper dentures, which may suggest that age is not a significant factor for speech adaptation in this respect. Indeed, one study involving bonded palatal expanders found no relationship between patient age and the time for speech adaptation. Speech adaptation may be quicker if the thickness and amount of palatal coverage of an appliance is minimized. This observation may explain the seemingly mild and short-lived impact of Invisalign on speech for many patients. It should be noted however that these studies did not consider the impact of newer aligner features that place auxiliary features on the palatal surface of the upper incisors (e.g. bite ramps) which may affect speech.[22- 25]

Conclusion

Periodontal health is essential for any form of dental treatment. Adult patients must undergo regular oral hygiene instruction and periodontal maintenance in order to maintain healthy gingival tissue during active orthodontic treatment. Oral hygiene instructions should be given before the start of orthodontic treatment and it should be reinforced during every visit.

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