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Complications in Orthodontic Treatment: A Literature Review

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Abstract

Orthodontic treatment can cause damage. The benefits derived from this treatment must be greater than the complications that can occur. It is important to consider the complications that can occur before deciding to treat malocclusion. This study aimed to describe the complications that can occur in orthodontic treatment and their prevention and management. Dentists must know the complications that can occur in orthodontic treatment. Certain steps must be taken as prevention or management of complication that occurs during orthodontic treatment.

Keywords: *Complication, Orthodontic, Caries, Pulp Reaction, Periodontal Tissue*

1. Introduction

Orthodontic is potential to cause significant damage to hard and soft tissue.[1] Orthodontic treatment must be significant to patients, it must be greater than any damage or potential risk that may occur.[1-3] Orthodontic treatment can increase mastication, speech and appearance, general health, comfort and confidence of the patient.[2,3] To assess risk or complication that can occur in a treatment is very important prior to deciding to treat malocclusion.[1,2] Treatment as well as treatment plans play important role in incurring complications that can occur in a treatment and dentists must be aware in assessing every aspects in patients and its malocclusion.[1,2] The most important aspect of orthodontic treatment is to have mouth cleanliness standards that are high before and after orthodontic treatment.[1]

However, clinically there are several general complications and complications that are rarely found. Orthodontic treatment is a medical intervention that is complex done in a long period of time.[1,2] Risks may shift to complication. The occurence of this complication depends on one's medical knowledge, public health and the patient's mouth, as well as patients' mouth cleanliness efforts. This has become considerations even from the start because it may influence the objective of a treatment.[1,2,4] Regulations that regulate medical actions require that every patients performing treatment be informed on the significance as well as complications that may occur and also sign informed consent.[2,4]

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2. Complications in Orthodontic Treatment

2.1. Enamel Demineralization

Enamel demineralization is general complication that occurs 2-96% from orthodontic patients.[1,3,5] This huge variation may occur as a result of various methods used to assess a score.[1] Every tooth may show demineralization but there are possibilities that may incur demineralization and early treated lesions.[1,4] Plaque that is allowed to accumulate on the bands and brackets of fixed orthodontic devices causes demineralization to occur. The increased complications of demineralization during treatment are caused by several factors, namely lesions that are more difficult to detect, the effect of pH of the oral cavity, an increase in the volume of dental plaque, the rapid development of bacterial flora caused by the location of retentive for plaque.[3-6] Duration of treatment does not affect the incidence or number of white spot formations, although a number of studies have found demineralization can occur quickly, within the first month of treatment of fixed orthodontic appliances.[1,5,6]

Things that can be done by instructing patients to always brush teeth. When demineralization takes place, professional prophylaxis with plaque control and the application of fluoride or additional fluoride mouthwash (0.05% sodium fluoride mouth rinse daily or 0.2% weekly), can help in demineralizing the lesion, preventing the formation of white spot and reduce decalcification that cannot be seen.[1,4,6] Bonding from orthodontic devices can induce plaque on the tooth surface. Resin Modified-Glass Ionomer Cement (RMGIC) is preferred as a bonding material because the release of fluoride and strength is almost the same as the resin.[2,6] Good oral hygiene is very important as well as food intake control to minimize this complication. This education must be done at each visit.[3-6]

2.2. Caries

Orthodontic patients have complication to caries.[6] Gorelick et al in it on the formation of white spot on children who already performed treatment with fixed orthodontic devices found that half of the patients have at least one white spot after treatment.[1,2] This was also observed with the increase of a number of main caries bacteria such as *Streptococcus mutans* and *Lactobacillus sp*.[2] Things that should be done is to evaluate the behavior of oral hygiene before orthodontic treatment starts. In several cases, high frequency of caries and bad oral hygiene may be the reason as to the delay or cancel orthodontic treatment.[2,6]

Recommendations from primary prevention methods used to avoid these complications are patient education about oral hygiene and correct food intake patterns, together with ingredients that release fluoride for brackets, bands and tubes.[2,3] This has implications for the need for caries level assessment at the start of treatment.[1] Studies have shown the use of fluoride mouthwash or toothpaste containing fluoride to prevent tooth decay due to caries during treatment with fixed orthodontic appliances.[2,3] In severe cases, open cavity requires interceptive-restoration.[1,3,4]

2.3. Enamel Facture and Wear

When placing components, careless use of bands can cause email fractures. Caution is needed when major restorations are present because they can lead to fractures in the unsupported cusp.[1,3-5,7] Debonding can also produce enamel fractures, both with metal and ceramic brackets.[1,3] Care must be taken when removing the bracket and bonding agent residue releasing from the bottom of the bracket slowly until the bracket is released from the enamel surface without damaging the enamel.[1,3,5,7] A good debonding technique is to remove the bracket by leaving some composite residue on the enamel surface, which can be cleaned later with a carbide bur. This procedure may be time consuming, but it is better

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to minimize complications of cracks and fractures in the email. The use of bur has the potential to remove enamel.[1,6,7] The frequency of enamel loss depends on the bracket, bonding material and debonding technique. The use of ceramic brackets and conventional adhesive resins can modify worse enamel trauma.[2,6,7]

Enamel wear against metal and ceramic brackets can occur.[3,7] It is common in the upper canine cusp during retraction on the lower canine bracket, the incisal edge of the upper anterior tooth on the lower incisor ceramic bracket, the maxillary posterior buccal cup of the bracket on the lower posterior tooth.[3,7] Ceramic brackets are very abrasive and therefore contraindicated for lower anterior teeth if there is a possibility of upper teeth, given that overbite can increase.[1-4,7] Enamel erosion must be recorded before treatment starts. Educate on proper diet intake, reduce or avoid carbonated and acidic drinks which are the cause of erosion.[1,3,7] Restorative procedures can be performed for the treatment of tooth enamel fractures.[3-7]

2.4. Pulp Reaction

Some degree of pulpitis occurs when tooth movement usually causes temporary pain and discomfort in the first few days after the use of the tool. This usually subsides for a few weeks, although it rarely causes loss of vitality, but it can increase pulpitis on previously traumatized teeth.[1,3,4,7] Mild strength is recommended in trauma teeth and vitality monitoring which must be repeated every three months.[1,3,7] If treatment with appropriate mechanics and force is used, it should not be able to cause significant problem.[3-5] Various studies on changes in pulp tissue vascularization during orthodontic treatment. Orthodontic forces affect the dental pulp by inducing inflammatory vascular changes.[3,6,7] One or more teeth that may experience trauma or large fillings can experience a bad condition that requires root canal treatment.[3,7] This can be minimized by using arch wire round nickel titanium, smaller in diameter during the initial stages of treatment thus the force used during the treatment phase must be kept to a minimum.[7] Complete and detailed dental history must be taken. Dental radiographic examination is very important. Patients who have risk factors for pulp necrosis with orthodontic treatment (impacted teeth, history of trauma, caries or restoration) should be notified of complications of pulp damage during treatment and informed consent. A mild continuous orthodontic force must be applied to move the teeth, without crossing physiological limits. Pulp symptoms that occur during orthodontic treatment must be recognized early and treated appropriately without delay.[6,7]

2.5. Change in color

Discoloration after orthodontic treatment is the result of various factors. Severe discoloration occurs when using resin curing chemically compared to lightcure.[2,6] Resin tags cannot be removed by cleaning procedures without affecting the enamel surface that it affects the texture of the enamel surface.[2] Evidence has shown that the use of adhesive resin for bonding brackets does not display good color stability as time goes on. Orthodontic forces induce pulp vascularization, ultraviolet light, corrosion products from orthodontic devices and especially the color combinations of food and drinks that induce color changes that lead to a yellowish color.[2,6]

2.6. Periodontal Tissue

Nearly all patients experience problems with gingival inflammation during orthodontic treatment.[5,7-9] Fixed orthodontic devices make oral hygiene difficult, and almost all patients experience gingival inflammation that is temporary and does not lead to attachment loss.[3,4,7-9] Plaque retention increased with fixed orthodontic appliances. Oral hygiene instructions are very important in all cases of orthodontic treatment, and additional uses such as electric toothbrushes, special proximal toothbrushes, and mouthwashes containing fluoride or chlorhexidine. Motivation and compliance of patients

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increase success. Cases of mouth cleanliness that is not too good from the start must be carefully considered when recommending patients for treatment.[3,6] Experience has shown that patients who are unable to maintain an oral health environment without tools thus the results of treatment will fail with the placement of orthodontic devices.[1,3,6]

Gingival hyperplasia can be a problem around the orthodontic band which leads to pseudo pocket and loss of attachment.[3,4,7-9] Although a few weeks after the band is released the attachment can return to normal.[3,6-9] Orthodontic treatment is not indicated for the group of patients who are experiencing the disease periodontal before periodontal disease is controlled.[3,6,8,9] Gingival recessions has been known to occur as a side effect during orthodontic treatment or after treatment which often occurs when the movement of teeth toward the facial fascia teeth has thin gingival tissue. It has been found that most cases of gingival recession that occur during orthodontic treatment occur in the upper and lower anterior teeth region.[8,9,11] Patients with pre-existing periodontal problems and those who have lost bone should be referred to a periodontal dentist. Periodontal status checking and routine scaling and polishing are recommended.[3,4,6-8] Other patients who need attention are those who have systemic disease, those who have diabetes with poor control and patients who suffer from epilepsy controlled with phenytoin which can cause gingival hyperplasia.[4,6-9]

2.7. Root Resorption

Some degree of root resorption associated with treatment with fixed orthodontic devices is 1-2 mm. Resorption can occur at the apical and lateral surface of the root, but radiography only shows apical resorption to a certain degree.[1,5,7] Many cases do not show clinical significance but, microscopic changes can occur.[1,3,5,7] Theories include excessive strength which is applied and hyalinization of the periodontal ligament which causes excessive activity of cementoclasts and osteoclasts.[1,3,5,7,10] Some studies have found no correlation with treatment time, while others found an increase in resorption with an increase in treatment time. Multifactorial etiology which was affected by individual biological characteristics, genetic predisposition and effects of orthodontic force, general health, type of malocclusion, tooth root morphology, history of previous root resorption, alveolar bone density, root condition to cortical bone, previous endodontic treatment, and patient age.[2-4,6,7,10]

After clinical resorption occurs, mild strength must be used, root length monitored every six months by radiograph.[1-5,7,10] Root resorption is an undesirable side effect seen in certain types of tooth movement, one of which is intrusion.[3,7,8,11] In extreme cases the equipment is removed, and it is recommended sequential root canal therapy with calcium hydroxide.[7] Fortunately, root resorption rarely produces significant morbidity after orthodontic therapy and the resorptive process usually stops with the cessation of active strength.[7,8,10] *Acaret* et al. showed that the application of intermittent force results in less root resorption than continuous application of force.[7,8] This explains the fact that pauses in force allow resorption to heal and prevent further resorption.[7,8,10] Among all teeth, maxillary incisors are most commonly involved in apical root resorption.[6-8,10]

2.8. Allergy

Allergy to orthodontic components intraoral is very rare, but there have been studies that studied the release of nickel and metal corrosion with fixed orthodontic devices.[3-5,7] The clinically significant evidence of nickel release is unclear, but must be considered in patients with nickel sensitive. In addition, some cases with severe allergies may be influenced by the use of latex gloves, elastic and elastomeric ligature (protein antigens against rubber) that are recommended for the use of other materials.[1,3-5,8] Methyl methacrylate found in bonding agents also causes allergies in a few patients but is very rare.[3,6,7] Extra oral allergies to nickel are more common in extra oral orthodontic devices, usually headgear.[1,3,4,7] More than 1% of patients have some forms of contact dermatitis

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and a few of them claim to have experienced a rash. The use of plaster attached to the area that comes in contact with the skin is enough to relieve symptoms.[1,3,4,7,8]

Allergic reactions can range from ulceration, erythematous lesions depending on the patient. Nickel hypersensitivity affects three out of ten general population, but clinically adverse reactions appear to be less documented because the symptoms are very mild. Nickel-induced contact dermatitis is an immune type IV hypersensitivity response that occurs 24 hours after exposure.[6,7,12] The diagnosis of nickel allergy is based on the patient's history, clinical findings, and clinical trials. Patients become sensitive to nickel because of previous contact with ornaments, glasses, and watches and can experience dermatitis. Intraoral signs and symptoms of nickel hypersensitivity are rare to occur because the concentration of nickel needed to trigger a reaction in the mouth is higher than what is needed on the skin.[6,7] If the reaction is severe it should be recommended that this orthodontic device be removed and not used.[6,7,12]

2.9. Allergy

Lacerations, ulcerations, hyperplasia or stomatitis often occur during treatment of removable or fixed orthodontic devices between treatment sessions. This is caused by archwire, brackets, bands, acid etching, and instruments that affect the oral mucosa, tongue, lips and cheeks.[4-5,7] The use of dental ortho wax on the brackets can help to reduce trauma and discomfort directly by the equipment component removable and fixed orthodontics that affect soft tissue. If the cause does not come in contact with healing this trauma will continue.[1,3-5,7] Following the case of eye trauma that is published in patients who use headgear. A number of safe headgear products have been designed and guidelines for use are now available.[3-5,7] Burns, both heat and chemical may occur accidentally both intraoral and extra oral by means of the use of chemicals or sterilized instruments that have not yet been cooled. All have the potential so caution is needed in its use. The impact of acid etching can be prevented by suction and rinsing with water after the etching procedure.[1,3,9 6,7]

2.10. Temporomandibular Dysfunction (TMD)

There is no evidence to support the theory that orthodontic treatment can cause TMD or cure it. Pre-presence of TMD should be noted, and patients are advised not to increase this condition. Some patients may suffer from an increase in symptoms during treatment which should also be discussed at the beginning of treatment. [1,3,4,7] If the patient experiences symptoms, it must be directed towards eliminating occlusal disharmony and clicking. Standards of care can also be indicated for example soft food consumption.[1,3,7]

Severe anterior skeletal open bite, the difference between centric relation and centric occlusion is greater than 4 mm, overjet is greater than 6 to 7 mm, unilateral lingual cross bite, and five or more posterior teeth are missing are conditions that have been associated with specific diagnostic groups of TMD. The current literature evidence suggests that orthodontic treatment, which is carried out during adolescence, is related to certain types of orthodontic mechanism or teeth extraction protocols on the possibility of developing TMD in the future. Although there is current evidence to show that orthodontic treatment is not a causative factor, it is strongly recommended to conduct TMD examinations for all orthodontic patients that is potential to detect pre-existing TMD problem.[6,7]

2.11. Treatment Failure

Treatment failures can be caused by uncooperative patients, incorrect diagnosis and treatment plans and improper care.[4] There is extensive research on stability after treatment.[7] The results of orthodontic treatment are potentially unstable and retention is needed for three main symptoms: 1) changes in gingival, periodontal and supporting bones during treatment require a period of time for adaptation 2) teeth in an unstable position after treatment, so they are easily affected by unbalanced soft tissue pressure, 3) jaw growth and continuous alveolar process that affect the outcome of orthodontic.[7,13]

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Early 6 months post-treatment is important, because it may take 4 to 6 months for periodontal ligaments and supporting bones. That is why teeth have a stronger tendency to move immediately after orthodontic treatment and their effects decrease gradually after the alveolar bone and periodontium return to their normal patterns.[7] The use of appropriate retainers can help reduce post-treatment relapse.[3,6,7]

Basically retention prevents relapse or in other words prevents the tooth from returning to its initial position from malocclusion. Retention is to keep the tooth that has just been moved in its position for a long time to stabilize the correction from malocclusion. The lifetime of the bite may change due to various factors.[13] This includes failure to eliminate the causative factor, ligamentous pull, improper occlusion function, periodontal conditions, eruption of third molars, genetic influence, tongue size, teeth and jaw, bone adaptation, bone pressure muscle, changes in growth and / or changes in maturation, various bad habits including mouth breathing, nail biting, sucking fingers or lips, sticking out the tongue, playing musical instruments, and other oral habits that may be beyond the control of the dentist.[6,7,13] Attitudes of patient in care plays an important role in supporting treatment outcomes. It is important to communicate with orthodontic patients to determine whether they feel the need for care and fully appreciate the commitment to care. This is because orthodontic treatment can last up to 2 years depending on the case, followed by a long retention period, which requires adequate patient compliance. [6,7]

2.12. Profile Damage

Premolar extraction is done by considering the patient's face profile. A recent review examined orthodontic effects on facial profiles and concluded that an important treatment plan. Unsatisfactory profile changes have become a common complaint after orthodontic treatment. Soft tissue changes also occur naturally with age, regardless of orthodontic intervention. Proper diagnosis considers the shape of the skeleton, the position of the teeth, and soft tissue thus it can negate any adverse effects on the profile due to the treatment mechanism. Ultimately, the patient's expectation of a facial profile is needed before determining treatment options.[1,3]

2.13. Swallowing Orthodontic Component

Orthodontic equipment consists of small components that are linked together. They can be accidentally ingested, although very rare, this is a potential hazard that should not be ignored. In the literature, ingestion of orthodontic components is accidentally generally smaller components such as bracket or band but even relatively larger equipment such as quad helix and RME equipment. To minimize complications, some recommend the use of rubber dams for safer debonding to prevent the bracket from accidentally escaping into the trachea or esophagus. The most common emergency diagnostic and management method is endoscopy. Symptoms of trachea-bronchial obstruction such as dyspnea, coughing and choking indicate an emergency requiring immediate removal of components usually by surgery. Anterior-posterior and lateral radiographs will reveal whether the object is in the ea or esophagus. If the device is in the digestive tract, the possibility is more than 90% that the component will pass smoothly together with faeces.[7] However, the imposition of large objects or sharp objects can cause ulceration and perforation. Therefore, it requires immediate surgery.[3,6,7]

2.14. Systematic Complications

The spread of infection among patients, between operators and patients or by third parties must be prevented. Use gloves, masks, sterile instruments and a clean work area as the most important thing. The medical history of each patient to determine risk factors even though this should be the standard for preventing cross-contamination regardless of their medical status.[1,3] General medical problems, such as heart, blood, bone, endocrine diseases, can affect orthodontic treatment.[2,3] Any change in the patient's health must be checked regularly.[3] Patients who are at risk of endocarditic should consult to a

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cardiologist beforehand. Patients must demonstrate good oral hygiene; antibiotics are usually needed for invasive procedures such as extraction, placement and removal of the band. Chlorhexidine mouthwash is given before treatment in some cases which are used every day.[1,3,8]

3. Conclusion

Prior to performing orthodontic treatment, dentists should know complications that may occur from the orthodontic treatment. However, heavy damage due to complication is rare. Standard practice steps such as knowing a detailed medical history before treatment and examination in each control schedule, paying attention to appropriate foods and instructions for maintaining oral hygiene. Therefore, orthodontic patients benefit from orthodontic treatment without any unwanted complications from orthodontic treatment.

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