Systematic Review

THE EFFECT OF DENTAL CARE DURING ORTHODONTIC TREATMENT: SYSTEMATIC REVIEW.

ABSTRACT:
The maintenance of stringent oral hygiene practices is imperative during orthodontic treatment in order to prevent plaque from accumulating over braces and other orthodontic appliances, leading to gingivitis inflammation and periodontal disease. Consequently, an orthodontist is responsible for providing advice to patients about oral hygiene to maintain periodontal health and for monitoring plaque control measures. In spite of their orthodontist's recommendation, most orthodontic patients do not follow their recommended instructions on how to maintain a satisfactory level of plaque control. We conducted our systematic review of literature in English. During the initial re-examination phase, there were no filters applied to ensure all studies were available for subsequent screening. Filters like human studies were added later, with English language studies being the only ones added. We found nine articles related to orthodontic treatment, and their relation to dental care, during our literature review. It is essential to maintain good oral hygiene during orthodontic treatment to reduce iatrogenic demineralization and caries. When a patient's DMFS score is high, prophylaxis programs are necessary during orthodontic treatment.

Keywords: Orthodontic treatment, orthodontists, dental care, dental diseases, oral hygiene, oral care.

INTRODUCTION:

There is no major problem related to malocclusions, however they may have an adverse effect on oral tissues and cause psychological conditions. Crooked teeth may lead to dental caries due to the accretion of dental plaque [1]. Therefore, malocclusions are thought to impart the dental caries, yet caries formation is directly linked to individual oral hygiene, which results in various dissimilarities between individuals. Researchers have claimed that there is no significant consortium between malocclusion and caries formation. However, other studies stipulate that caries are less prevalent in individuals with malocclusions [2].

Orthodontic treatments differ according to the type of malocclusion present. However, all orthodontic treatment methods are aim to ensure that teeth are aligned properly on the jaws and, lining up with one another. It is the greatest passion of both patients and orthodontists to have a smile that remains balanced and aesthetically pleasing. Fixed or removable orthodontic appliances can be irrationally painful in certain cases, as seen in any treatment process. In orthodontic treatment, the formation of non-cleanable surfaces can cause changes in mouth flora results in the formation of areas of decalcification on the enamel, leading to the onset of periodontal diseases [3].

Orthodontic therapy is believed to increase caries activity by changing the oral environment and increasing salivary lactobacilli levels as measured by salivary calcium concentrations. Acid that demineralizes enamel is believed to be produced by lactobacilli. At the end of active orthodontic treatment, a clinical examination often reveals that lesions were present, which may be incipient, non-cavitated, or advanced cavitated, carious lesions. To prevent such side effects, patients with fixed appliances must adhere strictly to oral hygiene protocols. Brackets can become detached if unwanted forces are applied to orthodontic appliances. In addition to impacting treatment duration, costs, and chair time, bond failure can also negatively impact patient satisfaction [4].

There is evidence that periodontal conditions and gum swelling are the most common adverse effects of orthodontic treatment on oral health. However, by controlling plaque, even teeth with poor periodontal health can be moved successfully without negative effects. In contrast, fixed appliances are often difficult to clean because they are mounted. As a result, food and bacteria can get trapped onto the multiple surfaces and spaces of the appliance. This can result in plaque accumulation and the accumulation of microorganisms [5].

It is also uncomfortable and a challenge for the patient to clean from unfamiliar angles. When orthodontic treatment is being carried out, patients may receive suboptimal oral care due to the factors outlined above. Plaque can accumulate on the teeth, causing gingivitis, which then triggers periodontitis. Compared to adults without fixed appliances with high plaque formation, orthodontic patients have a higher level of plaque coverage. In particular, young patients may be at risk for poor oral hygiene due to a less conscientious approach. The resorption of teeth is another negative outcome of orthodontic treatment.

External apical root resorption (ARR) results from a combination of factors including orthodontic treatment length, impacted teeth, thin roots, and anterior trauma history. Bruxism,

thumb sucking, and occlusal trauma also pose risk factors before treatment. Root resorption may be reduced by using light forces rather than heavy ones. Adult orthodontic patients face different challenges than young patients. As needed, these components can be treated prior to or simultaneously with orthodontic treatment so that the best long-term results can be achieved.

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METHODOLOGY:

Search Design:

This study aimed to perform a systematic literature search on the effects of dental care during orthodontic treatment using the Medline and PubMed Central databases in the English language. A predesigned data extraction form was used to extract data from the online databases such as Medline and PubMed Central.

Data extraction forms were designed to include information about study citations and characteristics (name of the author/s, year of publication, country, name of the journal, title of study, and dental care taken while undergoing orthodontic treatment). As well, the types of risks and complications reported during and after orthodontic treatment were included, depending on the time when they occurred.

Data must be electronically extracted from Medline and PubMed Central by using an electronic form, which must be designed by the Principal Investigator. Analysis will be based on observation recorded. Articles selected for the review was reviewed closely, and the data was analyzed by the principal investigator.

Term used for searching:

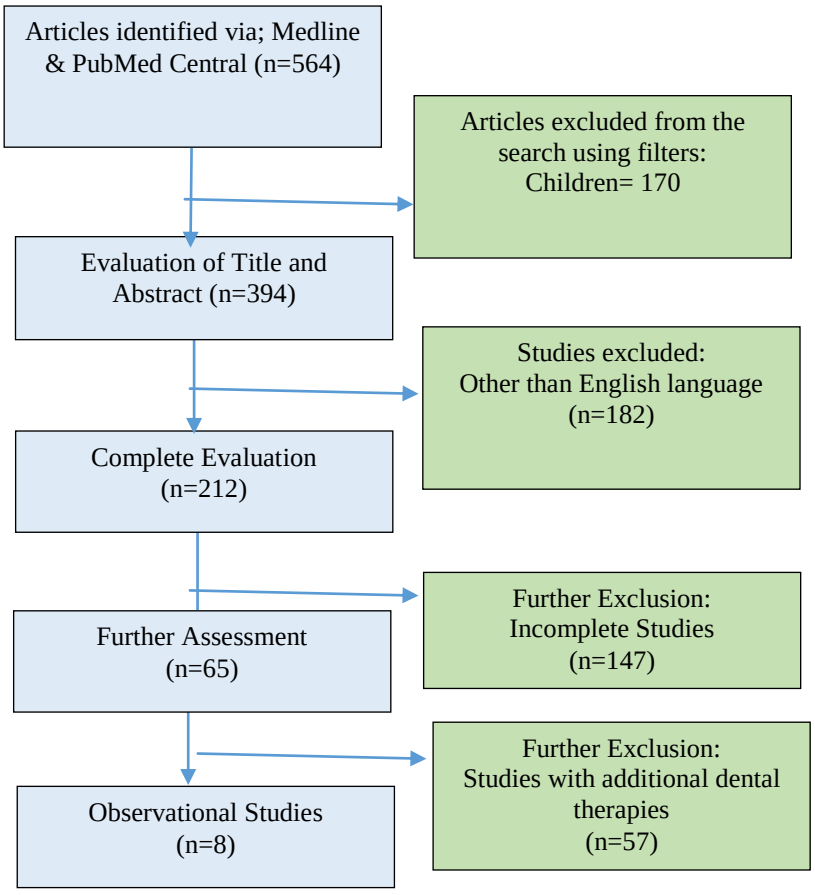
The search terms selected were in English language and were applicable to all types of risks and complications of orthodontic treatment, like: “orthodontic treatment complications”, “orthodontia complications”, “orthodonture complications” “dental orthopedics complications”, “misalignment treatment complications”, orthodontic retainers’ complications, orthodontic extrusion complications, dental care, dental aid. All these MeSH terms were a combination of orthodontic treatment complications and the effect of dental care on it using the Boolean operator ‘AND’.

Filters:

To ensure that all previous studies can be screened for subsequent screening, no filters were applied to the search at the beginning. Nevertheless, the following filters were added to Medline and PubMed Central as part of the exclusion criteria: Human studies, studies in English and adults over 18 years old. In this way, studies can be easily filtered out of the original list of literatures.

Inclusion and Exclusion Criteria:

A major goal of this study is to evaluate and review the previous research about the effect of dental care during orthodontic treatment. To accomplish this, the original list of article or case submissions must be screened for study eligibility. The inclusion criteria of this study includes, all the articles or cases, that treated the misaligned teeth by orthodontics; that treated both the genders (males and females); that considered only the orthodontic therapy which are independent of complications of other surgical procedure; all the dental care taken post the treatment reported under 12 months of the orthodontic therapy and not beyond this period. The exclusion criteria of the study is to exclude, all the articles or cases, that are not in the English language; that treated the non-human subjects; that included the patients aged below 18 years of age; that have dental care reported for complications additional to orthodontic therapy (aesthetic treatment; prosthodontic treatment, root canal treatment, etc..).



Flow Chart 1: Showing the screening of all the articles related to effect of dental care during the orthodontic treatment.

AUTHOR'S NAME	YEAR OF PUBLICATION	JOURNAL'S NAME	STUDY TITLE	RESULTS REPORTED	ORTHODONTIC THERAPY
Richmond S, Andrews M, Roberts Ct. [7]	1993	British Journal of Orthodontics	The provision of orthodontic care in the general dental services of England and Wales: extraction patterns, treatment duration, appliance types and standards.	The high prevalence of the extraction of premolars followed by removable appliance treatment signifies the traditional British approach to orthodontic treatment which is arguably a result of a high demand for the orthodontic treatment. The treatment done using upper and lower arch produced best standards of treatment.	Upper and Lower Arch Fixed Orthodontic appliances.
Sander Fm, Sander C, Sander Fg. [8]	2005	J Orofac Orthop	Dental care with manual toothbrushes during fixed orthodontic treatment--a new testing procedure.	More beneficial or less beneficial brush head designs were used in the care of teeth with fixed orthodontic attachments. High target values indicated high interaction between toothbrush bristles and the surfaces being brushed.	Fixed orthodontic treatment
Rossini G, Parrini S, Castroflorio T, Deregibus A, Debernardi Cl [9]	2015	European journal of orthodontics	Periodontal health during clear aligners treatment: a systematic review.	Oral hygiene procedures have a great impact on the periodontal health during orthodontic treatment. The use of removable appliances can minimize the orthodontics related negative effects on periodontal health allowing patients easier oral hygiene procedures.	Clear Aligner Treatment (CAT) that has been cited as a safe, aesthetic and comfortable orthodontic procedure for adult patients
Jiang Q, Li J, Mei L, Du J, Levrini L, Abbate Gm, Li H. [11]	2018	Journal of American Dental Association	Periodontal health during orthodontic treatment with clear aligners and fixed appliances: A meta-analysis.	Clear aligners were better for periodontal health than fixed appliances and might be recommended for patients at high risk of developing gingivitis.	Clear orthodontic Alkigners
Antezack A, Monnet-Corti V. [12]	2018	L Orthodontie Francaise	Oral and periodontal hygiene in orthodontic patients	The authors explain the effects of orthodontic treatments on dental plaque and the occurrence of dental and periodontal problems; they emphasize the role of pathogenic bacteria and highlight the need for efficient (both individual and professional) control of dental plaque.	Orthodontic appliances
Katarzyna Zarzycka-Kogut1, Marzena Pucek1, Jolanta Szymańska [13]	2014	Polish journal of Public Health	Orthodontic treatment – complications and preventive measures	Preventive dental care like : to examine accurately the patient's mouth during regular orthodontic visits, to perform professional preventive treatments accord-ing to the needs, teach proper oral hygiene with regard to the available products on the market designed for this purpose.	Orthodontic Aligners

Pinto As, Alves Ls, Maltz M, Zenkner Jeda [14]	2020	Braz Oral Res	Association between fixed orthodontic treatment and dental caries: a 1-year longitudinal study.	The mean increment of active caries lesions was 0.14 in Group-0 (G0) and 0.61 in Group-1 (G1). G1 showed a greater risk of developing active caries lesions than G0	Fixed orthodontic treatment
Martignon S, Ekstrand Kr, Lemos Mi, Lozano Mp, Higuera C. [15]	2020	Community Dent Health	Plaque, caries level and oral hygiene habits in young patients receiving orthodontic treatment	Clearly the best approach during orthodontic treatment is to prevent plaque and caries from occurring. The prevalence of demineralized white lesions is disturbingly high after orthodontic treatment and specialized gums and toothpaste need to be used to prevent this.	Fixed Orthodontic Treatment

Table 1: Showing the results of the systematic review of the articles related to dental care effect during the orthodontic treatment.

DISCUSSION:

The most common complications observed during an orthodontic treatment are: Plague formation, ware out of enamel, caries in teeth, resorption of tooth, reaction in the pulp, gingivitis and mobility of the teeth, TMJ problems of tooth, malocclusion, trauma in the soft orofacial tissues, systematic diseases and psychological trauma. The oral dental care (procedures, precautions) to avoid these complications are: brushing properly, along with cleaning the interdental spaces. Use of disclosing agent, anti-bacterial mouth wash and rinsing with fluoride mouth wash.

The maintenance of stringent oral hygiene practices is imperative during orthodontic treatment. In order to prevent plaque from accumulating over braces and other orthodontic appliances, leading to gingivitis inflammation and further periodontal disease. Consequently, an orthodontist is responsible for providing advice to patients about oral hygiene to maintain periodontal health and for monitoring plaque control measures. In spite of their orthodontist's advice, most orthodontic patients do not follow their recommended instructions on how to maintain a satisfactory level of plaque control.

According to researchers Atassi and Awartani from Saudi Arabia, dental hygiene was not adequate in patients receiving orthodontic treatment under fixed appliances [16]. It is argued by Terri that poor oral hygiene falls under the category of factors contributing to poor tissue status in orthodontic patients [17]. As a result, it is of tremendous importance for the orthodontist to emphasize oral health care practices to his or her patients when patients are undergoing orthodontic treatment.

The main reason orthodontic treatment is so popular is the aesthetics of the teeth. Orthodontic treatment is beneficial to oral health, appearance, and self-esteem, but if necessary care is not given to appliances used during orthodontic therapy, results can be unwelcome. Patients undergoing orthodontic treatment must be aware of potential risks in order to understand their responsibilities throughout the process. It is the symbiotic relationship between the patient and dental professional that determines the health of the teeth and the way a person views dentition.

PHASE OF ORTHODONTIC TREATMENT	*COMPLICATIONS REPORTED*
During an Orthodontic Treatment	Change in PH of Saliva. Decrease in Buffering and Cleaning properties of bacteria. Change in morphology and physiology of periodontal tissues. Change in morphology of alveolar bone. Alteration in composition of tooth cement. Modification of morphology and physiology of periodontium. White lesions Dental Plaque Enamel demineralization.
After an Orthodontic Treatment	The gums around the treated teeth becomes asymmetrical. Dental caries. Root resorption of teeth. Permanent loss of dental hard tissues.

Table 2: Showing the possible complications reported during and after the orthodontic treatment.

Among a sample of Indian women, Acharya et al. developed a study to endorse a translation of the DNS into the Indian language and found it to be reliable for assessing oral health neglect among the participants [18]. According to Bardal et al., approximately 44% of fixed orthodontic patients brush three times a day, 20% brush twice daily, 4% brush once daily, and 11% use interdental brushes or end-tufted brushes [19]. In this phase, a complete oral examination is performed routinely, together with scaling. During orthodontic treatment and after removal of appliances, the patient should be instructed to improve oral hygiene to prevent recession. Orthodontists must educate their patients on proper brushing technique along with the important consideration of adjuncts such as dental floss, interdental cleaning toothbrushes, and oral irrigators including their consideration of the importance of oral health. Also possible are tissue damage, demineralization of the enamel, nickel allergies, and relapse [20]. The dental professional can avoid negative outcomes of orthodontic treatment by taking the necessary precautions and initiating the right actions in a timely manner. Orthodontic treatment, on the whole, offers more benefits than risks. Plaque removed from areas of the mouth does not contain any signs of decay. An oral health regimen reduces gingival inflammation and remineralizes the enamel surface [21].

Motivating yourself and developing skills are key to controlling the plaque. The basics of dental hygiene are brushing your teeth, flossing between them, and rinsing your mouth. With a simple change in order, mouthwash can be followed by brushing in the future, allowing for more effective application of fluoride. Most children and adults brush their teeth poorly compared with the recommended method.

Chlorhexidine works similarly to fluoride as an antimicrobial agent. Both a varnish and a mouthwash are available [22]. Remineralization of chlorhexidine varnishes reduces the accumulation of Staphylococcus mutans. The use of chlorhexidine-based varnish prevents plaque from accumulating around brackets and bandings. Due to their ability to bond brackets

quickly, argon lasers have become increasingly popular in orthodontics over the past few years. The procedure also reduces chair time and strengthens enamel against acid erosion. The enamel surface was intact despite the laser beams altering its morphology. Argon laser-cured braces are effective in reducing enamel decalcification and have similar bond strengths to conventionally light-cured ones, according to in vitro studies.

During orthodontic treatment, argon laser treatment was found to reduce enamel decalcification in vivo. As nanoparticles (NPs) are small, insoluble particles less than 100 nm in size, they are also being used in a variety of health applications. Nano silver particles, such as Ag+1, are used as antimicrobials since direct contact may destroy bacterial membranes. During fixed orthodontic treatment, prevention strategies may be either microbiologic adhesion or demineralization of the enamel. Currently, nanoparticles have been incorporated into orthodontic bonding materials or acrylic resins for coating brackets and bands, including silver, TiO_2, SiO_2, hydroxyapatite, fluorapatite, and fluoro hydroxyl apatite. The lack of information on nanotechnology's use warrants more studies on the effects of NP sizes on human health.

CONCLUSION:

A good oral hygiene may prevent the formation of caries in bracket and ligation types. Iatrogenic demineralization/caries are primarily prevented by maintaining good oral hygiene during orthodontic treatment. For patients whose pre-treatment DMFS score is high, prophylaxis programs are required during orthodontic treatment. It is paramount that we focus on the prevention, education, and motivational methods for improving the oral health of orthodontic patients in order to avoid complications of this nature. Preventive medicine is better than curative.

ETHICAL CONSIDERATIONS:

Compliance with ethical standards

Ethical approval: This research contains a systematic review related to the defect of dental care during the orthodontic treatment and hence requires no ethical approval.

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