

Orthodontic Treatment Induced Gingival Recession- A Review on Impact and Treatment Outcomes

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Abstract: Gingival recession occurs as a result of displacement of marginal gingiva apical to the cement-enamel junction resulting in root surface exposure caused by several predisposing and precipitating factors. Clinical and case-control trials have shown orthodontic appliance therapy itself has a negative influence on the periodontium and associated soft tissue structures. Among several consequences, controversy still exists in occurrence of gingival recession as an uncommon manifestation caused by movement of teeth external to the alveolar cortical bone plate. Hence the present review was carried out to ascertain the role of orthodontic treatment in causing gingival recession by reviewing existing clinical, evidence based studies, gingival recession risk factors and discuss briefly on its impact and treatment outcomes. It was observed that orthodontic appliance therapy unaided by contributing factors often does not significantly induce gingival recession and impact treatment outcomes. However treatment carried out without consideration of periodontal health and without elimination gingival recession risk factors may trigger gingival recession that largely impacts the prognosis and treatment outcome of the orthodontic therapy. Thus, necessitates adequate awareness, gingival risk assessment methods, long-term prospective studies, appropriate treatment planning along with periodontal approach and consent prior to orthodontic appliance therapy.

Keywords: Gingival recession, malocclusion, overjet, orthodontic appliance, predisposing factors, proclination.

1. Introduction

Fixed appliance therapy is an integral part of orthodontic treatment that demands proper and effective oral health care to achieve the desired outcome and maintain the integrity of oral as well as periodontal tissues. One of the greatest challenges in fixed orthodontic appliances is the excessive accumulation of debris and dental plaque caused by improper oral hygiene practices resulting in considerable inflammation of the Oral and Para-oral soft tissues associated with loss of periodontal attachment, alveolar bone with subsequent loss of teeth [1]. On the other hand, clinical studies have also shown the fixed orthodontic appliance therapy itself has a negative impact on the periodontium by causing significant alveolar bone loss, increase periodontal pocket depth, bleeding on probing, root

resorption, gingival recession, appearance of white spot lesions and transient alteration of microbial flora which vary according to local factors such as age of the patient, food habits, severity of malocclusion, location of the appliance and appliance associated specific characteristics [2, 3]. Among these several consequences of orthodontic appliance therapy, controversy still exists in occurrence of gingival recession as an uncommon manifestation caused by movement of teeth external to the alveolar cortical bone plate [4].

Gingival recession commonly denotes displacement of marginal gingiva apical to the cement-enamel junction (CEJ) resulting in exposure of root surface to the oral environment often seen in adults of 50 years and above directly associated with age and several risk factors such as thin buccal mucosa, abnormal frenal attachment, ectopic eruption, aberrant morphology of tooth, trauma from occlusion, moderate to severe crowding, orthodontic tooth movement and traumatic injuries caused by forceful flossing, improper tooth brushing practices [5]. Prevalence of Gingival recession during or after orthodontic appliance therapy is indeed a clinical concern that requires combination of gingival recession risk factors assessment and appropriate oral hygiene practices by the patient [6]. Hence the present study was aimed to ascertain the role of orthodontic treatment in causing gingival recession by reviewing existing clinical, evidence based studies, gingival recession risk factors and discuss briefly on its impact and treatment outcomes.

2. Methodology

A structured literature search for articles written in the English language in PubMed/MEDLINE, EBSCOhost, Google Scholar, Scopus, and Web of Science databases was retrieved by using MeSH terms "Gingival Recession" OR "Orthodontic therapy" AND "Dental", "Dentistry" AND "Fixed appliance therapy" "Orthodontic treatment, Recession" OR "Orthodontic movement" OR "Gingival health" OR "All Metadata", "Periodontal therapy", "Vestibular recession".

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3. Gingival Recession Risk Factors

Recession of marginal gingiva especially seen during post-orthodontic treatment phase are progressive in nature with increased severity of long-term duration has a potential aesthetic, psychological and tooth related concerns such as dentin hyper-sensitivity, tooth discoloration depending on the associated risk factors [7]. Gingival recession associated risk factors can be broadly categorized as predisposing and precipitating factors. The predisposing factor includes gingival tissue biotype, amount of keratinized gingival tissue, width and thickness of the alveolar bone, position of the marginal gingival, vicinity of the root to the cortical plates, root prominence, anatomy of mandibular symphysis and ectopic tooth eruption [8, 9]. The precipitating factors are age of the patient, smoking, pregnancy, Para-functional habits, traumatic flossing and improper tooth brushing technique, poor orthodontic mechanics, tooth movement and active lingual retainers [10].

1) *Gingival Recession Risk and Orthodontic tooth movement*

In addition to the above described factors Melson and Allais [11], Johal A et al [7] emphasized on the importance of soft tissue variation among each individuals following dento-alveolar expansion, early correction of significant predisposing/precipitating factors, role of orthodontic intrusion, de-rotation, correction of traumatic occlusion associated with unfavorable effect on the gingival tissues and efficacy of interceptive orthodontics carried during mixed dentition period are of substantial concerns. Joss-Vassalli et al in a systemic review observed a weak association between orthodontic treatment and gingival recession. This study also demonstrated the significant role of incisor proclination, anatomy of mandibular symphysis, overjet and compensated mandibular incisors in Class III malocclusion [12]. Kim et al put forwarded that mandibular incisors show greater gingival recession and bone loss in skeletal class III patients than their maxillary counterpart [13]. Richardson et al reported that movement of teeth towards vestibular direction external to the cortical plate/sheath reduces gingival thickness due to narrowing of primary gingival fibers resulting in evident gingival recession [14]. Urs JC et al in a comparative study on orthodontic treatment against surgical distraction associated orthodontic therapy observed significant increase in the height of the clinical crown with mandibular incisors demonstrating variable degree of gingival recession after proclination caused by orthodontic movement and/or by surgical displacement [15]. Gorbunkova et al in a literature review revealed orthodontic tooth movement influences the position of interproximal alveolar crest, interdental papilla and marginal gingiva [10]. Djeu et al showed 10-12% of gingival recession during orthodontic treatment was due to continuous mechanical trauma caused by improper brushing habits [16]. Mostafa et al noted minimal loss of marginal gingiva if the tooth movement is guided within the alveolar bone envelope [17]. Acunzo et al [18], Zawawi et al [19] in their respective studies reported a significant correlation between thin periodontal biotype and pro-inclination orthodontic tooth movement due to decreased labial plate thickness and mechanical resistance. However

Kamak et al [20], Jati et al [8] suggested orthodontic tooth movement should not be considered as the key etiological agent; yet revealed orthodontic tooth movement induced cortical plate defects such as fenestration and dehiscence due to extremely thin cortical bone act as predisposing factor of gingival recession. Boke et al in a retrospective study found increased gingival recession at the mandibular incisor, cuspid region post-orthodontically in extraction patients treated with fixed appliances [21].

2) *Impact and Orthodontic Treatment outcomes*

Johal A et al highlighted on appropriate orthodontic planning that includes selective grinding and proximal reduction of enamel, adequate root torque, removal of occlusal trauma, crown-root alignment and interceptive orthodontics during mixed dentition along with best oral hygiene practices should be assessed prior to initiation of orthodontic appliance therapy to reduce the risk of gingival recession [7]. Renkema AM et al [22], Katsaros C et al [23] in a case-control study illustrated labial gingival recession was significantly higher in orthodontic patients than in untreated control group and also demonstrated bonded active mandibular lingual retainers as the predisposed factor. Closs et al in a retrospective study demonstrated loss of keratinized gingiva in mandibular incisors and areas with less than 2mm keratinized mucosa after orthodontic treatment [24]. Jati et al [8], Kahn et al [25] suggested early orthodontic intervention should be carried out to avoid gingival recession. Morris et al evaluated a weak positive correlation between maxillary arch expansion (posterior teeth) and prevalence of gingival recession after orthodontic tooth movements [6]. In contrast Renkema AM et al also observed complete absence of gingival recession after mandibular incisor inclination in a 5-year post orthodontic treatment retrospective study [26]. Similar study by the same author also showed age was the predominant factor in development of gingival recession in several cases rather than orthodontic retainer given during post-treatment phase [27]. Rodríguez and Pomarino in a clinical study showed gingival recessions (27.5%) were frequently seen with vestibular inclination however the authors observed post-orthodontic tooth movement associated gingival recession were insignificant [9]. Lee et al in a similar study concluded a significant association between orthodontic anterior tooth movement with labial gingival recession irrespective of labial gingiva and alveolar bone thickness, position of the tooth and periodontal status [28]. These contrasting results can be attributed to weak evidence based retrospective studies, poor methodology, interim follow-up, influence of existing attached gingiva, marginal gingiva and other confounding variables.

3) *Management of Gingival Recession*

Elimination of gingival recession risk factors largely impacts the prognosis and treatment outcome of the orthodontic therapy. Several treatment modalities and modification of orthodontic mechanics are recommended to minimize and/or eliminate the risk of gingival recession that includes incorporating good oral hygiene practices, early intervention of malocclusion, elimination of Para-functional habits, atypical extraction, avoiding proclination, controlled dento-alveolar expansion, segmented arch appliance therapy, ideal arch form maintenance

and use of customized bonding techniques [7, 29]. Johal A et al proposed soft tissue augmentation as a prerequisite and suggested free gingival graft in non-extraction cases, patients necessitating pre-surgical/pre-prosthetic rehabilitation prior to the orthodontic tooth movement and also recommended the use of modified coronally advanced tunnel flap along with Enamel Matrix Derivative (EMD) in management of post-orthodontic gingival recession cases [7]. Cairo et al [30], Pini-Prato et al [31] observed coronally advanced flap and/or connective soft-tissue tissue graft in combination with EMD showed good long-term follow-up results in recession coverage. Kosyfaki et al advised immediate muco-gingival surgeries in tooth protrusion or Pro-inclination cases where as suggested delayed surgery in retro-inclination and extrusion to enhance adoptive attached gingiva mechanism [32]. DeSanctis et al in a long term follow-up of treated multiple recession cases witnessed excellent results in modified coronally advancement flap and/or graft in case of maxilla and similar flap along with connective tissue graft in mandible [33].

4. Conclusion

Orthodontic appliance therapy unaided by predisposing and precipitating factors often does not significantly induce gingival recession and impact treatment outcomes. However treatment carried out without consideration of periodontal health may trigger gingival recession. It is well established that significant relation was observed among gingival tissue biotype, width of attached mucosa, pro-inclination, greater maxillary expansion and vestibular inclination tooth movement in occurrence of gingival recession after orthodontic treatment. Controversies still exist to establish the exact etio-pathogenesis behind the prevalence which necessitates adequate awareness, gingival risk assessment methods, long-term prospective studies, appropriate treatment planning along with periodontal approach and consent prior to orthodontic appliance therapy.

References

- [1] Haas AN, Pannuti CM, Andrade AK, Escobar EC, Almeida ER, Costa FO, Cortelli JR, Cortelli SC, Rode SD, Pedrazzi V, Oppermann RV. Mouthwashes for the control of supra gingival biofilm and gingivitis in orthodontic patients: evidence-based recommendations for clinicians. *Brazilian oral research*. 2014 Jul 11; 28:1-8.
- [2] Tufekci E, Dixon JS, Gunsolley JC, Lindauer SJ. Prevalence of white spot lesions during orthodontic treatment with fixed appliances. *The Angle Orthodontist*. 2011 Mar; 81(2):206-10.
- [3] Elkordy SA, Palomo L, Palomo JM, Mostafa YA. Do fixed orthodontic appliances adversely affect the periodontium? A systematic review of systematic reviews. In *Seminars in Orthodontics* 2019 Jun 1; 25(2): 130-157.
- [4] Levin L, Samorodnitsky-Naveh GR, Machtei EE. The association of orthodontic treatment and fixed retainers with gingival health. *Journal of periodontology*. 2008 Nov; 79(11):2087-92.
- [5] Patel M, Nixon PJ, Chan MY. Gingival recession: Part 1. Aetiology and non-surgical management. *British dental journal*. 2011 Sep; 211(6):251-4.
- [6] Morris JW, Campbell PM, Tadlock LP, Boley J, Buschang PH. Prevalence of gingival recession after orthodontic tooth movements. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2017 May 1; 151(5):851-9.
- [7] Johal A, Katsaros C, Kiliaridis S, Leitao P, Rosa M, Sculean A, Weiland F, Zachrisson B. State of the science on controversial topics: orthodontic therapy and gingival recession (a report of the Angle Society of Europe 2013 meeting). *Progress in orthodontics*. 2013 Dec; 14(1):1-5.
- [8] Jati AS, Furquim LZ, Consolaro A. Gingival recession: its causes and types, and the importance of orthodontic treatment. *Dental press journal of orthodontics*. 2016 May; 21:18-29.
- [9] Rodríguez YC, Pomarino SG. Orthodontic dental movement and its association with the presence of gingival recession. *Revista odontológica mexicana*. 2017 Jan 1; 21(1):e8-11.
- [10] Gorbunkova A, Pagni G, Brizhak A, Farronato G, Rasperini G. Impact of orthodontic treatment on periodontal tissues: a narrative review of multidisciplinary literature. *International journal of dentistry*. 2016 Jan 19; 2016.
- [11] Melsen B, Allais D. Factors of importance for the development of dehiscences during labial movement of mandibular incisors: a retrospective study of adult orthodontic patients. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2005 May 1; 127(5):552-61.
- [12] Joss-Vassalli I, Grebenstein C, Topouzelis N, Sculean A, Katsaros C. Orthodontic therapy and gingival recession: a systematic review. *Orthod Craniofac Res*. 2010, 13: 127–41.
- [13] Kim Y, Park JU, Kook YA. Alveolar bone loss around incisors in surgical skeletal class III patients. *Angle Orthod* 2009; 79:676–682.
- [14] Richardson CR, Allen EP, Chambrone L, Langer B, McGuire MK, Zabalegui I, Zadeh HH, Tatakis DN. Periodontal soft tissue root coverage procedures: practical applications from the AAP regeneration workshop. *Clinical Advances in Periodontics*. 2015 Feb; 5(1):2-10.
- [15] Urs JC, Antonini M, Albino T, Kuijpers-Jagtman AM, Stavros K. Gingival recessions of lower incisors after proclination by orthodontic or surgical displacement. *Am J Orthod Dentofacial Orthop*. 2013.
- [16] Djeu G, Hayes C, Zawaideh S: Correlation between mandibular central incisor proclination and gingival recession during fixed appliance therapy. *Angle Orthodontist*. 2002, 72: 238–45.
- [17] Mostafa YA, El Sharaby FA, El Beialy AR. Do Alveolar Bone Defects Merit Orthodontists' respect? *World journal of orthodontics*. 2009 Mar 1; 10(1).
- [18] Acunzo R, Rasperini G, Cannalire P, Farronato G. Influence of Periodontal Biotype on Root Surface Exposure During Orthodontic Treatment: A Preliminary Study. *International Journal of Periodontics & Restorative Dentistry*. 2015 Sep 1; 35(5).
- [19] Zawawi KH, Al-Zahrani MS. Gingival biotype in relation to incisors' inclination and position. *Saudi medical journal*. 2014; 35(11):1378.
- [20] Kamak G, Kamak H, Keklik H, Gurel HG. The effect of changes in lower incisor inclination on gingival recession. *The Scientific World Journal*. 2015 Jan 1; 2015.
- [21] Boke F, Gazioglu C, Akkaya S, Akkaya M. Relationship between orthodontic treatment and gingival health: a retrospective study. *Eur J Dent*. 2014 Jul; 8(3):373–380.
- [22] Renkema AM, Fudalej PS, Renkema A, Bronkhorst E, Katsaros C. Gingival recessions and the change of inclination of mandibular incisors during orthodontic treatment. *European journal of orthodontics*. 2013 Apr 1; 35(2):249-55.
- [23] Katsaros C, Livas C, Renkema AM: Unexpected complications of bonded mandibular lingual retainers. *Am J Orthod Dentofacial Orthop*. 2007, 132: 838–41.
- [24] Closs LQ, Branco P, Rizzato SD, Raveli DB, Rösing CK. Gingival margin alterations and the pre-orthodontic treatment amount of keratinized gingiva. *Brazilian oral research*. 2007; 21:58-63.
- [25] Kahn S, Rodrigues WJ, Barceleiro MD. Periodontal plastic microsurgery in the treatment of deep gingival recession after orthodontic movement. *Case reports in dentistry*. 2013 Nov 7; 2013.
- [26] Renkema AM, Fudalej PS, Renkema AA, Abbas F, Bronkhorst E, Katsaros C. Gingival labial recessions in orthodontically treated and untreated individuals: a case-control study. *Journal of clinical periodontology*. 2013 Jun; 40(6):631-7.
- [27] Renkema AM, Fudalej PS, Renkema A, Kiekens R, Katsaros C: Development of labial gingival recessions in orthodontically treated patients. *Am J Orthod Dentofacial Orthop*. 2013, 143: 206–12.
- [28] Lee JB, Baek SJ, Kim M, Pang EK. Correlation analysis of gingival recession after orthodontic treatment in the anterior region: an evaluation of soft and hard tissues. *Journal of Periodontal & Implant Science*. 2020 Jun; 50(3):146.
- [29] Antonarakis GS, Joss CU, Triaca A, Kuijpers-Jagtman AM, Kiliaridis S. Gingival recessions of lower incisors after proclination by orthodontics alone or in combination with anterior mandibular alveolar process distraction osteogenesis. *Clinical oral investigations*. 2017 Nov; 21(8):2569-79.

- [30] Cairo F, Pagliaro U, Nieri M: Treatment of gingival recession with coronally advanced flap procedures: a systematic review. *J Clin Periodontol* 2008, 35(8):136–62.
- [31] Pini-Prato GP, Cairo F, Nieri M, Franceschi D, Rotundo R, Cortellini P: Coronally advanced flap versus connective tissue graft in the treatment of multiple gingival recessions: a split-mouth study with a 5-year follow-up. *J Clin Periodontol*. 2010, 37: 644–50.
- [32] Kosyfaki P, del Pilar Pinilla Martín M, Strub JR. Relationship between crowns and the periodontium: a literature update. *Quintessence International*. 2010 Feb 1; 41(2).
- [33] De Sanctis M, Baldini N, Goracci C, Zucchelli G: Coronally advanced flap associated with a connective tissue graft for the treatment of multiple recession defects in mandibular posterior teeth. *Int J Periodontics Restorative Dent*. 2011, 31: 623–30.