

REVIEW ARTICLE

Combined periodontal and orthodontic treatment in adult patients with chronic periodontitis- A systematic literature review

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Abstract

Aim: To systematically assess changes of periodontal parameters before and after combined periodontal–orthodontic treatment for patients with chronic periodontitis (Armitage, 1999). **Materials and methods:** An electronic literature search from MEDLINE database of articles published between 2003 and 2018 was conducted. Sequential screenings at the title, abstract and full-text levels were performed. Clinical human studies in the English language that had reported combined periodontal – orthodontic treatment of infrabony defects due to chronic periodontitis were included. **Results:** The search resulted in 10 articles meeting the inclusion criteria: five of them reported combined periodontal – orthodontic treatment with tissue regeneration, five – without regeneration. Studies showed that the combined treatment application resulted in the infrabony defects healing, obtaining a significant probing depth reduction and clinical attachment gain. **Conclusions:** According to the evaluated articles, combined periodontal – orthodontic treatment did not have a negative effect on the healing process in periodontal tissue defects. Further efficacy studies should be carried out with more periodontal measurements of these procedures.

Keywords: Orthodontic appliances, Periodontitis, Regeneration, Treatment outcome

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Introduction

Periodontal infection is able to determine defects that involve alveolar bone and soft tissues defects and furcation lesions ⁽¹⁾. One of the main periodontitis sign– pathological tooth migration which can affect not only teeth function, but also aesthetics ⁽²⁾. Several non-surgical and surgical periodontal techniques have been developed showing optimal clinical outcomes based on the reconstruction of the infrabony defects and mucogingival tissues ⁽³⁾. More and more clinicians are talking about combined treatment of periodontal defects and its effective results^(1,3). There are many links between periodontology and orthodontics – every orthodontic intervention has a periodontal dimension⁽⁴⁾. Treatment planning and orthodontic biomechanics are basically determined by periodontal factors such as the structure of gingiva, width, and height of alveolar bone and length of the roots ⁽⁵⁾.

Orthodontic tooth movement is possible because of the response of the periodontal tissues to an external force– the bone rearrangement ⁽⁶⁾. Bone resorption in the pressure areas is induced by stimulation of osteoclasts while the stimulation of osteoblasts induces bone formation in the stretching areas. A small orthodontic force causes bone remodeling and reconstruction, excessive force – the periodontal ligament and the adjacent alveolar bone necrosis ⁽⁷⁾. It is not known how these biological processes can affect the healing of periodontal defects. Therefore, this systematic review evaluates and compares the periodontal changes after combined periodontal – orthodontic treatment for patients with periodontal tissue pathology.

Materials and Methods

A literature survey was performed using the Medline database. Clinical human studies in the English language that had reported combined

periodontal – orthodontic treatment of infrabony defects were included. The articles between 2003 and 2018 related to the topic were identified. Full articles were obtained from studies that met inclusion and exclusion criteria. The following data were extracted: year of publication, type of the study, sample size, orthodontic treatment duration, periodontal treatment method used, outcome measured, evaluation method, treatment outcomes. The review included studies analyzing effect of combined periodontal - orthodontic treatment in adult patients ≥ 18 years of age and in good general health, not pregnancy or lactating period, patients diagnosed as chronic periodontitis having teeth migration due to infrabony defects clinically and radiologically. It was decided to compare the most important measurements in infrabony defects assessment: probing depth (PD), clinical attachment level (CAL) and radiological data. All periodontal measurements were carried out using the normal periodontal probe and radiologically assessed using cone beam computed tomography (CBCT) scan or digital radiography. Quality assessment of all included studies was performed during the data extraction process. The quality appraisal evaluated the methodological elements that might influence the outcomes of each study. The Cochrane Collaboration’s two-part tool for assessing the risk of bias ⁽²⁵⁾ was used to assess bias across the studies and identify papers with intrinsic flaws in method and design.

Results

The initial search identified a total of 2098 articles. After filter activation, 816 potentially relevant articles were identified. Independent screening of abstracts resulted in the selection of 78 publications for possible inclusion. Inclusion and exclusion criteria were applied to the 78 full-text articles. Finally, 10 articles predefined criteria and were included in the systematic review. The review included 3 controlled clinical trials^(8,10,14), 6 articles were case series studies^(9,11,12,13,16,17), and 1 randomized clinical trial⁽¹⁵⁾. Orthodontic treatment duration was determined on each patient’s indications. One study of orthodontic treatment duration was not demonstrated⁽¹⁶⁾. In all studies, periodontal changes were measured before periodontal therapy and after orthodontic treatment. Four studies measured distant treatment results: one study measured after 6 months of postoperative follow-up⁽¹³⁾, one study after 3 and 6 months⁽¹¹⁾ and two studies after 12 months^(12,15). The quality assessment of the included studies revealed a high risk of bias (high risk of bias for one or more key domains) for the majority of included studies^(8,10,11,16,17). Three studies^(9,12,13,14) classified as unclear risk (unclear risk of bias for one or more key domains) and one randomized clinical trial⁽¹⁵⁾ being at low risk (low risk of bias for all key domains) (Table-1).

Tab. 1 Bias summary

	Random sequence generation	Allocation concealment	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other sources of bias
G. Corrente et al; 2003	?	?	+	+	+	?
D. Cardaropoli et al; 2004	?	?	?	+	+	?
C. Ghezzi et al; 2008	?	?	?	+	-	+
Sh. Ogihara et al; 2010	+	+	+	+	+	+
S. Boyer et al; 2011	?	?	+	-	+	+
C. Ghezzi et al; 2011	?	?	+	+	-	-
M. Sh. Attia et al; 2012	?	?	?	+	+	?
Af. Khorsand et al; 2013	?	?	?	-	+	?
T. Cao et al; 2015	?	?	?	+	+	?
Z. Gui Ma et al; 2015	?	?	+	+	+	-

“+” low risk of bias; “-” high risk of bias; “?” unclear

Probing depth and clinical attachment level changes after combined periodontal-orthodontic treatment

Periodontal therapy without regenerative materials

In G. Corrente et al; study ⁽⁹⁾ it was found that the application of combined treatment was successful – probing depth decreased and clinical attachment level gained significantly. A. Khors and study ⁽¹¹⁾ showed a statistically significant decrease in probing depth not only after orthodontic treatment application but also in postoperative measurements after 3 and 6 months. D. Cardaropoli and other authors ⁽¹²⁾ found that there was a statistically significant difference between probing depth, clinical attachment level initial measurements and the final results after orthodontic treatment, but after 1 year postoperative monitoring statistically, significant alterations were not observed.

Periodontal therapy with regenerative materials

Sh. Ogihara and others ⁽¹⁵⁾ showed that regenerative periodontal therapy (infrabony defects filled with *Emdogain*/demineralized freeze-dried bone allograft) and orthodontic treatment was successful in probing depth reduction and clinical attachment level gain. Combined treatment method with *Emdogain*/collagen bovine mineral bone was effective in C. Ghezzi et al; study ⁽¹⁷⁾. Authors argue that the biggest advantage of this method is that even early orthodontic treatment did not negatively affect the bone healing process.

Radiological changes of alveolar bone before and after applied periodontal – orthodontic treatment

Periodontal therapy without regenerative materials

The alveolar bone height preservation was not ensured measuring parameters after combined treatment and even after postoperative results in S. Boyer et al; study ⁽⁸⁾. On the contrary, Z.G. Ma et al; ⁽¹⁰⁾ study showed, that combined treatment in periodontal patients can preserve bone height, but not the bone density. G. Corrente⁽⁹⁾ found that vertical and horizontal bone defects were significantly decreased after combined treatment. According to the authors, combined periodontal – orthodontic treatment of

infrabony defects can provide effective treatment results. T. Cao ⁽¹³⁾ also applied the combined treatment and radiologically determined significant bone formation both horizontally and vertically.

Periodontal tissue changes after orthodontic treatment, depending on the time elapsed after applied periodontal treatment

Periodontal therapy with regenerative materials M.S. Attia study ⁽¹⁴⁾ compared the application of orthodontic treatment immediately or 2 months after periodontal therapy. Both methods were effective in probing depth decrease and clinical attachment level gain but better results were obtained in the group where orthodontic treatment was applied immediately. It was found, that the application of orthodontic treatment 1 year after periodontal therapy did not change measurements significantly in C. Ghezzi study ⁽⁹⁾.

More detailed results are presented in Table- 2.

Discussion

According to the articles, using combined periodontal - orthodontic treatment with or without tissue regeneration shows positive results: reduction in probing depth, gain in clinical attachment level.

Of course, long-term and stable periodontal treatment results depend on individual oral hygiene. Boyer et al; ⁽⁸⁾ note that dental arch correction with orthodontic appliances can improve and facilitate oral hygiene and ensure better treatment results. However, orthodontic appliances are a great place of plaque accumulation, so it is very important to have control visits to perform professional oral hygiene ⁽¹⁸⁾.

Excessive orthodontic forces can cause tooth ankylosis or root resorption ⁽¹⁹⁾. The suitable orthodontic force depends on root morphology: diameter, length and surface area ⁽²⁰⁾. Orthodontic treatment without periodontal intervention cannot restore the loss of surrounding tissues, because it is not possible to avoid connective epithelial migration toward the tooth root, so orthodontic treatment should be started after periodontal therapy ⁽²¹⁾.

Comparing the periodontal tissue changes after orthodontic treatment, depending on the time elapsed after the applied periodontal therapy,

better results were obtained if orthodontic treatment was applied immediately or 1-2 months after periodontal surgery ⁽¹⁶⁾. For example, in Ghezzi et al; study ⁽¹⁶⁾ orthodontic treatment was applied 1 year after periodontal surgery and the results were not significant because of the matured, formed new bone around teeth. However, Corrente et al; ⁽⁹⁾ state that early orthodontic treatment after periodontal therapy may affect the gums contour improving the aesthetic appearance.

Talking about radiological changes, Z. Gui Ma et al; study ⁽¹⁰⁾ suggests that orthodontic treatment can ensure the preservation of bone

height, but not the bone density. It is believed that patients with periodontitis may lead to metabolic bone disorders and bone remodeling may be unusual. Roberti and Chase ⁽²²⁾ state that orthodontic tooth movement can re-stimulate the periodontal ligament cells in the mitotic activity, and Melsen et al; ⁽²³⁾ found that orthodontic tooth movement promotes the formation of the new periodontal ligament. It was found that during tooth movement the mechanical stress stimulates the secretion of growth factors ⁽²⁴⁾. Growth factors stimulate blood vessels growing into the defect and then bone formation is in the remodeling process⁽¹⁵⁾

Table- 2: Author's result

Author	Samele size	Study design	Orthodontic treatment	Periodontal therapy	Outcome measured	Evaluation method	Treatment outcomes
G. Corrente et al; 2003	10	Case series	10±2,6 months	Open flap surgery, SRP	PD; CAL; VBH	Radiographs; probing	PD reduction 4.35±1.33 CAL gain 5.50±1.75 VBH fill 1.35±0.75 mm
D. Cardaropoli et al; 2004	28	Case series	6-18 months Follow-up 1 year	Open flap surgery, SRP	PD; CAL	Probing	PD reduction 4.29±1.12mm CAL gain 5.93±1.41 mm Follow up: PD 2.64±0.49 CAL 3.54±1.10
C. Ghezzi et al; 2008	14	Case series	1 Year after periodontal therapy	SRP; EMD/resorbable collagen membrane	PD; CAL	Radiographs; probing	Before orthodontics PD reduction 5.57±1.55 CAL gain 5.86±1.74 After orthodontics PD 0.07±0.2 CAL 0.43±0.7
Sh. Ogihara et al; 2010	24	Randomized clinical trial	12 months Follow-up 1 year	Open flap surgery; SRP; EMD+DFDB A	PD; CAL	Probing	PD reduction 4.21±1.35 CAL gain 3.67±0.76
S. Boyer et al; 2011	15	Controlled clinical trial	12-18 months	Open flap surgery, SRP	ABH	Radiographs	ABH Before 68.21±20.99 pix After 57.73±16.86 pix
C. Ghezzi et al; 2011	10	Case series	9±3.2 months	SRP + EMD + CBMB	PD; CAL	Radiographs; probing	PD reduction 3.7±1.77 CAL gain 4.4±1.71
M. Sh. Attia et al; 2012	15	Controlled clinical trial	6-12 months	Open flap surgery, SRP + Bio Glass resorbable collagen membrane	PD; CAL; Bone fill	Radiographs; probing	PD reduction 4.0±0.8 CAL gain 5.1±1.4 mm BF: 3.7±1.2
Af. Khorsand et al; 2013	8	Case series	10-24 months	Open flap surgery, SRP	PD	Probing	PD 0.23±0.05
T. Cao et al; 2015	14	Case series	18-19 months	SRP + GTR	PD; CAL ABH	Radiographs (3D CBCT); probing	PD reduction 2.89±1.16 CAL gain 3.30±1.57 ABH gain 2.11±1.30
Z. Gui Ma et al; 2015	40	Controlled clinical trial	20-33 months	Open flap surgery, SRP	ABH ABD	Radiographs (3D CBCT)	ABH reduction: 0.16±1.69 ABD reduction: 29.09±17.56

PD – probing depth; CAL – clinical attachment level; ABH – alveolar bone height; ABD – alveolar bone density; VBH- vertical bone height, CBMB – collagen bovine mineral bone; SRP – scaling and root planning; GTR – guided tissue regeneration

Conflict of Interest: None declared

Source of Support: Nil

Conclusion

All the studies demonstrated that orthodontic treatment for patients with periodontal disease is no longer a contraindication and it is more and more being used in combination with periodontal treatment. In addition, orthodontics enables not only to stop the pathological tooth migration but also restore function and aesthetics.

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