The Saudi Journal for Dental Research (2015) 6, 86–90

King Saud University

The Saudi Journal for Dental Research

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ORIGINAL ARTICLE

Effects of the initial stage of active fixed orthodontic treatment and sex on dental plaque accumulation: A preliminary prospective cohort study

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Received 25 July 2014; revised 7 September 2014; accepted 17 September 2014
Available online 14 October 2014

KEYWORDS

Orthodontics;
Periodontics;
Sex;
Dental plaque

Abstract *Objectives:* The aim of this pilot study was to assess the effect of orthodontic treatment and gender on plaque index.
Materials and methods: In this prospective cohort study, the O'Leary plaque index of 25 orthodontic patients was clinically examined before the beginning of treatment (as control) and after the leveling stage (as treatment group). The role of treatment and gender was assessed using two-way repeated-measure ANOVA, paired and independent-sample *t*-tests, and Pearson correlation coefficient ($\alpha = 0.05$, $\beta \leqslant 0.1$).
Results: ANOVA showed a significant increase in plaque index after treatment ($P = 0.000$), but without any difference between the genders ($P = 0.997$) or any interaction between the variables gender and treatment ($P = 0.796$). There were significant post-treatment increases in plaque index in males (paired *t*-test's $P = 0.018$) and females ($P = 0.000$). The plaque indices were not different between males and females, either before leveling (independent-sample *t*-test's $P = 0.785$) or after it ($P = 0.880$). There were no correlations between patients' gender and either of pre- or post-treatment

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.sjdr.2014.09.001

PI levels (both r statistics < 0.06, both P values > 0.83). However, the correlation between pre- and post-treatment plaque indices was significant ($r = 0.623$, $P = 0.001$).
Conclusion: Initial stage of active fixed orthodontic treatment can cause considerable dental plaque accumulation, similarly in men and women.

1. Introduction

Fixed orthodontic therapy is a risk factor for plaque accumulation, because of the increases in the retention areas and disrupting the oral hygiene maintenance.[1–4] Dental plaque is a highly complex bacterial structure which when accumulated, shifts to gram-negative anaerobic or facultative species which can cause periodontal disease.[1,4] Besides, it can cause white spot lesions, which is again an unfavorable complication.[5,6] Gingival and periodontal inflammations might disrupt the desired effect of orthodontic treatment by the loss of periodontal connective tissue attachment and inhibiting the remodeling.[7] Besides, gingival damage can worsen during orthodontic treatment.[1,8] Therefore, assessment of dental plaque is necessary in patients undergoing fixed orthodontic treatment.[4]

Plaque accumulation caused by orthodontic treatment is assessed in some studies.[2,4,9–13] Most studies on this subject have evaluated the effect of hygiene control measures during treatment, not the effect of treatment itself.[12,14] Although some studies agree that plaque aggregation increases by fixed orthodontic treatment,[2] some studies have not found increases.[10,15] This controversy might be attributed to the study durations and educations given to patients.

Adults are much more prone to periodontal problems than children.[1,16] This implies the need to assess the subject in adults.[13,14] Moreover, most previous studies have used the Silness and Löe plaque index.[4,17] This index is one of the most convenient ones; however, it cannot accurately discriminate the condition of plaque accumulation.[4] Therefore, the assessment of this topic using other common indices that might give a more objective view of the plaque might be of value. Furthermore, it is not known if the problem of plaque accumulation is more serious in males or females, although few studies have suggested that males might have poorer oral hygiene.[15,18] Hence, assessing the role of sex is helpful in better understanding the topic.

Due to the abovementioned controversies and shortcomings, this study was conducted to prospectively evaluate the changes in the plaque coverage area (estimated by the O'Leary plaque index)[19] after the active initial stage of active fixed orthodontic treatment (leveling and alignment) in young adults and adults, and also between the sexes. The null hypotheses were (1) there is no difference between the plaque index before and after the treatment; (2) there is no difference between the changes of plaque index in men and women; (3) the effect of treatment is similar.

2. Subjects and methods

This preliminary prospective cohort study was conducted in the Graduate School Clinic at the Manila Central University (MCU). The sample of this study comprised 50 repeated (before/after) observations. These 50 observations were acquired from a cohort of 25 Filipino patients undergoing the initial stage of fixed active orthodontic treatment from the beginning. Of the samples, 7 were males and 18 were females. The patients were young-adults and adults (aged 18 – 32). The institutional review board of the Faculty of the Graduate School of the Manila Central University approved the study design. Written consent forms were acquired from all the participants. Preliminary interviews using Inclusion/Exclusion criteria as well as dental check-ups were conducted with the respondents. Their dental and other health history recorded to ascertain patients' systemic and oral health. Exclusion and Inclusion criteria specified in this study was used to guide the random selection of respondents. Framing of sample was conducted from before the start of patients' strap-ups until the end of their initial orthodontic treatment, the leveling stage (3–6 months). Specifically, those included in the study satisfied all three requirements herein enumerated: (1) Healthy oral and gingival conditions prior to receiving the fixed labial orthodontics. This was confirmed in the information record presented by the patient who signed the consent form which thus prompted the beginning of treatment. (2) The absence of any prior hospitalization or intake of medicines during the conduct of this study. (3) No systemic health issues or risk factors which can affect their oral health conditions during orthodontic treatment. Explicitly, the Inclusion criteria were patients' willingness to participate, them being systemically healthy, non-smoker, literate, having no more than 2 extraction sites before the admission, having healthy normal gait and postures. As the Exclusion criteria patients, participants were reported not to have any gingival or periodontal disease prior to their orthodontic treatment, although during course of orthodontic treatment some patients showed signs and symptoms of mild periodontitis or moderate to severe gingivitis due to poor oral hygiene and resulted in oral inflammatory reactions. The other Exclusion criteria were any removable orthodontic appliances, any diseases or syndromes or signs/symptoms of temporomandibular disorders, contraindications for radiography, being heavy drinker or smoker, taking any NSAID medication, hospitalization or hormone therapy during the past 6 months prior to the study, being pregnant or nursing mothers, and other hormonal imbalances such as goiter or hyperthyroidism.

2.1. Orthodontic treatment

The leveling and alignment phase of fixed orthodontic treatment lasted for 3–6 months and was carried out using merely fixed appliances with the minimum possible forces exerted by frictionless round nickel titanium archwires.

2.2. O'Leary plaque index (PI)

The O'Leary plaque index (PI)[19] was measured for 25 patients before fitting the brackets and after the initial phase of active