# Comparison of longitudinal changes in clinical periodontal parameters of canines and first molars treated with fixed orthodontic appliances

**Neeraj Agrawal,[a] Debabrata Kundu,[b] Kavita Agrawal,[c] and Ankit Singhal[d]**
*Bhopal, Kolkata, and Garwha, India*

**Introduction:** Our objective was to learn the possible effects of fixed orthodontic therapy on the periodontium of the extraction sites adjacent to canines and first molars. This was a prospective cohort study. **Methods:** Sixty-two systemically healthy subjects were selected. The study was divided into the period of oral hygiene instructions and the period of active orthodontic treatment. Plaque index, gingival index, probing pocket depth, and clinical attachment loss were recorded for the canines and first molars at baseline, after 1 month of orthodontic therapy, and every 3 months until the completion of the orthodontic treatment. **Results:** There was a statistically significant increase in all clinical parameters (plaque index, gingival index, probing pocket depth, and attachment loss; $P < 0.05$) on the first molars compared with the canines. Significant increases in attachment loss were noted in both the canines (baseline, 0.06 ± 0.01 mm; end of treatment, 0.17 ± 0.02 mm) and the molars (baseline, 0.07 ± 0.01 mm; end of treatment, 0.20 ± 0.02 mm). **Conclusions:** Attachment loss cannot be explained solely by the effect of plaque or the banding of teeth. Other factors such as tooth extractions adjacent to the canines, tooth movement, and occlusal trauma may have contributing roles in the loss of periodontal support in adolescent patients. (Am J Orthod Dentofacial Orthop 2016;149:325-30)

It is well established that bacterial plaque is the primary etiologic factor in the development of gingival inflammation and periodontitis.[1] Various studies in the literature have addressed the impact of fixed, removable, and myofunctional orthodontic appliances or retainers in relation to supragingival plaque accumulation and gingivitis.[2] However, once appliances are removed, periodontal conditions may revert to normal: ie, those observed before the treatment.[3,4] Attention has also been given to qualitative alterations in the subgingival biofilm, mostly related to destructive periodontal disease and to putative periodontopathogens in subgingival areas during orthodontic treatment.[5,6]

[a]Reader, Department of Periodontology, People's Dental Academy, Bhopal, India.
[b]Professor and head, Department of Periodontology, Dr. R. Ahmed Dental College and Hospital, Kolkata, India.
[c]Reader, Department of Oral Medicine Diagnosis and Radiology, People's College of Dental Sciences and Research Centre, Kolkata, India.
[d]Reader, Department of Orthodontics, Vananchal Dental College and Hospital, Garwha, India.
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Address correspondence to: Neeraj Agrawal, Department of Periodontology, People's Dental Academy, Bhanpur, Bhopal-462037, India; e-mail, dna7kgmc@gmail.com.
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A systematic review of the control evidence suggests that orthodontic therapy causes small detrimental effects to the periodontium, but with the available data it is not clear whether these small adverse changes indicate large site-specific changes (eg, molar bands or extractions) or host-specific factors (eg, alterations of oral hygiene habits during orthodontic therapy).[7] In most fixed orthodontic therapies, there is a tooth and arch length discrepancy, and usually either the first or the second premolars are extracted. The spaces created by the extractions are used for alignment of the teeth, where anterior teeth are retracted, with some anchorage loss in the permanent first molars. The possible soft or hard tissue defects created by the extraction sites can pose both favorable and unfavorable periodontal outcomes after orthodontic therapy. We hypothesized that there is no difference in the periodontal statuses of canines and molars adjacent to extraction sites in patients treated with fixed orthodontic therapy. To determine the possible outcomes at the extraction sites, we compared the periodontal statuses of canines and molars during fixed orthodontic treatment.

## MATERIAL AND METHODS

Eighty subjects were enrolled in this longitudinal clinical study, which was conducted from May 2010 to

May 2014. Participants were recruited from the patients attending the outpatient department of orthodontics and periodontics at Dr. R. Ahmed Dental College and Hospital in Kolkata, India. The subjects and their parents were well informed about the study, and written consent was obtained. Ethical committee approval was obtained from the university's ethical board.

The inclusion criteria were patients 11 to 22 years of age who were in good general health and had all permanent teeth erupted (except the third molars). Only patients who were planned for extraction of all first premolars were selected for the study. Patients taking any form of tobacco or betel nuts were excluded. Patients who needed any auxiliaries, hooks, or the like on the fixed orthodontic appliances, or had extensive dental restorations or fixed partial dentures, were also excluded.

The study had a longitudinal prospective design and was divided into 2 experimental periods: oral hygiene education and follow-up.

The program of oral hygiene education was given to each subject, 2 weeks before the commencement of the study. It included motivation regarding the oral health benefits of effective plaque control, instructions in proper oral hygiene measures using the horizontal scrub technique of toothbrushing, and oral prophylaxis. All subjects requiring orthodontic treatment were made aware that satisfactory oral hygiene was a prerequisite for treatment. Only those who scored less than 1 on the plaque and gingival indexes at the end of this phase were included in the study.

The follow-up period was the active orthodontic treatment, which lasted for 14 to 22 months (mean, 18.3 months). All subjects were treated with 0.022-in slot appliances (MBT; 3M Unitek, Monrovia, Calif). Brackets were bonded (Fuji Ortho LC; GC, Tokyo, Japan) on each tooth excluding the permanent first molars, which were banded (stainless steel micro-etched orthodontic bands; IMD, Shanghai, China). During bonding, the adhesive flash was removed from the teeth with a probe, and each bracket was then light cured for 40 seconds (10 seconds on each side) at a distance of 1 mm from the bracket using a light-curing unit (2500; 3M ESPE Dental Products, St Paul, Minn). For banding, the margins of the bands were first adapted with a band pusher, and then the bands were tightly fitted to decrease the possibility of enamel dissolution. After this manipulation, the bands were cemented on the first molars. A transpalatal arch fabricated of 0.9-mm stainless steel wire was soldered to the maxillary first molar bands. During this period, repeated motivation and awareness of oral hygiene techniques were taught with the help of a disclosing solution, but no professional prophylaxis was given to any patient. All subjects received soft, multitufted orthodontic brushes (Colgate extra-soft orthodontic toothbrush; Colgate-Palmolive, New York, NY). In all patients, the curve of Spee was leveled using light forces from a Burstone intrusion arch fabricated from a 0.017 × 0.025-in CNA β III wire (Ortho Organizer, Inc, Carlsbad, Calif) tied as a 1-couple system distal to the lateral incisors on a continuous 0.016-in nickel-titanium wire and later on a 0.019 × 0.025-in Nitinol Heat-Activated Archwire (Unitek, Monrovia, Calif). The arches were considered to be leveled and aligned when a 0.019 × 0.025-in stainless steel archwire having an ideal arch form was ligated in the brackets. Space closure was carried out with a 0.019 × 0.025-in stainless steel wire using sliding mechanics with E-chains between the second molar to the crimpable hook mesial to the canine in each quadrant. The periodontal assessment was done by the same examiner (N.A.) using the plaque index, the gingival index, probing pocket depth, and clinical attachment loss. For recording all parameters, the examiner was blinded to the previous scores; each site was recorded 3 times, and the average of these recordings was scored as the final reading. For the molars, relative attachment loss was assessed using the top edge of the band as a reference point because of the difficulty in determining the cementoenamel junction. Recordings were done with a periodontal probe (UNC PCP-15; Hu-Friedy, Chicago, Ill). All values were reported to the nearest 0.5 mm with the periodontal probe. All permanent canines and first molars (6 sites per teeth) were measured at the baseline (T0), after 1 month of orthodontic therapy (T1), and at 3-month intervals (T2-T5) until the completion of the treatment.

### Statistical analysis

Clinical parameters were compared between the canines and the molars using 2-way mixed factorial analysis of variance (ANOVA) followed by the least significant difference (LSD) post hoc test. A $P$ value less than 0.05 was considered significant. The analysis was performed using SPSS software (version 21; IBM, Armonk, NY).

## RESULTS

Eighty subjects were enrolled for the oral hygiene education phase. Only 68 were found to be suitable for the follow-up period; the remaining 12 subjects either were unable to maintain oral hygiene despite our repeated instructions or lost interest in participation. Of the 68 participants, 62 completed the study satisfactorily. The remaining participants did not follow the scheduled follow-up program for various reasons.