

# Comparison of periodontal parameters after the use of orthodontic multi-stranded wire retainers and modified retainers

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## Abstract

**Objective:** The objective of the present study was to compare two types of fixed orthodontic retainers (a multi-stranded wire retainer and a modified retainer) in relation to established periodontal parameters. The multi-stranded wire retainer is commonly used, and the modified retainer has bends to enable free access of dental floss to interproximal areas.

**Methods:** For this crossover study, 12 volunteers were selected and used the following retainers for six months: (A) a multi-stranded wire retainer and (B) a modified retainer. Both retainers were fixed to all anterior lower teeth. After this experimental period, the following evaluations were made: Dental Plaque Index, Gingival Index, Dental Calculus Index and Retainer Wire Calculus Index. The volunteers also responded to a questionnaire about the use, comfort and hygiene of the retainers. **Results:** It was observed that the plaque index and the gingival index were higher on the lingual surface ( $p < 0.05$ ) for the modified retainer. Furthermore, the calculus index was statistically higher ( $p < 0.05$ ) for the lingual and proximal surfaces when using the modified retainer. The retainer wire calculus index values were also significantly higher ( $p < 0.05$ ) for the modified retainer. In the questionnaire, 58% of the volunteers considered the modified retainer to be less comfortable and 54% of them preferred the multi-stranded wire retainer. **Conclusion:** From the results obtained, it could be concluded that the multi-stranded wire retainer showed better results than the modified retainer according to the periodontal parameters evaluated, as well as providing greater comfort and being the retainer preferred by the volunteers.

**Keywords:** Orthodontic retainers. Gingival index. Plaque index. Calculus index.

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## INTRODUCTION

Fixed retainers are frequently used on the lingual side of the anterior lower teeth to stabilize the results of orthodontic treatment.<sup>3,9,22,24</sup> Such retainers are prescribed to avoid the relapse and crowding of mandibular incisors.<sup>3</sup> The greatest disadvantage of using fixed orthodontic retainers is the tendency for plaque and calculus to accumulate along the retainer wire<sup>3,12</sup>, which after prolonged periods tend to cause the loss of hard and soft tissues adjacent to the wire.<sup>3</sup> The presence of a fixed retainer makes oral hygiene difficult, as the retaining wire leads to areas that are more difficult to keep clean; this favors plaque formation around the teeth, which in turn can favor calculus formation and induce gingival inflammation and periodontal disease.<sup>1</sup>

Conventionally, plain fixed retainers are rectilinear wires fixed only to the canines,<sup>24</sup> however their use could not avoid lower incisor minor relapse. A variation of this retainer, known as the modified retainer,<sup>7,8,9,17</sup> has folds below the papillae of the incisors and canines to enable free access of dental floss, with the aim of facilitating oral hygiene. However, it is fixed to all the anterior mandibular teeth.<sup>8</sup> In a recent study, Shirasu et al<sup>21</sup>, compared the two models of fixed retainers and showed that with the modified retainers, there was greater plaque and calculus accumulation both on the wire and at the gingival margin, and consequently, this produced greater gingival inflammation. This result was attributed to the greater length of the orthodontic wire, its greater contact with dental surfaces and the fact that it was fixed to all the teeth in the anterior segment. However, the other retainer evaluated in this study was the conventional plain 3x3, which only needs to be fixed at its extremities, which is a relevant factor for smaller plaque and calculus accumulation on both the wire and at the gingival margin.

The use of a multi-stranded wire retainer attached to all the teeth in the anterior segment is prescribed in cases of severe crowding, thus avoiding the risk of relapse.<sup>10,25</sup> However, to date, there are no studies in orthodontic literature that compare these two types of retainers when they are fixed to all the teeth. In the light of this, the objective of the present study was to evaluate the plaque and calculus accumulation on the wire and at the gingival margin, as well as the gingival conditions caused by the use of the modified and multi-stranded wire retainers, when they are fixed to all of the anterior teeth.

## MATERIALS AND METHODS

### Selection of volunteers

Twelve volunteers were selected to participate in this study, all of whom underwent an anamnesis and a clinical oral examination. The inclusion criteria were that the volunteers: were not using another orthodontic appliance during the research period, had good alignment of the mandibular anterior teeth and had no periodontal disease.

The volunteers signed free and informed terms of consent which were in accordance with the Regulatory Rules and Directives of the National Health Council (Resolution No. 196/96) and the study began after approval by the Human Research Ethics Committee of the State University of Maringá.

### Experimental design

A crossover study was carried out, containing two treatment phases:

- » A – use of a multi-stranded wire retainer,
- » B – use of a modified retainer.

The experimental period was 6 months, with a 15-day interval between the two phases. Before each phase, the volunteers had the roots of their mandibular anterior teeth scaled and polished, and they received oral hygiene guidance. Clinical evaluations were carried out after the end of each phase. All the evaluations were carried out by the same examiner.

### Manufacture of the retainers

The retainers were made by the same orthodontist, from special plaster models obtained from each volunteer.

### Multi-stranded wire retainer

The retainer was made from multi-stranded 0.020-in orthodontic wire (Morelli, Sorocaba, Brazil) (Fig 1) and fixed 4 mm from incisal edges of mandibular anterior teeth, avoiding incisor rotation, changes in the intercanine distances and not disrupting esthetics. The height was standardized by using a dental floss which was folded and passed in the interproximal regions of lateral and central incisors on both sides (Fig. 2). In this manner, the retainer was held in position by the dental floss and a knot was tied to the buccal surface of the teeth enabling the retainer to be kept in exactly the same position it was in on the plaster model while it was being cemented to the canines. The retainer was then bonded to all of the anterior teeth.

### Modified retainer

The modified retainers (Fig 4) were made from 0.6 mm / 0.024-in round wire (Morelli, Sorocaba, Brazil) and fixed so that the upper bends were 4.5 mm from the most cervical point of the incisors (Fig 3), leaving a distance of approximately 0.5 mm from the lingual papilla.<sup>14,26</sup> The upper part of the retainer, located in the center of the lingual face of each tooth was left in passive contact with it so it could be a point of fixation. The bonding process was carried out using a silicon device and a resin composite, 3M Concise (3M-Glendora, CA, USA). In the cervical region, the end of the resin was kept at zero degrees in order to avoid creating a mechanical bacterial plaque retention area.<sup>7,8</sup>

### Clinical evaluations

After each phase, periodontal evaluations of the mandibular anterior teeth were carried out in two proximal and one lingual area by using



FIGURE 1 - Multi-stranded wire retainer cemented at ends and pre-stabilized with dental floss.



FIGURE 2 - Multi-stranded wire retainer after being fixed to all the teeth.



FIGURE 3 - Modified retainer fixed to the plaster model with pink wax.



FIGURE 4 - Silicone guide used in the bonding procedure.



FIGURE 5 - Modified retainer after being bonded to the teeth.

the: Dental Plaque Index,<sup>21</sup> Gingival Index<sup>18</sup> and Dental Calculus Index.<sup>19</sup> The amount of calculus on the retainer wire was also measured.<sup>3</sup>

### Questionnaires

All of the volunteers responded to a questionnaire after the end of each phase of the study, through which the two retainers were analyzed in terms of comfort, easiness to clean and their approval by the volunteers.

### Statistical analysis

The means obtained for the plaque, gingival and calculus index variables were compared by the Tukey's Studentized Range test (HSD), using a 5% level of significance.

## RESULTS

### Plaque index

In Figure 6, the mean bacterial plaque indices for lingual, proximal and total faces are shown for the periods when multi-stranded wire and modified retainers were used. Greater plaque accumulation was observed for the modified retainer, with the difference being statistically significant for the lingual and total faces compared with values for the multi-stranded wire retainer.

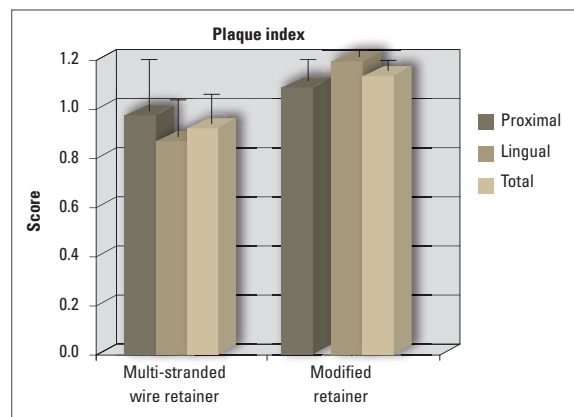


FIGURE 6 - Means and standard deviations for plaque index on the proximal, lingual and total surfaces for multi-stranded wire and modified retainers.

### Gingival index

In Figure 7, the mean gingival indices for lingual, proximal and total faces are shown for the periods when the multi-stranded wire and modified retainers were used. There was a statistically significant difference in the results only for the lingual face, with the modified retainer showing the higher index.

### Calculus index

The mean dental calculus indices are shown in Figure 8. There was a statistically significant difference in the results only for the total faces, when the multi-stranded wire and modified retainers were compared, with the modified retainer showing the higher index.

### Retainer wire calculus index

The results for the retainer wire calculus indices are presented in Figure 9. There was greater calculus accumulation on the modified retainer wire, with this difference being statistically significant.

### Questionnaire

The results for the questionnaire are presented in Table 1.

With regard to the comfort of the retainers, 58% of the volunteers thought the modified retainer was less comfortable. Fifty-four percent

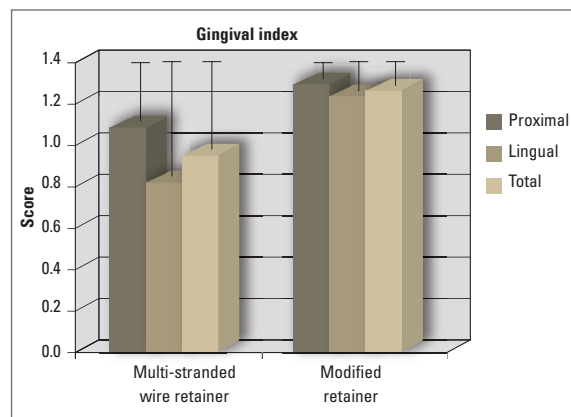


FIGURE 7 - Means and standard deviations for gingival index on the proximal, lingual and total surfaces for multi-stranded wire and modified retainers.

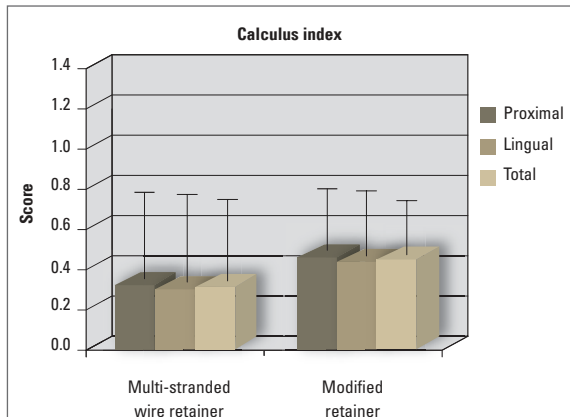


FIGURE 8 - Means and standard deviations for dental calculus index on the proximal, lingual and total surfaces for multi-stranded wire and modified retainers.

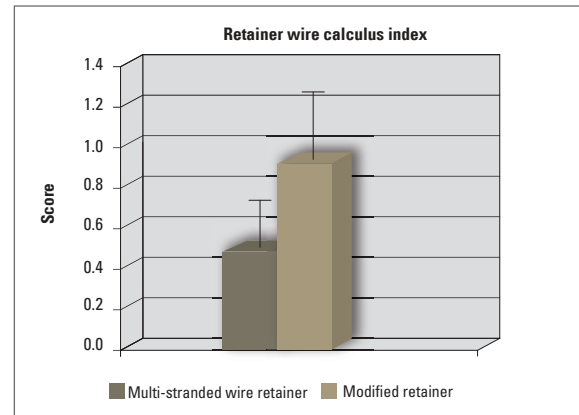


FIGURE 9 - Means and standard deviations of the scores obtained for the retainer wire calculus index for multi-stranded wire and modified retainers.

reported that they were able to achieve better hygiene with the conventional multi-stranded wire retainer. Seventy-nine percent confirmed the need to use a floss threader when using the conventional multi-stranded wire retainer, while 21% confirmed this need when using the modified retainer. Fifty-four percent of the volunteers reported that the conventional multi-stranded wire retainer was better, while 46% preferred the modified retainer.

## DISCUSSION

Orthodontic retainers are important resources in orthodontic treatment for the purpose of post-movement stabilization of teeth.<sup>3,22,23</sup> However, the greatest problem caused by their use is the difficulty of maintaining oral hygiene, leading to plaque and calculus accumulation on the retainer wire and in adjacent areas.<sup>3,12</sup> Modified retainers were created in an attempt to improve access to the interproximal regions to enable the use of dental floss.<sup>7,8,9,17</sup>

The present study has shown that a greater plaque accumulation occurs on lingual and total surfaces when using the modified retainer, when compared with the multi-stranded wire retainer (Fig 6). These results corroborate those found by Shirasu,<sup>21</sup> although the difference between the two types of re-

TABLE 1 - Results of the questionnaire administered to the volunteers.

	Multi-stranded wire retainer	Modified retainer
Comfort in use	58%	42%
Better hygiene	54%	46%
Need to use a floss threader	79%	21%
Preferred type of retainer	54%	46%

tainers was quantitatively smaller in the present study than that found in 2007. This can be explained by the fact that the multi-stranded-wire retainer in the present study was cemented onto all six anterior teeth, which favors the accumulation of plaque in these regions. The continuous presence of retainer wires creates areas that are difficult to clean.<sup>4</sup> Furthermore, the difficulty in maintaining hygiene leads to worse consequences for the periodontal areas in patients that use retainers fixed to all the teeth.<sup>4</sup> There was no statistically significant difference in plaque accumulation on the proximal surfaces, demonstrating that the modified retainer, in spite of offering free access for dental floss, does not offer any advantages with regard to the plaque index in the proximal region, since the volunteers managed to clean interproximal faces to a similar extent with both retainers.

The gingival index was higher for the modified retainer on the lingual surfaces (Fig 7), this being in agreement with the results found for the plaque index, as the greater the quantity of bacterial plaque, the greater the gingival inflammation.<sup>13</sup> This can be explained by the modified retainer design that has U-shaped bends on the lingual surface,<sup>8</sup> which lead to greater plaque accumulation, and consequently, to a greater degree of gingival inflammation. There was no statistically significant difference on the proximal surfaces, this being in agreement with the results found for the plaque index.

The calculus index for the total surfaces was higher for the modified retainer than the multi-stranded wire retainer. Although the proximal and lingual faces both had higher means for the modified retainer, they were not statistically different (Fig 8). This result can be attributed to the small sample of volunteers, the short evaluation time, the volunteers' manual care and good oral hygiene standards, as they were dental students.

Evaluation of the retainer wire calculus index demonstrated that the modified retainer had greater calculus accumulation (Fig 9). This can be attributed to the larger surface area of the modified retainer wire and to it being in greater contact with the dental surfaces; in agreement with a previous study.<sup>26</sup>

In the questionnaire applied to all of the volunteers, 58% chose the modified retainer as being the

least comfortable, complaining about the tongue sensitivity it caused. This could be attributed to this retainer being made with a longer piece of orthodontic wire.<sup>26</sup> With regard to cleaning the interproximal areas, 79% confirmed that it was necessary to use a floss threader with the multi-stranded wire retainer, and 21% confirmed this for the modified retainer. From these 21% all stated that they were unable to floss down to the gingival sulcus. This can be attributed to all the volunteers being dental students, who understood the need for flossing down to the gingival sulcus. For this reason, 54% of them stated that they could achieve better hygiene using the multi-stranded wire retainer, because although it required more time to clean the interproximal areas, they were able to do so more thoroughly. Fifty-four percent of the volunteers stated that they preferred the multi-stranded-wire retainer, and considered it to be better than the modified retainer, because they were able to perform interproximal cleaning more thoroughly, flossing down to the gingival sulcus, and also because they accumulated less food when eating.

## CONCLUSION

The findings demonstrated that the multi-stranded wire retainer offered better results than the modified retainer according to the periodontal parameters evaluated, as well as providing greater comfort and being the option preferred by the volunteers.

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