ORIGINAL ARTICLE

A Comparison of Adams Clasp Adjustment Using Novel Technique and Conventional Technique

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Background and aim: Adjusting the retention of orthodontic appliances and the patient's comfort are important factors for the efficacy of orthodontic treatment using removable appliances. The aim of the present study was to introduce a new technique for adjusting Adams clasp, which is the most important component involved in the retention of removable appliances, to provide greater retention and patient comfort.

Materials and methods: The subjects in the present study consisted of 45 patients referring to the Department of Orthodontics. Four removable maxillary plates were fabricated for each patient. One plate was adjusted from the area of both Adams clasps at overhead areas in the conventional technique. In the three remaining plates, the Adams clasp was bent in the middle area of the bridge under three vertical angles of 8, 15 and 20 degrees. The plates were placed in each patient's mouth and the retention, overbite change and patient pain scores were determined.

Results: The adjustment under a vertical bend of 15° in the middle area of the bridge resulted in maximum retention, followed by 8°, 20° and zero degree (the conventional technique). There were no significantly differences in the mean overbite change values between the four study groups. In addition, mean pain scores did not exhibit significant differences between the four study groups.

Conclusion: By creating a bend of 15° in the vertical direction in the bridge area of Adams clasp, the tip of the overheads moved 2 mm toward each other based on trigonometry principles, resulting in maximum retention without increasing patient discomfort.

Keywords ; Adams clasp, Retention, Adjustment.

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Introduction

Removable appliances have always been a part of orthodontic treatment and they are mainly used in interventions during mixed dentition period; they are also used as adjunctive appliances in fixed orthodontic treatment. In addition, they are used as retainers after orthodontic treatment.[1-5] An important consideration in the use of removable appliances is to prevent their displacement. In this context, properly designed retention is necessary for such appliances for an effective treatment.[6-8] Designing of Adams clasp (1950) along with modified overheads which are now known as Adams clasps resulted in a major advance in the retention of removable appliances. These clasps are usually fabricated using stainless steel wires measuring 0.7 mm in diameter with a piece of universal Adams pliers and contain a horizontal section and U-shaped loops (overheads).[8-9]

When a removable appliance is placed in the oral cavity for the first time, adjustment of the clasps is considered a special problem and subsequent problems can be avoided by complete seating of the clasp and its exact adjustment .[8]In appliances that will be used for a long time, it is particularly important to provide a balance between clasp comfort and clasp retention.[10-11] Adams clasps are adjusted in the oral cavity through the overhead or its arm and changing each one can disrupt the adjustment of other segments. In the case of Hawley plate, in particular, care should be exercised because if the wire crosses the occlusal surfaces of teeth, it might disrupt occlusal relationships rather than preserving them .[1]In addition, since overheads are the work-hardened part of the wire and have undergone manipulation, their excessive adjustment can make them susceptible to fracture due to wire fatigue .[12]

Therefore, due to the importance of retention in removable appliances [13], the aim of the present study was to evaluate retention of these appliance and patient comfort during adjustment of Adams clasps using a new technique in comparison to the conventional technique.

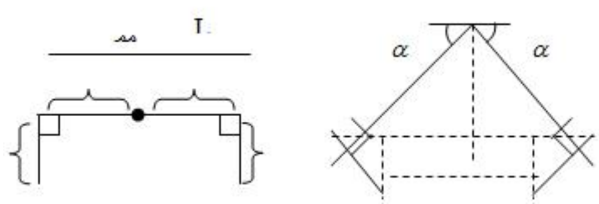
Material &Methods

In the present double-blind randomized clinical trial the subjects were randomly selected from those referring to the Department of Orthodontics, Faculty of Dentistry, Tabriz University of Medical Sciences. A total of 45 patients, in the 18–25 age range, who were interested in participating in the study, were selected. The inclusion criteria consisted of the following: 1) presence of first upper molars on both sides; 2) permanent dentition period; 3) absence of any rotation of first molars. The exclusion criteria consisted of lack of patient cooperation during recall visits.

The protocol of the study was approved by the Ethics Committee of Tabriz University of Medical Sciences under the code 92204. An informed consent form was signed by all the subjects.

Four alginate impressions were taken from the maxillary arch of each patient and 4 removable maxillary plates were fabricated for each patient, which had two Adams clasps on first molars with hooks on both sides on the middle portion of the palate along the mesial surfaces of first premolars with acrylic resin covering of the palate.

One of the plates was adjusted from the area of both Adams clasps and the overhead areas using the conventional technique; a piece of Adams pliers was used to produce a slight inward movement at the tip of the overheads. In the three remaining plates the Adams clasps were subjected to three different angles at the middle of the bridge. These three angles were achieved as follows and the three angles were selected in a manner to make the adjustment at a range of 1–3 mm, based on trigonometric principles:



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$| AB | = 2(L_2 \cos(\alpha) – L_1 \sin \alpha)$

$| d | = 2L_2 - | AB |$

change in length

Based on the hypotheses of the present study the distance between the mesiobuccal and distobuccal line angles of maxillary first molars was assumed to be 10 mm based on Wheeler's report:

$L_2 = 5$ mm

$L_1 = 3$ mm → arrowhead length
α = angle variation

α = 8° → | d | = 0.93 ≈ 1 mm
α = 15° → | d | = 1.89 ≈ 2 mm
α = 20° → | d | = 2.61 ≈ 3 mm

Therefore, the three angles selected in the present study were calculated at 8°, 15° and 20°.

In order to create angles in the clinic the following procedures were followed:

A protractor was used to draw the angle in question and then a piece of 0.7 wire was used to create the angle using a three-prong plier (Meduim, Length: 13 mm, Maxwire thickness: 0.9 mm Hard Dentarum). Then the created angle was marked as a reference and as an index for the angle in question.

In order to randomize the selection of Adams plates, they were coded and randomization software program (Rand list version 1.2; DateIng GmbH, Tubingen Deutschland) was used to assign the samples to different groups and angles. Each plate was placed in the oral cavity for one day and retention was measured using a Correx Tension gauge (Swiss Made) by applying a downward puling force perpendicular to the plate at the middle hook area. Since a research in databases did not bring up similar studies, a pilot study was carried out in which based on PPD 1.2 software program an error of 0.3 was deemed acceptable for measurement error and in all the cases.

To evaluate occlusal interferences, at first each patient was asked to occlude his/her teeth and the amount of bite opening in the anterior area (considering the patient's initial overbite) was measured; the patient's inter-incisal distance was measured before placing the plate and the some distance was measured again after placing the plate.

To evaluate patient comfort, his/her discomfort during plate removal was registered by VAS in all the 4 situations, in which a 10-scale VAS was used with images and oral explanations.

Data were analyzed with descriptive statistical methods (means ± SD); Kruskal-Wallis test was used to evaluate differences in means at different adjustment techniques and in cases in which the differences were significant Mann-Whitney U test was used for two-by-two comparisons. SPSS 17 was used for data analysis. Statistical significance was defined at $P<0.05$.

Results

Kruskal-Wallis test showed that adjustment at 15° resulted in maximum retention, followed by 8°, 20° and zero degree (Fig 1).

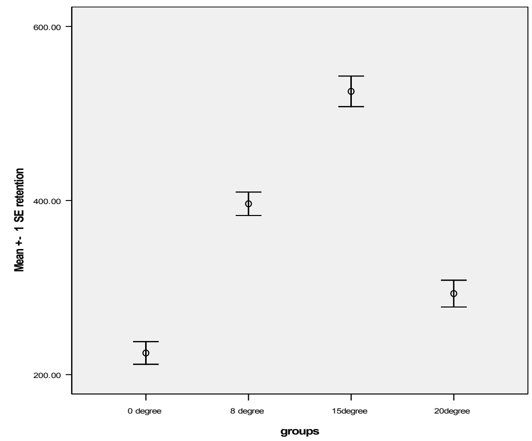

Fig 1. Comparison of retention values in the groups under study.

The results of Mann-Whitney U test showed a significant difference between the two zero degree and 8° adjustment techniques, with higher mean retention with the 8° technique. There was a significant difference between zero degree and 15° adjustment techniques, with higher mean retention with the 15° technique. There was a significant difference between zero degree and 20° adjustments, with greater mean retention with the 20° adjustment. There was a significant difference between 8° and 15° adjustment techniques, with greater mean retention with 8° adjustment. Finally, there was a significant difference between 15° and 20° adjustment techniques, with greater man retention with the use of 15° adjustment technique.

Descriptive evaluation in relation to overbite change values showed that the 20° adjustment technique, with a mean of 1.3mm, had the greatest overbite change value, and 8° and 15° adjustment techniques, with a mean of 1.17mm, had the least overbite change value (Fig 2).

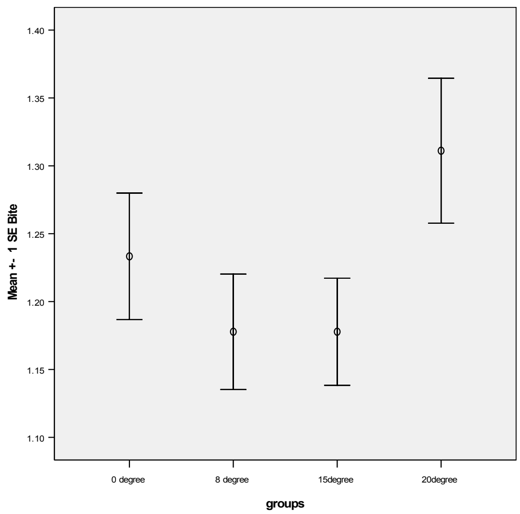

Fig 2. Comparison of overbite change values in the study groups.

The results of Kruskal-Wallis test showed no significant differences in mean overbite change values between the four study groups ($P \geq 0.05$), with the highest and lowest overbite change values in the 20° and 8° adjustment groups, respectively.

The results of Kruskal-Wallis test showed no significant differences in mean pain scores between the study groups ($P \geq 0.05$), with the highest and lowest pain score in the 20° and 8° adjustment groups, respectively (Fig 3).

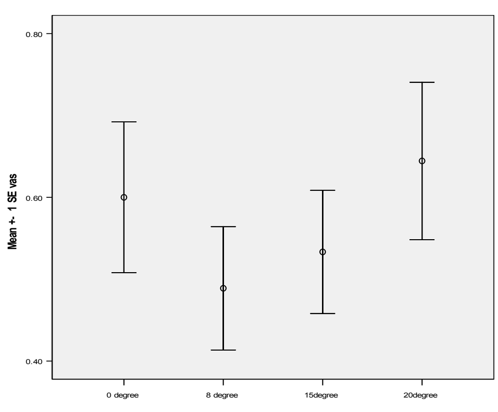

Fig 3. Comparison of VAS scores between the study groups.

Discussion

Demand for orthodontic treatments is rapidly increasing and treatment with removable appliances is particularly important along with fixed orthodontic treatment.[14] Success or failure of treatment with the use of removable appliances depends, to a great degree, on the participation and cooperation of the patient and adequate retention is absolutely necessary to attract patient participation.

With commonly used conventional technique for adjusting Adams clasp, the clinician carries out the procedure without having proper knowledge about the amount of bending of the clasp and sometimes it is necessary to create several bends to achieve the desired retention. At this stage it is possible to make minor adjustments on the overheads because they are the most work-hardened part of the clasp and continuous adjustments carried out without accurate measurements result in failure due to wire fatigue.[1-8,15] The new technique was introduced and selected because the wire is manipulated to a lower degree and can be measured and presented on an objective manner.

Comparison of the conventional technique and creation of an 8° bend showed a slight decrease in retention and based on trigonometric principle the overheads moved 1 mm toward the undercut. Therefore, a 1-mm movement of the clasp into the undercut was not adequate and did not encompass the tooth. When the bend increased to 15° the retention increased further and the clasp achieved complete adaptation with the tooth contour and based on trigonometric principle the overheads moved 2 mm toward the undercut. However, by increasing the angle to 20° the overheads moved 3 mm toward the undercut but retention decreased because at this situation a coil state and expelling force were created due to the pressure applied to the tooth and the reactive force created resulted in faster exit of the clasp and an increase in patient pain and discomfort. Therefore, based on the results of the present study 15° is the ideal angle. With this angle there were no problems in relation to occlusal interference and patient discomfort; therefore, by introduction of this technique and the optimal angle for adjusting the Adams clasp the patient's and the clinician's time was saved and the efficacy of the appliance improved and the patient's comfort increased. In addition, wire fatigue decreased due to prevention of repeated bends.

Conclusion

Based on trigonometric principle the tip of the overheads moved 2 mm toward each other by creating a vertical angle of 15° at the bridge area of the Adams clasp and adequate retention was achieved without patient discomfort.

Even if a clinician uses a technique other than that introduced in the present study, the best protocol for adjusting Adams clasp is to move the tip of the overheads 2 mm (1 mm on each side of the clasp) into the undercut.

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