COMPARISON OF OCCLUSAL BALANCE CONTACTS IN PATIENTS TREATED WITH STANDARD EDGewise AND PREADJUSTED STRAIGHT-WIRE APPLIANCES

This study investigated the functional occlusion in two groups of patients treated to a Class I canine and molar relationship by fixed appliance therapy. Group A consisted of 24 patients treated with standard edgewise appliances, whereas the 15 patients in group B were treated with a straight-wire appliance. The occlusal contacts were assessed intraorally with articulating ribbon of 8 microns thick. All procedures and measurements were performed by the same examiner. The results revealed that balancing contacts were significantly more frequent in group A. In both groups, most subjects had balancing contacts between their second molars (P < .05). The prevalence of posterior protrusive contacts in group A was similar to group B. Most of the subjects in group B demonstrated canine guidance on laterotrusion, whereas in group A, the majority exhibited group function (P < .05). Mutually protected occlusion was present in an overwhelming percentage of group B, as compared to no patient in group A (P < .05). Patients treated with edgewise appliances did not exhibit ideal functional occlusal relationships, whereas most individuals after straight-wire appliance therapy had a mutually protected (ideal) occlusion. World J Orthod 2009;10:216–219.

Key words: canine guidance, occlusion, group function, mutually protected occlusion, occlusal balance contacts

In the classic work of Angle and a more recent one by Andrews, criteria for an optimal occlusion were established. These are based upon static antagonistic tooth contacts. However, it seems much more reasonable to incorporate functional occlusion criteria into the diagnosis and treatment plan. A number of investigations have attempted to determine what an optimal functional occlusion constitutes. Still, there is no universal consensus. This inconsistency might be due to material and method variability.

Sadowsky and BeGole assessed the occlusion of 75 subjects (aged 25 to 55 years) who had been treated with edgewise appliances at least 10 years previously and compared them to 75 untreated subjects (same age range). Seventy of the treated and 75 of the untreated individuals had differences between centric relation and centric occlusion. Balancing (mediotrusive, non-working side) contacts were present in 66 of the treated and 58 of the untreated subjects.

Sadowsky and Polson compared the occlusion of orthodontically treated patients to untreated subjects from two centers (Illinois and Eastman). The patients had been treated at least 10 years earlier with an edgewise appliance. At the Illinois center, 85% of the treated and 87% of the untreated individuals had balancing contacts, whereas at the Eastman center, this amounted to

Mohammad Sadegh
Ahmad Akhoundi, DDS, MS
Abolfazl Hashem, DDS, MS
Hassan Noroozi, DDS, MS

1Associate Professor, Department of Orthodontics, Deputy of Dental Research Center; Vice Chancellor of Research, Faculty of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.
2Private Practice, Tehran, Iran.
3Assistant Professor, Dental Research Center, Tehran University of Medical Sciences, Tehran, Iran.

CORRESPONDENCE
Dr Mohammad S.A. Akhoundi
Tehran University of Medical Sciences
Tehran 1433634947
Iran
Email: ahmadakh@tums.ac.ir
41% of the treated and 45% of the untreated subjects. The difference between the treated and untreated persons in both centers was not significant.

Rinchuse and Sassouni\(^7\) evaluated functional occlusion in 24 subjects who had four premolars extracted as part of their orthodontic treatment, in 25 treated subjects without removal of teeth, and 27 subjects who had an ideal static occlusion with no history of any orthodontic treatment. Although there was a slight difference in the number of balancing contacts among the three groups, this was not significant. Canine-protected occlusion occurred infrequently in the three groups since they all showed predominately unilateral and bilateral balanced occlusion.

Recently, Milosevic and Samuels\(^8\) assessed functional occlusion in 188 patients treated with fixed appliances. The prevalence of centric relation–centric occlusion discrepancies was 82%, and 132 subjects had balancing contacts. One hundred forty four subjects had posterior tooth contacts during protrusion. Using articulator-mounted casts, Clark and Evans\(^9\) evaluated functional occlusal in 37 postorthodontic patients who had been treated with straight-wire appliances. Twenty-four subjects revealed premature contacts on closing in centric relation and a slide between centric relation–centric occlusion. Most of the subjects demonstrated canine guidance during laterotrusion, however, with balancing contacts between their second molars.

The purpose of the current investigation was to evaluate and compare the occlusion in two groups of patients who had been treated with either standard edgewise or straight-wire appliances. Although preadjusted appliances were introduced many years ago, standard edgewise brackets are still used by a considerable number of orthodontists in many countries.

**MATERIALS AND METHODS**

The sample comprised two groups: Group A consisted of 24 subjects (21 females, 3 males) treated with an edgewise appliance, while group B had 15 subjects (10 females, 5 males) treated with a straight-wire (Roth system) appliance (Table 1). Group A subjects had been treated in a private clinic, whereas group B received their orthodontic treatment in the Department of Orthodontics at Tehran University of Medical Sciences. Individuals were included in the study if they met the following criteria:

- Class I profile and normal vertical facial dimension
- Extraction of all four first premolars
- No remaining spaces between any teeth after therapy
- No orthognathic surgery
- Second molars not banded during treatment
- No occlusal adjustments after orthodontic treatment
- Debonding less than 3 months earlier with a Hawley-type retainer for retention
- Static Class I canine and molar occlusion
- No extensive restorations/caries or missing teeth (except for third molars)

All individuals were examined on two occasions at least 3 weeks apart in a supine position by one operator calibrated on six items. The mandible was guided into centric relation using bimanual manipulation.\(^12\) To override any existing neuromuscular control of habitual closing, each subject had to bite for at least 15 minutes on a cotton roll placed in the premolar region. Contacts were recorded in centric relation, centric occlusion, and during medio- and laterotrusion using Bausch articulating ribbon 8 microns thick.

**Table 1** Sex and age distribution of the subjects in group A (edgewise appliance) and B (straight-wire appliance)

<table>
<thead>
<tr>
<th></th>
<th>Group A (n = 24)</th>
<th>Group B (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females (%)</td>
<td>21 (87.5%)</td>
<td>10 (66.7%)</td>
</tr>
<tr>
<td>Males (%)</td>
<td>3 (12.5 %)</td>
<td>5 (33.3%)</td>
</tr>
<tr>
<td>Mean age (y)</td>
<td>16.5</td>
<td>17.8</td>
</tr>
<tr>
<td>SD (y)</td>
<td>2.4</td>
<td>5.2</td>
</tr>
<tr>
<td>SE (y)</td>
<td>0.6</td>
<td>1.0</td>
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</tbody>
</table>

SD = standard deviation, SE = standard error.
Laterotrusive contacts were recorded starting from centric occlusion at 1.5 mm and 3.0 mm from the midline to the left and right as described by Clark and Evans. Protrusive contacts were divided into posterior (interferences) and anterior (guidance) contacts.

All data were analyzed with SPSS 10.05 software. Categorical data were analyzed by chi-square test and continuous data by t test. For all tests, a probability < .05 was taken as the level of significance.

### RESULTS

There was no significant difference regarding the distribution of both sexes in the two groups (P > .05). The frequency of balancing contacts on both sides was significantly greater in subjects treated with an edgewise appliance (P < .05). Only one subject in group B had balancing contacts at 1.5 mm laterotrusion to the left. The frequency of balancing contacts in the first molars at 3.0 mm laterotrusion was not significant (P = .07) between the two groups, but was significantly greater at 1.5 mm in group A (P = .02). There was no significant difference in the frequency of balancing contacts in left laterotrusion for the second premolars. In right laterotrusion, no contacts between the second premolars were observed. Sixty-seven percent of the patients in group A and all patients in group B had balancing contacts on the left second molars, this difference being significant (P < .05). However, on the right side, the difference between the two groups was not significant (P > .05).

Overall, 92% of patients in group A had balancing contacts as compared to only 7% in group B.

On the left first molars, 67% of the subjects in group A and 93% of those in group B had centric relation contacts, whereas on the right first molars, these amounted to 58% in group A and 93% in group B (P < .05). Distribution of centric relation contacts in the second premolars in both groups on both sides was lower but similar (P > .05).

Most subjects in group B demonstrated canine guidance in laterotrusion, whereas the majority in group A exhibited group function on both sides in the two laterotrusive positions (P < .05). Mutually protected occlusion was present in 93% of the subjects treated by straight-wire appliances, but in no patient in group A (P < .05). Table 2 shows that there was no significant difference in the prevalence of protrusive contacts between the two groups (P > .05).

Protrusive contacts were observed in 17% of the subjects in group A as compared to 0% in group B.

### DISCUSSION

A number of studies have assessed functional occlusal relationships in patients following orthodontic treatment. Because all varied in methodology, their results are difficult to compare, as highlighted by Takai et al.

In this study, both groups had bilateral centric relation contacts. The higher frequency of contacts in group B compared to group A demonstrates the good adaptation of the subjects treated by straight-wire appliances. The low frequency of contacts in the second premolars in both groups was probably related to an insufficient settling process. A comparison of centric relation contacts with other studies is not feasible because this aspect has not yet been evaluated otherwise.

The predominant occlusion in laterotrusion in group A was group function as compared to canine guidance in group B. The curve of Spee was almost flattened in all patients so it does not seem to be a major determinant of the posttreatment occlusion. But canine inclination was superior in the straight-wire group. As expected, the prevalence
of canine guidance was increased with increasing laterotrusion (1.5 mm vs 3.0 mm). This is in agreement with the conclusions of Clark and Evans.9

The differences between their study and this one can be explained by the fact that Clark and Evans recorded tooth contacts with articulating paper in mounted casts. However, Celar et al14 reported that semiadjustable articulators duplicate only 73% of the intraoral identifiable protrusive and 81% of the laterotrusive contacts. Similarly, Tamaki et al15 described a duplication of only 66% of the protrusive and 80% of laterotrusive contacts. Another reason for the differences between the Clark and Evans study and this one can be explained by the fact that Clark and Evans recorded tooth contacts with articulating paper in mounted casts. However, Celar et al14 reported that semiadjustable articulators duplicate only 73% of the intraoral identifiable protrusive and 81% of the laterotrusive contacts. Similarly, Tamaki et al15 described a duplication of only 66% of the protrusive and 80% of laterotrusive contacts. Another reason for the differences between the Clark and Evans study and this one may be related to different prescriptions of preadjusted appliances used. Also, their subjects were evaluated 1 week after debonding, having not worn any removable or fixed retainer since.

Given that patients in this study were allocated at random to either treatment regimen, it can be expected that the distribution of pretreatment occlusal contacts was similar between the two groups.

In view of the fact that all patients of this study were evaluated by only one operator, no interoperator error has to be considered. Further, it needs to be taken into consideration that the investigating operator of this study was calibrated on six items. Also, all examinations were performed on two occasions with an interval of at least 3 weeks. This should also exclude any significant intraoperator error.

As mentioned earlier, all the patients in this investigation were Class I patients who had their four first premolars extracted. They had very similar malocclusions leading to similar treatment plans, which diminishes the bias that the outcomes of this study were not at all appliance-related.

CONCLUSION

It seems that the use of preadjusted appliances results in a better functional occlusion and diminishes the number of detrimental occlusal contacts. Also, this study emphasizes that dynamic evaluation of the posttreatment occlusion is more important than the commonly used static assessment of the occlusion.

REFERENCES