Frequency of occlusal interferences: A clinical study in teenagers and young adults

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The importance of occlusal interferences in the etiology of bruxism and functional disturbances has been studied in many ways and the controversial reported results have been reviewed by Carlson and Droukas. The clinical relevance of these occlusal interferences has been demonstrated as symptoms and considerable disturbance in the activity of the masticatory muscles could be registered after the experimental introduction of occlusal interferences.

Certain types of occlusal interference are considered to be more severe than others: (1) unilateral contacts between the retruded position of the mandible (RP) and intercuspal position (IP), especially if the slide from RP to IP is directed laterally, and (2) balancing (nonworking) side interferences, preventing contacts on the working (functional) side.

Earlier studies concerning the frequency of occlusal contacts and interferences are based on varying definitions, methods of investigations, and patient materials. This study investigated the frequency of occlusal contacts, interferences, or both, in persons without pronounced dysfunction or pain in the masticatory system.

Because nonworking interferences can appear outside the so-called functional region, it was considered essential to register these interferences at several different mandibular positions in the contact movement region, including the extreme lateral contact positions of the mandible.

MATERIAL AND METHODS

The two different age groups investigated consisted of 60 teenagers with a mean age of 15 years and 80 young adults with a mean age of 22 years. The teenagers, 27 girls and 33 boys in the age range of 14 years 2 months to 16 years 3 months, were students at schools in the town of Umeå. For the young adults, who were on average 7 years older, the age range was 20 to 31 years. This group consisted of 40 women and 40 men dental students. The

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Fig. 1. Lateral movement 6 mm to right for registering contact relations on balancing/nonworking side.

individuals in the two age groups were selected to represent persons without temporomandibular (TMJ) pain-dysfunction symptoms.

The morphologic jaw relations in the sagittal, transverse, and vertical dimensions were registered in the IP. The number and location of missing permanent teeth were also recorded. The occlusions in the teenage group included one prenormal and three postnormal, one open, one deep, six cross and one scissor. Sixteen individuals had one to four teeth missing. Occlusions among the adults were one prenormal and one postnormal, and two cross. Twenty-five persons had one to five teeth missing. All of the others had normal morphologic jaw relations and no teeth missing.

The definitions here of occlusal contact positions are those suggested in the Glossary for Prosthodontic Terms. Interference is defined as a premature unilateral tooth contact in RP or unilateral contacts on the balancing side, while contacts appear bilaterally in RP or simultaneously on both sides on lateral excursions of the mandible.

The contact relationship between the teeth in the upper and lower jaws was examined in the RP of the mandible, and the occurrence and site of interferences was registered. The RP was obtained after repeated hinge movements performed by the dentist with moderate pressure on the chin of the patient.

When recording the tooth contacts in the retruded
position and localizing the occlusal interferences, the dentist used information from the patient in addition to occlusal indicator wax (Sybron/Kerr, Romulus, Mich.).

The size of sliding movements from RP to IP was recorded in anterior and lateral aspects, and referred in millimeters to one of the following five intervals: 0 to 0.1, 0.2 to 0.4, 0.5 to 0.8, 0.9 to 1.2, and ≥1.3 mm. To make it easier to estimate the size of the sliding movement, opposing teeth were marked with a black pen while the teeth were in the intercuspal position. Marks were made in the midline on the front teeth and in the premolar region.

Investigation of the tooth contacts on the nonfunctional side was also done with the help of the patient and occlusal indicator wax. The mandibular contacts on the balancing side were registered in the positions where the pen mark between the lower central incisors had moved 3, 6, and 9 mm and maximally toward the opposite side. These positions were obtained with the help of a millimeter-graded ruler (Fig. 1).

Maximal horizontal and vertical movements of the mandible were recorded according to methods earlier described by Agerberg.9,10

The obtained data were analyzed at the Umeå Datacenter. The standard computer program of the Statistical Package for the Social Sciences was used to calculate mean values, standard deviations, and correlations. The following levels of significance were used: \( \alpha = .05 \geq p > .01 \); \( xx = .01 \geq p > .001 \); \( xxx = p \leq .001 \).

Table I. Percentage distribution of unilateral contacts/interferences in retruded position noted for teeth of upper and lower jaws

<table>
<thead>
<tr>
<th>Mean age of subjects</th>
<th>Tooth No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>15 Years</td>
<td></td>
</tr>
<tr>
<td>Upper jaw</td>
<td>2</td>
</tr>
<tr>
<td>Lower jaw</td>
<td>2</td>
</tr>
<tr>
<td>22 Years</td>
<td></td>
</tr>
<tr>
<td>Upper jaw</td>
<td>4</td>
</tr>
<tr>
<td>Lower jaw</td>
<td>10</td>
</tr>
</tbody>
</table>

RESULTS
RP-IP relations

When the lower teeth were brought into light contact with the upper teeth in the RP, bilateral tooth contacts were registered in 25% of the individuals in both age groups (Fig. 2). Seventy-five percent had occlusal interferences (unilateral tooth contact) with a fairly even distribution between the right and the left side. The difference between right and left sides was at most 8% and not statistically significant. The teeth most frequently responsible for the occlusal prematurities in the retruded position in both age groups were the premolars and the first molar (Table I). In the younger age group, interferences generally appeared on the first premolar and the first molar, whereas in the older age group most interferences appeared on the first and second premolars.
Fig. 3. Frequency of balancing contacts and balancing interferences at four different registered positions of mandible, noted for left (L) and right (R) side in group of 15-year-olds.

Table II. Percentage distribution of size of slide from retruded position to intercuspal position

<table>
<thead>
<tr>
<th>Mean age of subjects</th>
<th>Slide (in mm)</th>
<th>0.0 to</th>
<th>0.2 to</th>
<th>0.5 to</th>
<th>0.9 to</th>
<th>1.2 to</th>
<th>≥1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior</td>
<td></td>
<td>25</td>
<td>23</td>
<td>27</td>
<td>23</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td></td>
<td>83</td>
<td>15</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td></td>
<td>83</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Years</td>
<td></td>
<td>6</td>
<td>18</td>
<td>39</td>
<td>26</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Anterior</td>
<td></td>
<td>65</td>
<td>30</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td></td>
<td>69</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The distance between the RP and IP varied from 0 to more than 1.3 mm. The distribution in the four intervals up to 1.2 mm was quite even in the teenage group with 23% to 27% in each (Table II). Among the young adults the mean value of the RP-to-IP distance was higher and 0.5 to 1.2 mm in 65%.

Lateral displacement of the lower jaw sliding from RP to IP of 0.2 mm or more occurred in one of three in the teenage group, whereas it was almost twice as common among the young adults. Lateral slide to the right and to the left was equally frequent in both groups.

Lateral movements

In the teenage group, tooth contacts on the balancing side occurred with a relatively even distribution between the right and left side in the four positions registered. The frequency of contacts varied between 6% to 13% (Fig. 3).

In the adult group, the distribution of contacts between the right and left side was also fairly even, but with a higher frequency of 23% to 25% at a lateral movement of 3 mm (Fig. 4). The difference between the two groups was significant ($p < .001$) at this position of the lower jaw. At the other positions, the tooth contacts varied from 8% to 14% for both sides in the adult group.

The frequency of balancing interferences increased with the size of the lateral movement in both age groups (Figs. 3 and 4). The increase between each of these positions varied between 5% and 11% in both groups studied. At maximal lateral movement and at 9 mm the incidence was almost equal in the two groups. Between the right and the left side there were differences from 0 to 8%. Regarding the sex factor, no significant differences could be found in the number of tooth contacts or interferences at the different positions of the lower jaw.

Seventy-five percent of teenagers and adults alike had one to three tooth contacts in all nine positions registered (eight lateral and RP). Twelve percent and 11% of the individuals in the two groups had no interference in any of the studied mandibular positions. Thus, no less than 88% and 89% had at least one occlusal interference. Two or more interferences occurred in 55% and 54% of the individuals in the two groups.
No correlation between the number of missing teeth (four or five at the most) and the number of interferences in the recorded occlusal positions could be found.

The mean values of the size of maximal lateral movements in both age groups were almost identical and maximal opening was 55.8 mm in both groups (Table III).

DISCUSSION

The dental literature is full of differences in definitions of occlusal interferences and methods used for registration of them. Indeed, the differences in the investigated materials appear to be partly responsible for the variations in different studies.

Occlusal interferences were considered to exist when the distance between RP and IP exceeded 1 mm and a simultaneous lateral displacement of the lower jaw occurred. With this definition, interferences were found in 29% of 120 patients before orthodontic treatment, and in 52% of 23 patients after orthodontic treatment. In the group investigated before treatment, there was a gross overrepresentation of cross occlusions compared with the material presented in our study.

In another study, interferences between RP and IP were considered present when lateral displacement of the lower jaw was ≤ 5 mm. With this definition, the incidence of interferences was 39% in a bruxist group of 33 individuals and 22% in a control group of 45 persons.

In an extensive study of children in three age groups of 7-, 11-, and 15-year-olds, the magnitude of mandibular displacement from RP to IP and the occurrence of interferences were recorded. Unilateral contacts appeared in 38% to 58%. Nonworking-side interferences were significantly more common in 7-year-old children (40%) than in 11- and 15-year-old persons (20%). Functional nonworking-side interferences on lateral mandibular movement of ≤ 3 mm varied between 3% in the two older groups and 13% in the youngest.

In the present investigation, the existence of laterally displacing contacts/interferences between RP and IP were registered in four different intervals from ≥ 2 mm. The frequency of lateral displacement was 34% among the 15-year-olds and 66% among the 22-year-olds. If only lateral displacement of ≥ 5 mm is considered, the frequency drops to 2% and 5%, which is considerably less than earlier reported. The difference in the results...
between these two investigations is probably explained by difficulties in estimating the size of these very small displacements and by the differences in the investigated materials.

Nevertheless, the examination methods used in this study have been analyzed earlier for intraobserver and interobserver variations, which were found to be relatively small. Clinical examination of occlusion showed that registrations could be made with good reproducibility. The so-called severe interferences could be diagnosed with relatively small differences between the observers, which was also the case in registering the sagittal distance between the retruded and intercuspal positions.

A remarkable difference between the two investigated age groups was found concerning the incidence of lateral displacement of the mandible between RP and IP; it was almost twice as common in the older group. Several factors, such as eruption of third molars, increased number of restorations, and loss of teeth probably account for most of this difference. The distance between the retruded position and the intercuspal position showed lower mean values than presented in earlier studies. This was especially noticeable in the younger group. The difference probably depends on the samples and the clinical methods used.

In registering the contact relations on the balancing side, we found contacts at 3 mm lateral slide twice as common (23% to 25%) in the older group as in the younger group (12% to 14%). This difference, which is statistically significant, can probably be explained by the increased wear of the teeth that occurs with increased age. In a study of 17-year-olds, nonworking-side interferences were found in 30% of the subjects. The incidence of balancing contacts was, however, considerably higher in a sample of both 11- and 23-year-olds (65%). This discrepancy is probably the result of differences in the methods of registration. In the present study the patient's tactile sensibility was used in combination with the Kerr occlusal indicator whereas in the study mentioned the registrations were made with the aid of alginate indices.

Tryde et al. and Siirilä and Laine found that, with the help of tactile sensibility, an individual can perceive the presence of interdental objects as thin as 0.02 mm. It therefore seems unlikely that an index technique could give more exact information than that obtained directly from the patient. It is probable that a certain overregistration is obtained with the index technique compared with the one used in this study.

The incidence of balancing interferences increased with the size of the lateral slide of the lower jaw from 5% to 10% at 3 mm to 24% to 25% at maximum lateral slide. This emphasizes the importance of registering tooth contacts on the balancing side even at extreme positions of the mandible and indicates that this examination should not be restricted to the so-called functional contact region. Clinical experience shows that even extremely laterally situated balancing interferences can be used in bruxism. It is therefore important to examine the contact relation between the teeth at all different positions of the mandible because contacting points and surfaces vary between different positions. A similar incidence was observed in interferences and contacts at 9 mm and maximum lateral movement of the lower jaw. The mean values for maximal lateral movements were 9.5 mm for the 15-year-olds and 9.8 mm for the 20-year-olds. These values correspond to those found by Agerberg in a normal population of the same ages.

Nonfunctional-side interferences have been found in 30% to 36% of patients with functional disturbances of the masticatory system. This finding does not seem to be a generally important etiologic risk factor as has been suggested. The overall frequency of interferences, according to the definitions, amounted to 88% in the group of 15-year-olds and 89% for the 22-year-olds. This means that in examining the occlusion, one is almost always likely to find some contact relationship previously referred to as severe interferences. Most of the interferences we found in RP were only accompanied by small lateral glides. Because an objective measurement of the use of interferences is not available, nor is a method to estimate the individual adaptability to an interference, the consequences of this variable are difficult to estimate. Individual use of occlusal interferences appears to be the most significant factor to cause effects on the masticatory apparatus. A clinical way of evaluating this is to look for wear facets. In experimental studies, however, occlusal disturbances have been shown to cause short-term signs and symptoms of mandibular dysfunction.

The investigated individuals had, as mentioned, no functional problems, but in the older group, slight symptoms of disturbed function (clicking of the TMJ) appeared in 18%. The finding in this study that almost of 10 individuals with a basically well-functioning stomatognathic system have so-called severe occlusal interferences leads us to believe that their etiologic importance in the development of mandibular dysfunction has been overemphasized. Inasmuch as interferences appear to be frequent findings even among individuals without mandibular dysfunction, they must be regarded as normal findings and generally not of any specific etiologic importance. This seems to be true also in epidemiologic samples of a similar age group presented by Wänman and Agerberg. A recent literature review on occlusion also supports this observation, and further support comes from the findings in another new study.
SUMMARY

Contact relations between the teeth in the lower and upper jaws in the retruded position and on the nonfunctional side were investigated in two different age groups with mean ages of 15 and 22 years, respectively. The subjects had no complaints of mandibular dysfunction. The relations on the nonfunctional side were registered in four different positions of the mandible.

Unilateral tooth contacts in the retruded position were found in 75% of the persons in both age groups. Lateral displacement of the mandible of 0.2 mm or more in sliding from RP to the IP occurred in 34% in the younger group and in 66% of the adults.

Contacts on the balancing side at the four different lateral positions were found in 6% to 13% among the teenagers and in 9% to 25% among the adults. Balancing interferences, which appeared in 5% to 10% of the persons in both age groups at 3 mm lateral movement, increased 5% to 11% between each one of the other positions registered. These interferences reached a level of appearing in every three to four persons at maximal lateral movement of the mandible.

No less than 88% and 89%, respectively, of the individuals in both age groups had at least one occlusal contact, usually defined as an interference, in one or more of the nine registered positions of the mandible. Because the subjects had well-functioning masticatory systems, this study does not support the opinion that the mere presence of occlusal interferences is of major importance in the etiology of mandibular dysfunction.

REFERENCES