Relationship Between Non-Alignment and Incisal Wear of the Anterior Teeth

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Summary

The purpose of this work was to examine the prevalence of non--alignment and incisal wear of upper and lower anterior teeth in an examined population of dental students as well as to analyze the relation between alignment and incisal wear of the anterior teeth. The subjects chosen for this study were dental students (40 female, 40 male) of the School of Dental Medicine in Zagreb. The age of the subjects ranged from 20 to 26 years, mean 22.8 ± 1.8 years. Alignment of the teeth and incisal wear were assessed on the basis of stone casts in accordance with two index systems (NONAS and IwI). By testing the methods it was shown that the reproducibility of assessments of teeth alignment and incisal wear was satisfactory. In the upper jaw, one or more teeth were non-aligned in 48% of cases (most frequently the upper lateral incisors), while in the lower jaw there were 47% cases of non-alignment teeth (most frequently the lower central incisors). The prevalence of incisal wear of the anterior teeth in the population of dental students was 95%. By Pearson's chi-square test, the relationship between the condition of alignment and incisal wear of anterior teeth was determined. The highest degree of tooth wear was registered on the right and left upper central incisor as well as on the right lower canine.

Key words: *alignment, incisal wear, anterior teeth.*

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Introduction

Irregular position of the anterior teeth is a frequent condition in modern man (1-3). The relationship between the condition of the teeth alignment and dental health has been studied by many investigators (4-8). In their study, Berge, Johannessen and Silness (9) showed that irregular position or non-alignment of one or more teeth in one or in both jaws was related to significant incisal wear of the anterior teeth. Johansson et al (10) examined the correlation between space and tooth wear. Their results indicated that insufficient space of the dental arches was correlated with tooth wear. However,

previous studies of children and adolescents suggested that the prevalence and severity of wear were related to age (11-14).

As one of the possible etiological mechanisms of tooth wear parafunctional habits (bruxism) were also shown in the literature. Bauer et al (8) evaluated the possible association between the degree of wear and anterior guidance. They concluded that when anterior guidance, incisor inclination and relation were normal, the area of enamel under load was smaller and the space for bruxism larger. Parafunctional forces thus appear to result in a higher degree of wear than is found with the reduced functional space of a steep incisor position. Anterior guidance could not be evaluated as a parafunctional inducing factor, but only as determining the wear pattern in the individual.

The purpose of this work was to examine the prevalence of non-alignment and incisal wear of upper and lower anterior teeth in a population of dental students and to analyze the relationship between alignment and incisal wear of the anterior teeth.

Material and method

The subjects chosen for this study were dental students (40 female, 40 male) of the School of Dental Medicine in Zagreb. The age of the participants ranged from 20 to 26 years, mean 22.8 ± 1.8 years. Assessment of alignment condition and incisal wear of anterior teeth was carried out on stone casts (Vel-mix$^{®*}$) of the upper and lower jaw. The impressions were taken in stock trays using an alginate impression material.

The alignment condition of the anterior teeth was assessed on the stone casts by the method used for the assessment of non-aligned surfaces of the anterior teeth (NONAS) as described by Silness and Roynstrand (4). A thin line on the border between the incisal edge and the buccal surface of the anterior teeth was traced by a pencil marker. When the incisal trace line of a tooth coincided with the arch line described by the incisal edges of the six anterior teeth the tooth was considered to be aligned and was assigned 0 (NONAS = 0 score) (Figure 1). If the trace line of a tooth deviated from the arch line

the tooth was considered to be non-aligned and was scored 1 (NONAS = 1) (Figure 2). To test the reproducibility of this method the casts were evaluated twice by two examiners (Kappa coefficient was 0.77 between two series of scores what shows that the reproducibility of the assessment of anterior teeth alignment was "significant") (15).

Although the assessment of tooth wear can be assessed reliably in a clinical setting, most studies were performed on stone casts (16). Incisal wear of the middle and lateral incisors and canines of the upper and lower jaw was assessed during examination of the plaster-casts under artificial light. The assessment was carried out using the incisal wear index (IwI), according to Silness et al (17). The criteria for assessment of incisal wear index of teeth are shown in Table 1. Twofold evaluation of the casts was made jointly by two examiners to measure the reproducibility for assessment of incisal wear of the anterior teeth in the upper and lower jaw. For the upper anterior teeth the Kappa coefficient was calculated 0.85, whereas for the lower anterior teeth the coefficient was 0.82. These values of the Kappa coefficients demonstrated "almost perfect" reproducibility of index assessment of the wear of anterior teeth between two examiners (15).

Statistical methods

For the description of the pattern and severity of incisal tooth wear means and standard deviations of the IwI scores for the various morphological tooth types were calculated. Pearson's chi - square test was used to test the distributional differences between IwI and NONAS indexes. Mann-Whitney two-sample non-parametric test was used to detect differences between in NONAS scores of the upper and lower jaw, and also IwI scores. A significance level of 5% was used for rejection of the null-hypothesis.

The results

The results of the NONAS index show that 55 participants had one or more non-aligned anterior teeth in the upper jaw. Frequencies of non-alignment for the types of the upper anterior teeth were

the following: 11 + 21: ~ 28%, 12 + 22: ~ 48%, 13 + 23: ~ 17%. The mean of the NONAS index for the upper jaw was NONAS = 0.73 ± 0.80. In lower jaw, 58 participants had one or more non-aligned teeth. Frequencies of non-alignment of the lower anterior teeth were: 31 + 41: ~ 47%, 32 + 42: ~ 26%, 33 + 43: ~24%. The mean of the NONAS index for the lower jaw was 0.85 ± 0.92. The results of the Mann-Whitney test showed that the NONAS indexes of the upper and the lower jaw were not statistically different (p>0.05).

Occurrence of incisal wear of the anterior teeth in the upper and lower jaw was registered in 95% cases of the examined population. The means and the standard deviation of the incisal wear index (IwI) are shown in Table 2. The distributional difference between the incisal wear of the teeth (IwI index) and the non-aligned area of the anterior teeth was tested by Pearson χ^2 - square test. The results of this test showed that the distributional differences between the IwI index and the NONAS index were statistically important only for the right upper middle incisor (p = 0.002; χ^2 = 15.6, degree of freedom (df) 3), for the left upper middle incisor (p = 0.007; χ^2 = 11.2, degree of freedom (df) 3) and for the right lower canine (p = 0.04; χ^2 = 9.4, degree of freedom (df) 3). For all other observed teeth the distributional differences were not statistically important (p > 0.05). In addition, with regard to IwI index and the NONAS index, differences between the female and male sex were not found.

Discussion

The most frequent clinical sign associated with the functional non-alignment of dentition is tooth wear. The data gained from the epidemiological studies show that the occurrence and degree of tooth wear is greater in older populations (18, 19). In these studies, several etiologic factors of tooth wear were also analyzed. Although the influence of age cannot provide a complete explanation of the occurrence and amount of tooth wear, it is suggested that the cumulative influence of age is an important factor of tooth wear (20). In addition, the impact of parafunctional activities (bruxism) on tooth wear cannot be excluded (8, 21). Knight et al (5) indicated that

adult tooth wear is not independent of the tooth wear that occurred during childhood. Bruxism is suggested as a possible common etiologic mechanism that may account for the relationship between childhood and adult tooth wear.

In this study, the condition of alignment (NONAS index), the wear of the anterior teeth (IwI index) in the upper and the lower jaw and possible correlation between these indexes were observed. The results of the analysis of the anterior teeth showed that the conditions of alignment in the upper and lower jaw were similar. In the upper jaw, one or more teeth were non-aligned in 48% of the cases (most frequently lateral incisors), while in the lower jaw were 47% cases non-aligned (most frequently middle incisors). Comparing the NONAS index in the upper and the lower jaw by the non-parametric Mann--Whitney test, did not show significant differences (p>0.05). Berge et al (9) reported that one or more teeth were non-aligned in both jaws in about 50% of the cases, and they did not find the differences between the upper and lower jaw. By reviewing the literature, a limited number of data is available concerning the pattern of tooth non-alignment in jaws, although the results of several studies suggest that crowding of the anterior teeth is more emphasized in the lower jaw, compared to the upper jaw (22). The demonstration of relationship between non--alignment and tooth wear agrees with the results of Johansson et al (10) who studied space relationship and reported that less crowding was correlated with high tooth wear.

The results of this study indicate that high occurrence (95%) of incisal wear of the anterior teeth in the upper and lower jaw in a population of the dental students was found. High occurrence of 98% in a population of dental students of similar age group (23 ± 1.7 years) was found in a longitudinal study by Silness et al. However, regardless of the high prevalence of incisal wear of anterior teeth in the examined population of dental students there was no statistically significant relationship between age and incisal wear. The wear pattern found for anterior teeth is discussed in relation to cuspid protection and the group function theories of occlusion (12).

By Pearson's χ^2 - square test, statistical correlation between non-alignment of the teeth (NONAS index) and incisal wear of the anterior teeth (IwI

index) was established in this study. Right upper middle incisor (p = 0.002), left upper middle incisor (p = 0.007) and right lower canine (p = 0.04) were non-aligned teeth with the highest degree of incisal wear. Berge et al (8) came to a similar conclusion i.e. they established correlation between non-alignment and incisal wear of anterior teeth, and pointed out that the highest degree of incisal wear occured on the upper and lower middle incisors. Within the limitations of the study, tooth wear of anterior teeth is a clinical sign of disturbed dentition that can require a certain type of orthodontic and occlusal treatment with regard to improvement of esthetic and functional needs of the patient.

Conclusion

The results of the study show that the conditions of alignment of anterior teeth interfere with incisal occlusion in such a way that the non-alignment is followed by tooth wear. High occurrence (95%) of incisal wear of anterior teeth in the upper and lower jaw was found in the examined population of dental students (80 participants). Right and left upper middle incisor and right lower canine were the teeth which showed the most significant incisal wear. In this conneition this type of correlation should be limited to the examined population with practically all teeth intact.