Importance of Hamular Distance for Calculation of the Width of Maxillary Anterior Teeth

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Summary

Without pre-extraction photographs or casts it is not easy to select suitable artificial teeth.

The aim of this study was to determine the relationship between the width of frontal maxillary teeth and the width of the hard palate. The aim was also to determine the possibility of reconstructing maxillary frontal teeth dimensions, based on hard palate dimensions.

Teeth and hard palate dimensions were measured on maxillary casts of 80 fully dentate individuals (26 men and 56 women) of Angle class I occlusal relationship.

The maxillary central incisor is the widest among the frontal maxillary teeth and canines are wider than second incisors. The width of the maxillary frontal teeth arch, measured with a flexible ruler is 52.05 mm, hamular distance 47.1 mm, distal maxillary width 46.1 mm, sum of the widths of all maxillary frontal teeth 46.04 mm, frontal maxillary width 35.8 mm, and finally the width between canine cusp tips is 34.19 mm.

Based on the results of this study, the sum of all maxillary frontal teeth widths is equivalent to hamular distance dimension, as well as distal maxillary width, as there were no statistically significant differences between them. After extraction of all teeth, distal maxillary width is lost, which is not possible to reconstruct because of the individual rate of alveolar bone resorption. On the other hand, hamular distance remains the same dimension during the lifetime, because it is not determined by teeth position but by anatomical structures. Therefore, the hamular distance dimension is a suitable reference for determination of the dimension of the sum of all maxillary frontal teeth widths.

Key words: *hamular distance, maxillary frontal teeth width, distal maxillary width.*

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Introduction

Esthetically acceptable dentures do not differ from the natural teeth (1-4). Therefore the selection of artificial teeth is an important phase in complete denture construction. Dimensions, shape and colour are the most important factors in selection of artificial teeth (5-7).

Attempts have been made to find a method for satisfactory selection of anterior teeth. The temperamental theory was the first one introduced (5), but unfortunately completely unscientific. Almost 90 years ago, Williams (9,10) suggested that a correlation existed between the upside-down facial shape and the shape of the upper central incisors. The dental outlines of the upper incisor were classified into three categories: tapered, ovoid and square-shaped. Leon William's theory was the most accepted one although it did not suggest the size of the teeth. Frush and Fisher (11-13) introduced the dentogenic (SPA) theory. Selection of artificial teeth was determined on the basis of sex, personality, and age (SPA) of any individual. Lowery and Nelson (14, 15) proposed that a close relationship existed between face, tooth and tooth arch form (palate form).

However, new studies were neither able to confirm the relationship between face form and the shape of upper central incisor (16-18), nor between palatal shape and the form of the upper central incisor (19).

The appearance of artificial teeth is usually not as natural as it should be. It has been documented in the literature that artificial teeth are too narrow or too long since the size of the prosthetic molds were too narrow in comparison with natural teeth (20).

The aim of this study was to determine the possibility of reconstruction of maxillary incisors and frontal teeth dimensions using some dimensions of the hard palate.

Material and methods

A total of 80 individuals (26 men and 56 women, aged 18-30 years) participated in the study. Individuals were Angle class I occlusion (mimimal tooth rotations or compressions were allowed). Exclusion criteria were: one or more teeth missing (except third molars), frontal teeth dental restorations, prosthetic appliance or attrition. Patients undergoing orthodontic treatment or patients with asymmetries and abnormalities in tooth size or shape were also excluded from this study.

All patients were informed about the aim of the study and the methods to be used and gave their consent.

Alginate impressions of the maxillary jaw were made (Alginoplast fast set, Heraeus Kulzer, Hanau, Germany) and casts were poured in the hard stone (Vel-Mix Stone, Kerr Italia S. p. A., Salerno, Italy). Measurements were made on the casts using a precise caliper (TMA MEBA, Zagreb, Croatia). All the measurements were made by one person.

The width of maxillary frontal teeth was measured at their widest part. The sum of the widths of upper frontal teeth was computed by adding together the widths of the left and right central incisor, the left and the right second incisors and the left and the right canines. A flexible millimeter ruler was also used to measure the curved distance between the disto-aproximal contact points of the canines and the first premolars. The distance between the cusp tips of maxillary canines was also measured.

Hamular distance (distance between the left and the right hamular notch), frontal maxillary width (distance between central fissures of maxillary first premolars) and distal maxillary width (distance between the apices of the mesial triangular fossae on the right and left maxillary first molars) were measured on the casts.

Statistical analysis was made in SPSS 12 for Windows. Normality of the distribution was checked by Kolmogorov-Smirnov test. Means and standard deviations were calculated and the significance between means was tested using paired t test.

Results

The distribution of the data was not different from normal distribution, as revealed by Kolmogorov-Smirnov ($p>0.05$).

Means and standard deviations of maxillary frontal teeth widths are shown in Figure 1.

Significance of the differences between dimensions of the maxillary frontal teeth on the left and

on the right side of the dental arch is shown in Table 1. No statistically significant differences were found between the widths of the teeth on the left and right side of the dental arch ($p>0.05$).

Means and standard deviations between canine cusp tips, sum of the width of all maxillary frontal teeth, width of maxillary frontal teeth arch (measured with a flexible ruler), frontal maxillary width, distal maxillary width and hamular distance are shown in Figure 2.

Significance of the difference between palate width and the sum of the widths of all maxillary frontal teeth is shown in Table 2. No statistically significant difference was found between hamular distance and the sum of the widths of all maxillary frontal teeth. Also, no statistically significant difference was found between distal maxillary width and the sum of the widths of all maxillary frontal teeth ($p>0.05$). Since the widths are not significantly different hamular distance dimension, as well as distal maxillary width could be used for selection of the sum of the widths of all maxillary frontal artificial teeth. Statistically significant differences were found between other tested widths ($p<0.05$) and therefore are not suitable for selection of the width of all frontal artificial teeth.

Discussion

Selection of artificial teeth is very important in removable prosthodontics because of its esthetic value. Decision on the selection of artificial teeth has to be based on the proper shape and exact dimensions. Central position of the frontal teeth, especially maxillary frontal teeth, has the strongest influence on esthetics (21).

Among maxillary frontal teeth, central incisors are the widest and canines are wider than second incisors (Figure 1).

In dental literature mean values are presented for the teeth, regardless of their position on the left or right side of the dental arch. Significance of the differences between dimensions of equivalent teeth on the left and right side of the dental arch was tested (Table 1). No statistically significant differences were found ($p>0.05$). According to Brand and Isselhard (22) and Berkovitz et al. (23) the maxillary central incisor is 8.5 mm wide, maxillary second incisor 6.5 mm, and maxillary canine 7.5 mm. These results are in agreement with our results.

The sum of the width of all maxillary frontal teeth is important for esthetics of the frontal dental arch. The aim of this study was to examine the relationship between the width of maxillary frontal teeth (sum of widths of all maxillary frontal teeth, dimension of maxillary frontal teeth arch measured with a flexible ruler, width between canine cusp tips) and the palate widths (frontal maxillary width, distal maxillary width and hamular distance). Results are shown in Figure 2.

The width of maxillary frontal teeth arch (measured with a flexible ruler) is 52.05 mm, the hamular distance 47.1 mm, distal maxillary width 46.1 mm, and the sum of widths of all maxillary frontal teeth 46.04 mm, frontal maxillary width 35.8 mm, and finally the width between canine cusp tips 34.19 mm.

The width of maxillary frontal teeth is important for selection of artificial teeth in removable prosthodontics. Width of the dental arch and width between the canine cusp tips are also important. Significance of the differences was tested between the sum of the widths of all maxillary frontal teeth and other widths: the frontal maxillary width, distal maxillary width and hamular distance. Significance of the differences was also tested between hamular distance and the width of the maxillary frontal teeth arch measured with a flexible ruler, and between hamular distance and the width between the canine cusp tips. No statistically significant difference was found between the distal maxillary width and the sum of the widths of all maxillary frontal teeth, or between hamular distance and the sum of the widths of all maxillary frontal teeth ($p>0.05$, Table 2).

The sum of the widths of all maxillary frontal teeth is not significantly different from distal maxillary width or hamular distance. After extraction of all the teeth, distal maxillary width is lost and it is not possible to reconstruct it because of the individual rate of alveolar bone resorption. On the other hand, hamular distance does not change during the lifetime (24), and it is not determined by teeth position but by anatomical structures. Consequently, hamular distance is suitable reference for maxillary frontal teeth width selection.

Frontal maxillary width is significantly smaller than the sum of the widths of all maxillary frontal teeth ($p<0.05$, Table 2). Width between canine cusp tips was significantly smaller than the hamular distance. Width between canine cusp tips measured in this study did not differ from values reported by other authors (25, 26).

The dimension of the maxillary frontal teeth arch, measured with a flexible ruler, is significantly larger than the hamular distance ($p < 0.01$, Table 2). It is also larger than the sum of the widths of all maxillary frontal teeth ($p < 0.01$, Table 2). This is due to the position of the teeth in the dental arch.

Conclusions

1. The values of the dimensions of frontal maxillary teeth may be helpful in the dental industry for appropriate tooth molds.
2. Hamular distance dimension (distance between left and right hamular notch) is not statistically different from the sum of the widths of all maxillary frontal teeth ($p>0.05$), and therefore it is suitable for the selection of the width of all maxillary frontal artificial teeth.