

Comparative Analysis of Pontic Dimensions in Lateral Bridges

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Summary

Objectives: *The aim of the investigation was to analyse the topographical and anatomical shape of premolar-molar pontic segments in relation to the following variables: tooth occurrence in either one jaw or both jaws, prevalence of specific masticatory unit replacements according to sex, mesiodistal, buccolingual and occlusogingival diameter as well as the pontic height and the hygienic angle values.*

Material and Methods: *The investigation included 251 patients aged between 18 and 75 whose 973 units of lateral bridges on both jaws were examined. For this purpose a slide rule and modified protractor were used. Data were obtained from analysing information expressed in numbers. Statistical technique employed was the percentage difference test. Homologous natural teeth were a control group.*

Results and Conclusion: *First molar is the most commonly replaced tooth in both jaws in men as well as in the mandible in women, whereas first premolar is the most commonly replaced tooth in women's maxilla. Mesiodistal diameter of lateral segment pontics differs from the control group values, particularly in molar pontics, due to both the mesialization of the distal tooth and the reduction of the interrupted dental arch. Buccopalatal or buccolingual dimensions of the lateral segment pontics showed the biggest deviation, which was expected with regard to the static and hygienic requirements. The occlusogingival diameter of the lateral segment pontics was almost identical to the same diameter of the maxilla check specimen, whereas it proved to be slightly smaller in the mandible. This points to height reduction between the jaws. The means of the hygienic angle in the maxillary and mandibular pontics amounted to 48° and 53° respectively.*

Key words: *pontics, lateral bridges, oral health, aesthetics*

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Introduction

Conventional bridges may be defined as replacements made of alloplastic material, enabling a patient to have long lasting, functional, phonetic and aesthetic restorations of the masticatory organ. Bridges are individually adapted to the morphological and anatomical features of every patient. By constructing a bridge the physician-dentist, in only one procedure, ensures either replacement or shaping of the specific parts of dental arch in order to reestablish both the function and aesthetics and to protect soft and hard tissues of the stomatognathic system. Although it is essential to accomplish perfection of the construction, the actual results will vary greatly from person to person, depending on the right selection of the type of replacement material, on dimensions and on biological acceptance as well as its incorporation into the oral cavity (1).

Correct dimensioning as well as a good selection of colour and shape is essential if a satisfactory result is to be achieved. More over, a bridge should be well tolerated by the tissues and aesthetically acceptable. In the course of modelling the bridge, attention is very often, paid to the anatomical features of the teeth to be replaced. However, loading should be avoided if possible (2). The longer the span the greater the load. The load of the bridge depends primarily on the selection of the possible abutment as well as on the buccolingual width of the construction. Length of the pontics is the third factor that plays an important role in the load capacity evaluation which progressively decreases if the number of series connected pontics is increased (3). If the principle of statics is followed it is necessary to model the pontic width by about one third narrower than the original natural teeth dimension. In literature different opinions can be found; Tjan (4) believes that both natural and replaced teeth should be of equal dimensions, thus protecting the remaining teeth and cheeks and preventing marginal periodontal lesions to occur. In 1982 Körber and his collaborators (5) in their respective investigations recommended the "insoma structures" which have proved to be more economical than conventional pontics. Besides, they are aesthetically far more satisfactory and exhibit less load on the mucosa.

All pontics should be designed to be as far as possible self-cleansing. They should also be constructed so that it is relatively simple for the patient to

keep them clean. Because all the surfaces of the bridge should be easily approached for the foregoing reasons there are often conflicts between hygiene and modelling. Therefore, it is difficult to get the two demands to harmonise (6). Furthermore, the quality of materials together with their mechanical, biological, physical, technological and aesthetic properties should also be considered (7).

By replacing one or more natural teeth which have been extracted, pontics fill the gap between the edentulous alveolar ridge, thus trying to imitate them. Sometimes they fail to achieve the purpose completely because pontics "do not grow from the alveolus". Various descriptions of the pontic design have been offered in order to make up for the mentioned drawback (8,9). In 1966, Stein (10) offered some generally accepted guidelines for bridge design modelling. He suggested that the occluding surface of the pontic should be reduced either by 10% if only one tooth is to be replaced, or by 20 or 30% if two or three teeth must be replaced. Although these rules were established thirty years ago they have been obeyed so far in modern fixed prosthodontics (11). Today, it is necessary to form interdental spaces within the bridge design (12) because it is believed that disproportional shape is responsible for poor tissue condition under the replacement (13). In 1974 Konfeld (14) discussed bridge hygiene, considering the existing relationship between the bridge design, the retainer and the mucosa. He pointed to the importance of the hygienic angle which, in appropriately modelled bridges, enables cleansing of "dead space" from the oral side of the fixed prosthetic replacement.

The Aim of Investigation

Every fixed bridge prosthesis is likely to result in an adaptation problem: the bridge design and the mucosa may be in conflict thus preventing the proper cleaning of the replacement. It is essential to keep the periodontium healthy in order to preserve the functional durability of the replacement.

The aim of the investigation was:

- to analyse the topographical and anatomical features of the pontics according to sex and to jaw;
- to analyse extraction prevalence and lateral teeth replacement;

- to analyse the differences between pontics of the premolar-molar segment according to sex and jaws;
- to corroborate the obtained data and homologous values in natural teeth;
- to analyse the veneer prevalence in lateral bridges;
- to analyse the values of the hygienic angle.

Materials and Methods

Upper and lower lateral bridges were examined over a period of six months. They were all constructed at the Department of Fixed Prosthodontics School of Dental Medicine University of Zagreb. Those bridges, or adequate parts of semicircular bridge constructions, which employ canines and third molars as the very last abutments were analysed. 973 units of lateral bridges in 251 patients, aged between 18 and 75 were measured.

Measurements were carried out with a slide rule, accuracy of 0.1 mm. The span was from 0 - 200 mm for pontics. A protractor was used to measure the hygienic angle, with accuracy of 0.25 degrees.

The conventional pontics (designated MCK) were first separated from the "insoma structures" (designated MI), and then analysed accordingly.

The definitions for the measured variables: height, width, pontic thickness, the values of the hygienic angle are as follows:

- Height (V) of the pontic is the perpendicular running from the junction of the buccal cusp tips up to the most proximal convexity point of the veneer towards the mucosa of the ridge.
- Width (X) of the pontic is the mesiodistal length measured between the vestibular divisions of the respective pontics in the region of the contact surface. The mesial and distal adjacent tooth of the measured pontic (added unit) can be either the crown or the pontic.
- Thickness (Y) of the pontic is the greatest buccopalatal length (for upper teeth) or buccolingual length (for lower teeth).
- Hygienic angle (K MCK i K MI) is the angle created by the straight line which connects the most distant point of the pontic oral surface in its lateral projection in relation to the horizontal line.

Examined variables have been written on the Work Sheet (Figure 1).

First name and surname	
Sex	
Age	
Record No.	
Localization of bridge (upper right - GD; upper left-GL; lower right-DD; lower left-DL)	
Numerical relation crown - pontic	
Total length of bridge in mm	
Complete crown (PK)	
Veneer crown (FK)	
Classically modelled pontic (MCK) Angle	
Insoma pontic (MI) Angle	

Figure 1. Work sheet

Data were statistically analysed according to sex, according to jaws (lower-D, upper-G, each jaw was analysed separately) and according to bridge units (crowns - complete PK and veneer FK, and pontics - conventional MCK and "insoma" MI). Both sides (right and left) were analysed together (15,16).

Statistics for Windows Release 4.0 A in Modulu Basic Statistic Tables was used -programme Probability Calculator. Values for $p < 0.05$ were employed as the statistically significant difference.

The results obtained by measuring natural teeth according to: Lavelle, Lenhossek, Sicher-Tandler and De Yonge-Cohen were our check sample. Our measurements were carried out with the same parameters with accuracy of 0.1 mm. In this way we were able to obtain clinically comparable results.

Results

Our survey included 156 females (62%) with 605 units of lateral bridges, and 95 males (38%) with 368 units in both jaws. In the maxilla in both sexes the-

re were 312 (58%) retainers and 228 (42%) pontics. In the mandible in both sexes there were 251 (57%) retainers and 192 (43%) pontics which pointed to a regular statical relation where three abutments carried two pontics (Table 1).

Out of 263 (100%) upper premolars in both sexes 100 (39%) were related to retainers. They were exclusively veneers whereas the remaining 163 (61%) units were constructed as pontics. In the upper molars in both sexes there were 98 (60%) retainers and 65 (40%) pontics, out of which the second molar was in 9 (5%) cases replaced by the pontic. First molar was replaced in 56 cases (34%) (Table 2).

In both sexes, 115 (57%) modelled premolars, in the mandible, out of 201, were related to retainers, which were exclusively veneers. The remaining 86 (43%) premolar units were constructed as pontics. The first molar in the lower jaw, in both sexes, was a pontic in 81 (85%) cases, whereas in 14 (15%) cases it was provided with a retainer. In 53 (67%) cases the second molar was an abutment out of which 35 (60%) retainers were complete metal crowns while 18 retainers (34%) were veneers (Table 3).

These are the results obtained by applying the percentage difference test to the measured data:

Extraction of the first maxillary molar was statistically more significant in women (Table 4). There was no statistically significant difference in the extraction of upper teeth of the lateral segment in men (Table 5).

The results also revealed that extraction of the first mandibular molar in men was statistically more significant with regard to the second mandibular molar or both mandibular premolars. In other examined teeth there were no statistically significant differences (Table 6).

The first molar was the most commonly extracted tooth in the lower jaw in women followed by first premolar. There was no statistically significant difference between the second premolar and the second molar (Table 7).

In the upper jaw of both sexes, extraction of the first premolar, with regard to the homologous teeth in the lower jaw was statistically more significant.

In the lower jaw of both sexes extraction of the first molar was more common with regard to the homologous teeth in the upper jaw.

Lower pontics in both sexes had significantly smaller values than natural teeth (Table 3).

All the premolar units of the examined specimens had a veneered buccal surface. In addition, in 35 cases (20%) in men, the occluding surface was also veneered, and in 98 cases in women (35%). Molar pontics were not aesthetically pleasing in men, particularly those in the second molar. About two-thirds of the male examinees had complete metal units, which did not produce good aesthetic results. In women there was no significant difference between molar and premolar segments (Tables 4,5,6 and 7).

In both jaws the third molar was rarely included in the prosthetic appliance. When this was the case then the abutment was provided with a complete crown (Table 1).

The means obtained in this investigation for the upper first premolar are as follows: mesiodistal diameter 6.6 mm, buccolingual diameter 5.4 mm, conventional pontics 5.5 mm and "insoma pontic" 5.0 mm. Height 7.3 mm, is the means 7,8 mm for conventional pontic and 6.0 mm for "insoma pontics".

The second upper premolar revealed the following values: mesiodistal diameter 6.4 mm; buccolingual 5.4 mm; height 7.3 mm.

The first upper molar had a mesiodistal diameter of 7.3 mm, buccolingual diameter was 5.8 mm, height was 7.5 mm.

The second upper molar had a mesiodistal diameter of 6.5 mm, buccolingual diameter 6.0 mm; height 6.7 mm (Table 8).

The means for the lower units are as follows: mesiodistal diameter of the first premolar was 6.3 mm, second premolar 6.7 mm, first molar 8.1 mm, second molar 7.6 mm. Buccolingual diameter of the first premolar was 5.2 mm, second premolar 5.1 mm, first molar 5.1 mm, second molar 5.0 mm. Height of the first premolar 6.8 mm, second premolar 6.6 mm, first molar 6.7 mm, second molar 6.9 mm (Table 9).

The means of the hygienic angle in the upper pontics was 48°, whereas in the lower pontics it was 53°. It is particularly significant to note that figures of the hygienic angle in conventional pontics were bigger than those in the "insoma structures" hygienic angles (Table 10).

Discussion

Results of the analysis which was carried out at the Department for Fixed Prosthodontics, School of Dental Medicine University of Zagreb over a six month period revealed that female patients outnumbered male patients by as much as twice. About 62% of patients were women and 38% men. However, this could be misleading. Namely it might seem that females in Zagreb are more likely to suffer from dental disease than males patients. The most important difference between men and women in this respect is in their attitude to dental medicine and the degree of enthusiasm which they exhibit for having the work carried out. Experience indicates that a considerably greater number of women take the trouble to visit the dental practitioner. Furthermore, being more health conscious women are willing to fully co-operate thus achieving more easily satisfactory results than men. Women know that the psychological benefits to be gained by the restorations of their appearance are often considerable and can make a very real difference to their whole outlook on life (17).

The means of the mesiodistal diameter for the first upper premolar according to Lavell (after Langlade) (18) is 6.4 mm, according to Lenhossek (after Scheff) (19) it is 7.5 mm, according to Sicher-Tandler (20), and De Yonge-Cohen (21) it is 6.8 mm. The results obtained in this investigation revealed means of 6.6 mm, which means that the mesiodistal dimension of premolar pontics clinically observed was 10% smaller than the value of the same dimension in the control group. The molar pontics in both jaws showed an average reduction of the mesiodistal dimension by one third, which points to a mesialization of the second molars, particularly of the third molars after the extraction of their mesially adjacent tooth (Tables 4,5,6,7).

Buccolingual diameter of the upper first premolar according to Lavell is 8.9 mm, according to Lenhossek 9.0 mm. Sicher-Tandler and De Yonge-Cohen measured the same dimension and obtained the value of 8.9 mm. The results of our investigation revealed means of 5.4 mm, buccolingual diameter of the conventional pontic was 5.5, whereas an "insoma pontic" revealed means of 5.0 mm. Buccopalatal or buccolingual dimension of the premolar pontics was 40% smaller. In molar pontics it decreased

by 50% of the natural teeth mean (control group) (Tables 8,9).

The height of the upper first premolar according to Lenhossek is 8.0 mm, according to Sicher-Tandler and De Yonge-Cohen 8.7 mm. Our results revealed values of 7.3 mm, conventional pontics 7.8 mm, and the "insoma" 6.0 mm, which showed a deviation of 10%. The second upper premolar and molar pontics showed height values which were equal to the values of the control group. The lower pontics had statistically significant smaller values than natural teeth, thus being one of the essential factors in the reduction of the vertical occlusal relationship (Table 3).

Our results correspond to those obtained by Kalay (22).

In dental literature Zubov (23), thoroughly compared the indexes of premolars and molars which have been reported by a great number of authors. In addition Vukovojac compared the vestibulolingual and cervicoocclusal diameter of the upper and lower molars, in a specific ethnogroup, with figures found in dental literature. Results of his research revealed a slight tendency to microdontia (24).

The hygienic angle, apart from being dependent on shape, depends of the variables Y and V. Since the Y variable continually decreased by 50%, it influenced angle measurements. The bridges in this specimen did not deviate from a statistically significant value of the optimal angle of 45° which ensures satisfactory cleaning (25) (Table 10).

Conclusions

On the basis of the obtained results the following can be concluded:

1. The total number of bridge units in the postcanine area in both sexes, obtained as a result of our investigation, revealed very favourable static relations: per every two constructed pontics, on average, three crowns were modelled for the purpose of retaining.
2. In women, the first premolar was most commonly replaced by a pontic in the maxilla, and in the mandible the first molar was most commonly replaced by a pontic.

3. In men premolar and molar extraction in the maxilla were comparable whereas the first molar was most commonly replaced by a pontic in the mandible.
4. The mesiodistal dimension of premolar pontics was 10% smaller than the equal dimension of natural teeth. On the other hand, molar pontics revealed height reduction of one third compared to the control group.
5. Buccooral dimension of the premolar, as well as for molar pontics, was smaller by 40%, and 50% respectively than the control group means, i.e. smaller than natural teeth.
6. The average height of the first upper premolars for both sexes was 10% lower than the height of the natural teeth, whereas the second premolar and molar pontics revealed height values comparable to those of the control group. Pontics were statistically lower than the natural teeth in the mandible. This information can be useful in the study of reduced vertical occlusal relationship.
7. Aesthetically pleasing pontics were 20% lower than conventional ones.
8. The hygienic angle means amounted to 51°, thus enabling patients to keep good personal dental and oral hygiene.
9. Aesthetically pleasing occlusal surfaces are more commonly found in women than in men.