Occlusal Analysis Of Parameters In Subjects With Partial Edentulism Kennedy Class I

Petar Jankulovski[1], Jadranka Bundevska[2], Milena Velevska[3], Vesna Fiser[4]

[1,2](Department of prosthodontics, University Dental Clinical Center 'Sveti Pantelejmon', North Macedonia)
[3,4](Private Dental Practice 'PZU JANKULOVSKI', North Macedonia)

Abstract:
Background: *The aim of this paper is to determine the value of occlusal forces and their distribution in subjects with partial edentulism - Kennedy class I, before and after prosthetic rehabilitation with a partial acrylic prosthesis, using occlusal analysis. Also, to determine the differences in the values of the occlusal forces and their distribution between the control group and the examined group and to determine if there is a difference in the values of the occlusal forces and their distribution among the subjects wearing a partial acrylic prosthesis depending on the length of the prosthetic saddles.*
Materials and Methods: *A total of 20 subjects classified into two groups were included in this study. The first group was represented by 10 subjects with natural dentition with intact dental arches (with or without the third molars) with neutroocclusion (Angle class I malocclusion), without pathological changes of other components of the masticatory system (control group). The examined group was represented by 10 subjects with partial edentulism Kennedy class I, with bilaterally shortened dental arches and partial denture wearers with different lengths of prosthetic saddles. In our study, for occlusal analysis, we used an exact method with a computerized device for measuring and analysing occlusal forces, the T-Scan III Evolution System.*
Results: *The obtained results were statistically processed and presented in the form of tables and graphs.*
Conclusion: *The statistical analysis of the obtained results shows that: subjects with intact dentition and neutroocclusion class I according to Angle have a correct distribution of occlusal forces; in subjects with partial edentulism class I according to Kennedy before the prosthetic treatment, the occlusal forces are concentrated in the area of the remaining natural teeth which are overloaded; and in the subjects with the incorporated partial acrylate prosthesis, the occlusal forces are also redistributed to the artificial teeth, which leads to a balancing of the occlusion. The obtained results confirm the efficiency of partial acrylic dentures when it comes to the rebalancing of occlusal forces.*
Key Word: *prosthodontic therapy, mobile dentures, T-Scan III Evolution system, occlusal analysis*

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I. Introduction

The occlusion and articulation of the natural and artificial teeth is an unavoidable topic in all areas of dentistry - orthodontics, mobile and fixed dental prosthetics, implantology, oral and maxillofacial surgery, periodontology, pedodontics, and dental diseases. In order to diagnose occlusal irregularities, it is essential to have an objective knowledge of the occlusion and articulation of the teeth, but also to have a method that will allow the dentist to analyze.

Bostancıoğlu SE, Toğay A, Tamam E., in their study, aimed to compare the sensitivity of two different methods for digital occlusal analysis, that is, between the T-scan III system and the CEREC Omnicam system. They concluded that although both systems are efficient, the T-scan III system proved to be more effective, as it has a higher sensitivity [1].

Koos B, Godt A, Schille C, Göz G., investigated the accuracy of two methods, and the obtained results showed that the T-Scan III method is superior to the usual articulating paper methods, and improves the routine diagnostics with marking foils [2].

Gözler S, Vanlioglu B, Evren B, Gözneli R, Yildiz C, Özkan YK used the T-Scan III to evaluate the effect of a temporary hydrostatic splint on occlusion. The results showed an increase in the maximum biting force, and it goes in favour of a change in the neurophysiological position of the masticatory muscles [3].

Chaturvedi S, Addas MK, Alqahtani NM, Al Ahmari NM, Alfarsi MA., using the T-Scan III, examined and compared occlusal forces in subjects wearing total dentures. The results showed that the digitally manufactured total prostheses made with the subtractive technique are superior to the total prostheses made with the additive and conventional techniques [4,5].

Chaithanya R, Sajjan S, Raju AVR., examined the change in the occlusal contacts and the dynamics of the occlusal force after a prosthetic treatment with a fixed dental aid manufactured using the conventional method. They concluded that the therapist assessment with articulating paper markings and occlusal perception are not reliable in restoring occlusal balance [6].

Metwally, A., with the help of the T-Scan III evaluated the occlusal forces in 20 subjects. He concluded that the total prostheses made with CAD/CAM technology provide better patterns of distribution of occlusal forces than conventionally made total prostheses. T-Scan computerized analysis helps to obtain a bilaterally balanced occlusion and distribution of occlusal forces [7]

Taking into consideration our current knowledge about occlusal forces during the masticatory act, in this study we set the following goals:

➢ using occlusal analysis, to determine the value of occlusal forces and their distribution during jaw movement, in individuals with intact dental rows, neutroocclusion (class I malocclusion according to Angle), without pathological changes in other components of the masticatory system, which will represent the control group;

➢ to determine and assess the value of occlusal forces and their distribution in subjects with partial edentulism class I according to Kennedy, before prosthetic rehabilitation;

➢ to determine and assess the value of occlusal forces and their distribution in subjects with partial edentulism class I according to Kennedy, after prosthetic rehabilitation with a partial acrylate prosthesis;

➢ to evaluate the differences in the values of occlusal forces and their distribution between the control group and the studied group;

➢ to determine if there is a difference in the values of occlusal forces and their distribution between subjects with partial edentulism before prosthetic rehabilitation and subjects with partial edentulism after the incorporation of a partial acrylate prosthesis;

➢ to determine if there is a difference in the values of the occlusal forces and their distribution among the subjects wearing a partial acrylate prosthesis depending on the length of the prosthetic saddles (short or long prosthetic saddle).

II. Material And Methods

A total of 20 subjects classified into two groups were included in this study. The first group was represented by 10 subjects with natural dentition with intact dental rows (with or without the third molars) with neutroocclusion (Angle class I malocclusion), without pathological changes of other components of the masticatory system (control group). The examined group was represented by 10 subjects with partial edentulism Kennedy class I, i.e. bilaterally shortened dental arches and wearers of partial prostheses with different lengths of the prosthetic saddles, i.e.:

· 10 subjects with partial edentulism with bilaterally shortened dental arches Kennedy I class before prosthetic rehabilitation (first subgroup);

· 10 subjects with partial edentulism with bilaterally shortened dental arches Kennedy I class after prosthetic rehabilitation with partial acrylate prosthesis (second subgroup).

In these two subgroups of subjects, the occlusal analysis was performed before the prosthetic treatment, and then at the end of the treatment after the fabrication and incorporation of the partial acrylate prosthesis in the patient's mouth.

The occlusal analysis was performed by using an exact method, with a computerized device for measuring and analysing occlusal forces, the T-Scan III Evolution system (Figure 1). The normal occlusal and articulating relationships between the jaws ensure an equal distribution of masticatory forces during the act of mastication. The T-Scan III Evolution system allows for the occlusal forces to be measured in a very precise way during maximum intercuspation and during articulatory movements of the jaws. This device allows simultaneous qualitative and quantitative computerized analysis of occlusal forces displayed as a dynamic overview in the form of a video recording.

Figure 1. T-Scan III Evolution system

Before the recording can be done, it is necessary to select the size of the sensor holder and the size of the sensor. This is done by trying out the holder in the patient's mouth, which should cover the first molars in the upper jaw so that the patient can bite comfortably. The size of the sensor is selected according to the size of the holder. Afterwards, the patient data is entered into the database of the software. Apart from the general information, the values of the width of the crown of the upper central incisor, which is measured with an electronic calliper, are also entered. At the same time, the approximation of the dental arches is created and appears on the screen (Figure 2).

Figure 2. Approximation of the dental arches
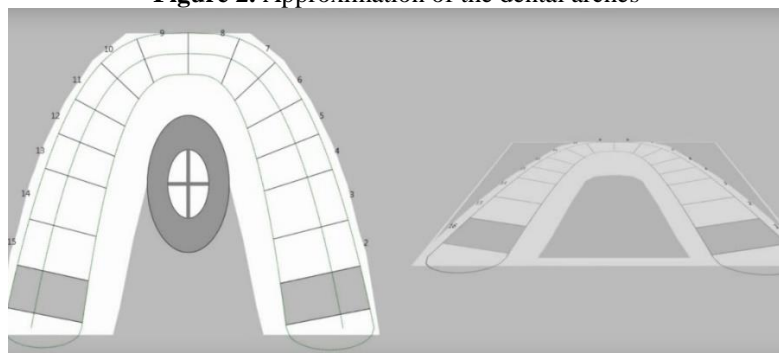
After the sensor is mounted, it needs to be calibrated. The calibration allows the use of all colours from the spectrum that will visually show the differences in the strength of the occlusal forces. By pressing the recording button located on the handle of the T-Scan, the recording is activated. At the same time, the approximation of the patient's dental arch immediately appears on the screen, on which the data on the quality and quantity of the occlusal forces are displayed as a film in 2 and 3 dimensions. Pressing the button on the handle again ends the recording. The strength of the force expressed in percentage as well as the time sequence of the patients bite appears on the screen. We must point out that multiple recordings can be done of the same patient (Figure 3). The obtained data is stored on the computer and can be used for viewing and analysis. Also, the data can be printed for the purpose of analysis and documentation.

**Figure 3**. Two-dimensional and three-dimensional display of occlusal force values
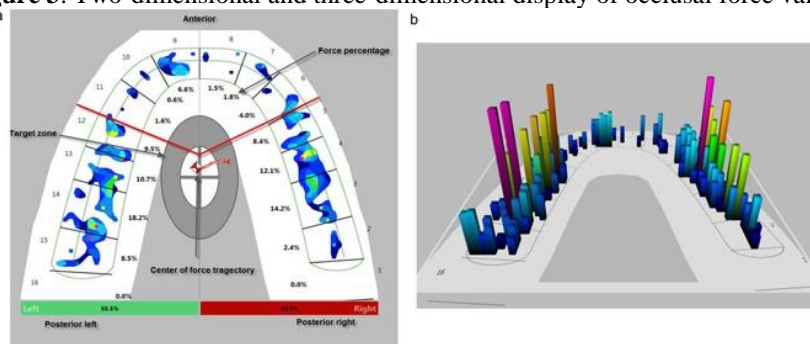
III. Results and Discussion

Table no. 1 show the distribution of occlusal forces between the left and right side of the jaw, expressed in percentages. From them we can notice that in all the studied groups we have almost balanced occlusal forces between the left and right sides, with a small difference between them. The obtained results coincide with the results obtained by the authors Kürklüarpacay, D., Bayindir, F. and Dinçkalyanikoğlu, N., in their study [4].

Table 1. Distribution of occlusal forces between the left and right side

	Left (%)	Right (%)	Difference (Right-left)
G1	48.120	51.880	3.768
G2	49.220	50.780	1.560
G3	46.050	53.950	7.900
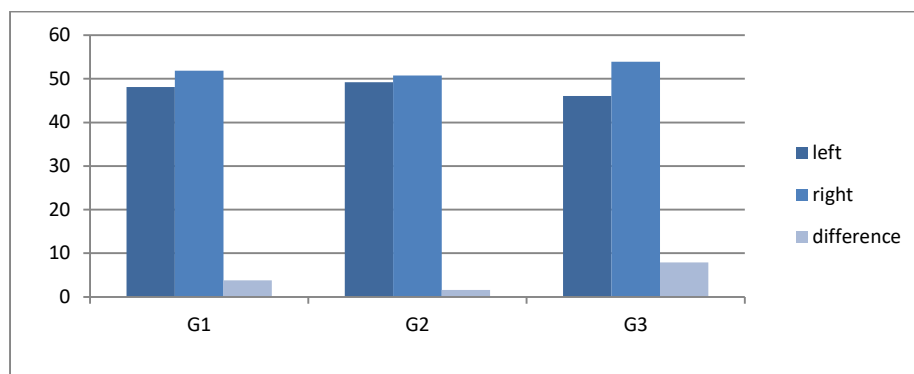
From the results shown in table no. 2 regarding the location of the center of force (COF), we can note the following: in 90% of the subjects from the control group (G1) the center of occlusal force is located in the white and gray ellipse; in the subjects from the first subgroup (G2), the center of force is dislocated outside the white and gray ellipse. The reason for the dislocation of the force is the partial edentulism in the jaws, i.e. shortened dental rows (Kennedy I class) before the prosthetic rehabilitation; while in 60% of the respondents from the second subgroup (G3), the center of occlusal force is located in the white and gray ellipse. The relocation of the center of occlusal force in the white and gray ellipses is due to the incorporated acrylate partial denture in the subjects' mouths.

Table 2. Distribution of location of center of occlusal force

	G1	G2	G3
White ellipse	7 (70 %)	0 (0%)	1 (10 %)
Grey ellipse	2 (20 %)	0 (0%)	5 (50 %)
Dislocated	1 (10 %)	10 (100%)	4 (40 %)
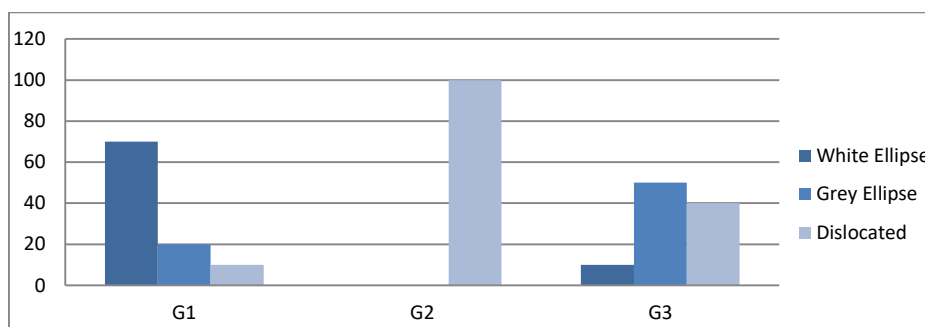
IV. Conclusion

From the statistical analysis of the obtained results, we came to the following conclusions:
- subjects with intact dentition and Angle class I neutroocclusion have a correct distribution of occlusal forces.
- in subjects with partial edentulism Kennedy class I before the prosthetic treatment, the occlusal forces are concentrated in the area of the remaining natural teeth which are overloaded.
- in subjects with partial edentulism after the prosthetic treatment with the incorporation of a partial plate prosthesis, the occlusal forces are redistributed to the artificial teeth as well, which leads to the balancing of the occlusion.
- the obtained results confirm the efficiency of partial acrylate prostheses when it comes to the rebalancing of occlusal forces.

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