

# Analysis of Occlusal Contacts in Different Types of Prosthodontic Appliances, Eichner Classifications, Presence RCP-ICP Slide and the Type of Occlusion

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## ABSTRACT

*The aim of the study was to determine the number and the type of the occlusal contacts (strong, weak) with respect to the type of the prosthodontic appliance (fixed, removable, combined fixed-removable) and with respect to the Eichner classification in patients with their appliances being in a good function for a long time. The aim of the study was also to determine the number and the type of the occlusal contacts (strong, weak) with respect to the type of occlusion (canine guided, group function or balanced) and the presence of the RCP-ICP slide. A total of 440 patients with different types of prosthodontic appliances were examined for the antagonistic occlusal contacts using occlusal strips of 11 mm and 50 mm. The average number of occlusal contacts was 10.5 for the upper and 10.46 for the lower posterior teeth, approximately 5 on each side of the tooth arch. The results of the study suggest that the biggest number of occlusal contacts were recorded for the small span fixed appliances (2 on average), the greater span fixed and fixed-removable prosthodontic appliances exhibited 1.6 occlusal contacts, and the removable complete denture exhibited 1.2 contact per the tooth in the posterior region. The number of the hard occlusal contacts was significantly greater in fixed and fixed-removable prosthodontic appliances in comparison with the complete dentures ( $p < 0.05$ ), while there was no significant difference between the prosthodontic appliances for the weak occlusal contacts ( $p > 0.05$ ). The overall number of the occlusal contacts, as well as the number of the hard occlusal contacts was significantly greater in the Eichner class I cases ( $p < 0.05$ ) in comparison with the Eichner classes II and III. The number of the weak occlusal contacts showed no significant differences with respect to the Eichner classification ( $p > 0.05$ ). There was no significant difference in the number of occlusal contacts between the appliances with RCP-ICP slide and where ICP and RCP corresponded ( $p > 0.05$ ).*

## Introduction

Favorable occlusion is an important factor in fully dentate subjects, as well as in patients with prosthodontic appliances. Good occlusion and even distribution of occlusal forces protect periodontal tissue and enhance stability of prosthodontic appliance. In cases with complex restorations, precise records of jaw relationship and restoration of occlusal morphology according to specific concepts are necessary for the long-term service in the mouth and the patients satisfaction<sup>1-9</sup>.

The aim of this study was to determine the number and the type of occlusal contacts (strong, weak) with respect to the type of prosthodontic appliance (fixed, removable, combined fixed + removable) and with respect to the Eichner classification in patients with their appliances being in good function for a long time. The aim of the study was also to determine the number and the type of the occlusal contacts (strong, weak) with respect to the type of occlusion (canine guided, group function or balanced) and the presence of the RCP-ICP slide.

## Patients and Methods

For the purpose of the study 440 patients with different prosthodontic appliances were examined (fixed, removable, combined). All of them were well informed about the purpose and the design of the study and participated as volunteers. Their prosthodontic appliances were 3–5 years in mouth and all of them were in good function and the patients reported no problems during mastication, speech or with their oral hygiene. All of them reported to be satisfied. Absence of the problems with prosthodontic appliance and the patients satisfaction served as criteria for the patients to be included in the study.

The types of occlusal patterns were registered according to the following criteria:

1. *Balanced Occlusion* – simultaneous contact bilaterally during lateral excursion of the mandible within 2 mm range;

2. *Group Function Occlusion* – simultaneous contact of working cusps on at least two posterior teeth including the canine during lateral excursion of the mandible within 2 mm range and no contacts on the contralateral side and

3. *Canine Protected Occlusion* – contacts on canine on the working side and no contralateral contacts within the excursion of the mandible of 2 mm range.

Relationship between RCP (retruded contact position) and ICP (intercuspal contact position) was determined according to Helkimo<sup>10</sup>.

Number of occlusal contacts were registered using an occlusal strip of 11 mm and an occlusal articulating paper of 50 mm. As the first step, the patients were asked to bite firmly in their habitual occlusion and the articulating blue ribbon (50 mm) was placed between the teeth of the maxilla and the mandible and the paper was tried to pull out strongly. Then a thin articulating paper of other color (11 mm), not wider than one occlusal unit, was also placed against occlusal antagonistic pairs and it was tried to pull out. When the two different colors of thicker and thinner ribbon corresponded, occlusal contacts were defined as the intensive occlusal contacts (strong) and if only a spot of thicker paper was noticed, than it was defined as less intensive occlusal contact (weak contact).

Eichner Classes was also determined, dependent of the presence of antagonistic contact units<sup>11,12</sup>.

Statistical analysis was performed using descriptive statistic methods and the

difference between the groups was tested by the Kruskal-Wallis test.

### Results

There were 62% canine guided excursive movements on the right side and 63% on the left side of the arch. There were 28% group function guided occlusion on the right side and 27% on the left side and there was 10% balanced occlusal scheme on the right and left side of the arch.

The examined patients had 48% of the fixed prosthodontics appliances, 44% of the combined (fixed and removable appliances) and 8% of the patients had removable full dentures. There were 24% of the patients who had Eichner I class, 38% had Eichner II class and 38% had Eichner III class of occlusal relationship.

The number of the occlusal contacts (all, strong, weak) in different prosthodontic appliance is shown in the Table 1 and in the Figure 1. The number of the occlusal contacts (all, strong, weak) in different Eichner classes is shown in the Figure 2. The number of occlusal contacts (all, strong, weak) in cases where ICP-RCP corresponded and in cases when a slide between ICP-RCP was registered is shown in the Figure 3.

Kruskal-Wallis test revealed significant difference between different Eichner Classes (I, II and III) for all upper occlusal contacts, all upper occlusal contacts on the left and right side of arch, for all lower occlusal contacts, all lower occlusal contacts on the left and the right side of arch and for all strong occlusal contacts (upper and lower strong contacts) ( $p < 0.05$ ), while there was no difference between Eichner Classes for the all weak occlusal contacts (upper or lower jaw) ( $p > 0.05$ ). However, Eichner Class I had the biggest number of strong occlusal contacts, followed by Eichner Class II, while Eichner Class III had the smallest

number of strong occlusal contacts (Figure 2).

Significant difference in number of occlusal contacts also existed between different prosthodontic appliances (removable, fixed, combined) for all upper and

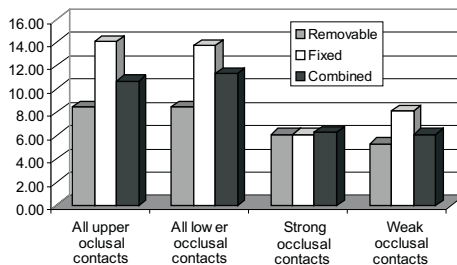


Fig. 1. Number of all occlusal contacts and strong and weak occlusal contacts in fixed, removable and combined prosthodontic appliances.

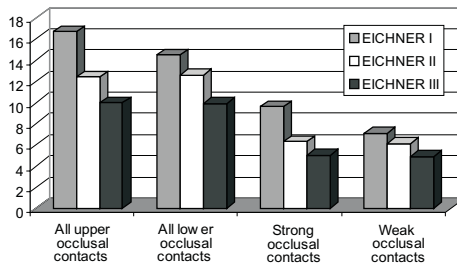


Fig. 2. Number of occlusal contacts in Eichner Class I, Class II and Class III.

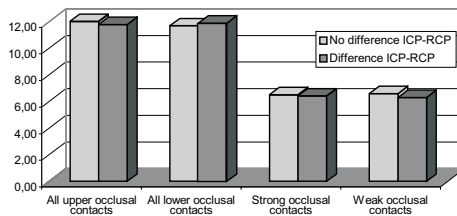


Fig. 3. Number of occlusal contacts depending on coincidence between the centric relation and maximum intercuspation or the slide up to 1 mm between centric relation and maximum intercuspation.

**TABLE 1**  
 NUMBER OF THE REGISTERED OCCLUSAL CONTACTS IN DIFFERENT PROSTHODONTIC  
 CONSTRUCTION (FIXED, REMOVABLE AND COMBINED (= FIXED + REMOVABLE))

Occlusal contacts	Removable (n = 72)		Fixed (n = 182)		Combined (n = 176)	
	X	SD	X	SD	X	SD
All upper	8.5	6.8	14.1	7.1	10.7	4.5
All upper left side	4.0	2.1	7.0	3.1	5.2	2.0
All upper right side	4.5	4.0	7.1	3.3	5.5	2.9
All lower	8.5	6.8	13.7	5.1	11.3	5.1
All lower left	4.5	2.3	6.9	2.9	5.3	2.9
All lower right	4.5	4.1	6.7	2.7	5.9	2.7
Weak contacts	6.1	5.2	6.1	3.0	6.3	3.6
Left weak	3.1	3.9	3.0	1.6	3.2	1.9
Right weak	3.0	4.3	3.1	1.8	3.1	2.0
Strong contacts	5.3	6.1	8.1	3.4	6.0	3.1
Left strong	2.6	3.2	4.2	2.8	3.1	1.5
Right strong	2.7	2.8	4.0	2.6	2.9	1.6

lower occlusal contacts and strong upper and lower occlusal contacts ( $p < 0.05$ ), while there was no difference in weak occlusal contacts ( $p > 0.05$ ). However, fixed prosthodontic appliances had the biggest number of occlusal contacts, followed by combined (fixed + removable) prosthodontic appliances, while removable appliances had the smallest number of strong occlusal contacts (Figure 1, Table 1).

No significant difference for the occlusal contacts was noted between the appliances with the difference in ICP-RCP position and the appliances where ICP-RCP corresponded ( $p > 0.05$ ).

### Discussion

The most common type of occlusion was canine guided (approx. 60%), then group function (approx. 30%) and the balanced occlusion was recorded in the smallest percentage (approx. 10%). The majority of prosthodontic appliances had also some of the natural antagonistic

teeth in contact (Eichner class II, 38%), 24% had more than few natural antagonistic contacts (Eichner Class I, 24%) and 38% had no natural antagonistic contacts. Fixed appliances were the most frequent – 48%, combined appliances were present in 44% and removable in 8% of the examined patients. The occlusal contacts in all prosthodontic appliances were well distributed over the occlusal table of the canine/premolar and molar areas. None of the contacts was recorded between the incisors. Most of occlusal contacts were point contacts, but surface contacts on the flat worn parts were also noted.

The results of the study suggest that the biggest number of occlusal contacts were recorded for the fixed appliances, then for the combined fixed-removable appliances and the lowest number of occlusal contacts was registered in removable dentures. On the average 2 occlusal contacts were registered for the fixed appliances for each occlusal unit; 1.6 con-

tacts in combined (fixed and removable appliances) and 1.2 contacts in removable appliances. This is much less than 3 occlusal contacts (tripodisation) for each occlusal unit in normal eugnat dentate subjects according to gnathological principles<sup>13–16</sup>. In spite of this fact, no one of the patients had problems with chewing or stability of a denture, or any problems with periodontal tissue considering abutments.

The number of the hard occlusal contacts was significantly greater in fixed and fixed-removable prosthodontic appliances in comparison with the complete dentures ( $p < 0.05$ ), while there was no significant difference between the prosthodontic appliances for the weak occlusal contacts ( $p > 0.05$ ).

The overall number of the occlusal contacts, as well as the number of the hard occlusal contacts was significantly greater in the Eichner class I cases ( $p < 0.05$ ) in comparison with the Eichner classes II and III. The number of the weak occlusal contacts showed no significant differences with respect to the Eichner classification ( $p > 0.05$ ).

There was no significant difference in the number of occlusal contacts between the appliances with RCP-ICP slide and where ICP and RCP corresponded ( $p > 0.05$ ).

All examined appliances were of different age, in good function and patients were satisfied. All the appliances had teeth with cusps (not flat occlusal sur-

face). All three types of occlusal designs (canine guided, balanced, group function) were registered, canine guided occlusion for smaller fixed appliances, group function for bigger restoration without natural canines and balanced in few complete dentures. Any of the occlusal design seems to be compatible with satisfactory long-term function.

Most of the occlusal contacts were points, but in some dentures small surface weak occlusal contacts were also registered on the flat worn parts of the occlusal table.

It seems that at least one or more occlusal contacts per occlusal unit is enough for the long-term service and acceptable patient-assessed oral function, which is in agreement with »biological occlusion«<sup>13</sup>. This finding corroborates with recent recommendation for a simplified occlusal design in fixed prosthodontics aiming a minimum of one occlusal contact per lateral tooth. Previously, a similar approach called »physiological occlusion« was defined as an occlusion that deviates in one or more ways from the theoretically ideal, yet is well-adapted to<sup>16</sup>. Among the basic guidelines considered by Becker and Kaiser<sup>13</sup>, besides a minimum of one occlusal contact per tooth, cusp-to-fossa occlusal scheme, no posterior contacts with protrusive movements (except in full dentures) and the absence of the interference in RCP-ICP slide seem to be satisfactory, which is in agreement with the findings of this study.

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## **ANALIZA OKLUZIJSKIH KONTAKATA KOD RAZLIČITIH PROTETSKIH NADOMJESTAKA, RAZLIČITIH KLASA PO EICHNERU, RAZLIČITIH OKLUZIJSKIH KONCEPCIJA I PRISUTNOSTI RCP-ICP POMAKA**

### **S A Ž E T A K**

Cilj rada bio je odrediti tip i broj okluzijskih kontakata (slabi, čvrsti) u odnosu na vrstu protetskog nadomjestka (fiksni, pomični, kombinirani) i klasu po Eichneru u pacijenata sa nadomjestcima koji dobro zadovoljavaju funkciju duže vremena. Cilj je također bio odrediti tip okluzijskih kontakata u odnosu na koncepciju okluzije (vođenu očajnikom, grupnu funkciju ili balansiranu) i prisutnost ili odsutnost RCP-ICP pomaka. Sudjelovalo je ukupno 440 pacijenata sa različitim protetskim nadomjestcima. Registrirani su okluzijski kontakti pomoću artikulacijskog papira debljine 11 mm i 50 mm. Prosječan broj okluzijskih kontakata iznosio je 10.5 kod gornjih, a 10.46 kod donjih stražnjih zuba, otprilike po 5 kontakata za svaku polovicu zubnog luka. Najveći broj okluzijskih kontakata registriran je kod fiksnih radova manjeg raspona (2 prosječno po zubu), 1.6 okluzijskih kontakata bilo je kod fiksnih radova većeg raspona ili kod kombiniranih radova, te 1.2 okluzijskih kontakata kod totalnih proteza. Broj okluzijskih kontakata bio je značajno veći kod fiksnih i kombiniranih radova u usporedbi sa totalnim protezama ( $p < 0.05$ ), dok nije zabilježena značajna razlika između različitih nadomjestaka za slabe kontakte ( $p > 0.05$ ). Ukupan broj kontakata, a posebno čvrstih kontakata bio je značajno veći kod Eichner klase I ( $p < 0.05$ ) u odnosu na Eichner klasu II ili III. Broj slabih okluzijskih kontakata nije bio statistički značajno različit između različitih Eichner klasa ( $p > 0.05$ ). Nije bilo značajne razlike u broju okluzijskih kontakata između protetskih nadomjestaka koji su imali RCP-ICP pomak i onih koji to nisu imali ( $p > 0.05$ ).