

# Prosthetic treatment after teeth extractions in patients with type 2 diabetes mellitus

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## SUMMARY

**Introduction** Good and well balanced diet provided by adequate mastication is part of therapy in patients with type 2 diabetes mellitus (DM). The critical period presents the time immediately after teeth extractions; hence, immediate denture is a rational therapeutical choice for diabetic patients. The presence of immediate denture and its compression might compromise wound healing process, affect chewing ability, food intake and consequently blood glucose level in type 2 DM patients.

**Objective** The objective of this study was to compare socket opening diameters (SOD), chewing ability, changes in blood glucose level and food intake in type 2 DM patients with and without maxillary immediate complete denture (MICD) during a three-week wound healing period.

**Methods** The study comprised 78 type 2 DM partially removable denture wearers (42 candidates for teeth extractions and 36 candidates for teeth extractions and insertion of MICDs). During the three-week period participants were followed for SOD, chewing ability and changes in blood glucose level and food intake.

**Results** Patients with MICD showed significantly lower reduction of SOD (seventh, 14th, 21st day) and higher chewing ability (seventh, 14th, 21st day) in comparison to patients without an MICD. Significantly lower number of patients with an MICD had changes in blood glucose level and food intake.

**Conclusion** Maxillary immediate complete denture presents a good therapeutic choice for type 2 DM patients, as it provides possibility of adequate mastication after teeth extractions and maintenance of nutritional status and blood glucose level.

**Keywords:** type 2 diabetes mellitus; immediate denture; chew ability; food intake

## INTRODUCTION

Type 2 diabetes mellitus (DM), commonly found in dental patients, is one of the most prevalent diseases worldwide [1]. Oral disturbances associated with DM include more extensive periodontal disease, salivary gland dysfunction, various types of stomatitis and delayed wound healing [2–5]. Besides relationship between metabolic control of DM and oral health status [6], studies have also shown higher prevalence of missing teeth and teeth with deep pockets indicated for extractions in diabetic patients compared to nondiabetics [7]. Alterations in oral status and loss of teeth affect masticatory ability and food selection [8, 9, 10]. In connection with this, complete and partially edentulous patients showed nutrition disadvantage with reduced intake of dietary fiber and vitamins B6, C, carbohydrates, beta-carotene, and folate [11, 12]. Malnutrition and lack of some nutrients, such as carbohydrates, vitamin A, and omega-3 fatty acids, prolong wound healing process [13]. Clinical studies concerning the effects of type 2 DM on dental postextraction wound healing are rare, with lack of data about nutrition and chewing ability during the postextraction period. Aronovich et al. [14] reported unpredictable wound healing between well and poorly controlled diabetics after teeth extractions with no statistically significant difference in postextraction outcomes between observed groups. Estimating wound healing, four weeks after

teeth extractions, Huang et al. [15] found similar outcomes in type 2 DM in oral hypoglycemics and nondiabetic patients. Since good and well balanced diet is important as a part of diabetes therapy and wound healing process generally, the rational choice for diabetic candidates for teeth extraction is to receive immediate dentures on the day of tooth extraction in order to obtain adequate chewing ability. However, the presence of immediate denture and its compression might change the conditions of postextraction wound healing process, representing another risk for impaired wound healing in diabetic patients.

## OBJECTIVE

Having in mind the lack of data about nutrition and chewing ability in postextraction period in type 2 DM patients, the aim of our study was to determine whether the presence of immediate denture influences the reduction of postextraction sites during wound healing process, glycaemic control, chewing ability and food intake of diabetic patients after tooth extractions.

## METHODS

### Study population

The study population comprised 78 type 2 DM patients aged 45 to 64 years (42 candidates for

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teeth extractions and 36 candidates for teeth extractions and insertion of complete maxillary immediate dentures – MICD). The inclusion criteria for all participants were the following: wearing maxillary partial removable dentures (with the presence of three remaining teeth in the anterior and premolar maxillary regions with signs of terminal periodontitis) and mandibular complete dentures for more than five years, and a disease history of at least two years with a glycosylate hemoglobin level less than nine (HbA1c < 9). The exclusion criteria were smoking and not wearing new dentures on a regular basis during the observation period (for the group of patients with MICD). Six individuals from the group of patients with MICD were excluded because they had not regularly worn new dentures; the final number of participants with MICD was 36.

Pre-prosthetic procedures included non-traumatic extractions of remaining three maxillary teeth without elevation of full-thickness flap to preserve the bone ridges and soft tissue. For patients who were indicated to receive MICD, new dentures were placed immediately after teeth extractions. Post-insertion denture adjustments necessary for removing difficulties that included pain and discomfort were performed during the regular follow-up. Informed consent was obtained from all participants in the study. The study protocol was approved by the Ethics Committee of the Faculty of Dental Medicine, University of Belgrade (No. 32/36) and conducted in accordance with the Helsinki Declaration.

### Clinical examinations

Dental records for all participants were provided at the Clinic of Prosthodontics and Clinic of Oral Surgery, Faculty of Dental Medicine, University of Belgrade. Regular follow-up of the postextraction wound healing in type 2 DM patients with and without MICD were scheduled after three and seven days, and weekly, during a three-week period in order to obtain the records of complete socket epithelization. In the course of observation period, the same investigator, who was unaware of patients' prosthetic status, (presence of MICD) measured bucco-lingual diameter (using dental caliper) from postextracted socket openings and expressed as mean value. The presence of any side effects or complications (symptoms of dry socket and infection) were also recorded. The patients were given both verbal and written instructions on how to control pain and discomfort in the first three weeks after the extractions and denture insertions. As analgesic, 400 mg per os of ibuprofen (Brufen®, Galenika, Belgrade, Serbia) was recommended. Using the same observation days, the patients self-reported the chewing ability of the food they usually eat. Chewing ability was categorized by the following six-point verbal rating scale (VRS): 1 = able to chew with no difficulties, 2 = just noticeable chew discomfort, 3 = weak discomfort during chewing, 4 = moderate discomfort during chewing, 5 = severe discomfort during chewing, 6 = not able to chew. Three weeks after wound healing, all the patients self-reported the usual blood glucose levels

obtained through home testing with a glucose meter (in accordance with the study of Aronovich et al. [14]) and self-reported changes in food intake (in accordance with the study of Madhuri et al. [16]).

The results were presented as frequencies or as mean  $\pm$  standard deviation. One-way ANOVA with repeated measures and post-hoc Bonferroni test was applied within the groups. Comparisons between appropriate group/time points were done by using Student's t-test for the independent samples. Frequencies of participants' characteristics in compared groups were analyzed by  $\chi^2$  test. The differences were considered to be significant for  $p < 0.05$ . The data were analyzed with Statistica (StatSoft Inc., Tulsa, OK, USA) for Windows (Microsoft Corporation, Redmond, WA, USA).

### RESULTS

Table 1 represents the socket opening diameter (SOD) in type 2 DM patients with/without an MICD. The reduction of SOD was progressive in both groups, being more prominent for type 2 DM patients without an MICD in comparison to patients with an MICD, with differences that were statistically significant on the seventh, 14th, and 21st day after teeth extractions. In addition, all postextraction sockets healed uneventfully without any signs of infection or dry socket conditions.

**Table 1.** Socket opening diameter in type 2 diabetes mellitus patients with/without maxillary immediate complete denture (MICD) during the wound healing process

Time of observation	Socket opening diameter (mm)	
	Patients without MICD (n = 42)	Patients with MICD (n = 36)
Day of extraction	6.57 $\pm$ 0.18	6.62 $\pm$ 0.16
3rd day	5.54 $\pm$ 0.24 <sup>b</sup>	6.05 $\pm$ 0.13 <sup>b</sup>
7th day	3.54 $\pm$ 0.27 <sup>b</sup>	4.45 $\pm$ 0.21 <sup>b,a</sup>
14th day	1.16 $\pm$ 0.10 <sup>b</sup>	2.47 $\pm$ 0.10 <sup>b,a</sup>
21st day	0.1 $\pm$ 0.04 <sup>b</sup>	0.4 $\pm$ 0.08 <sup>b,a</sup>

<sup>a</sup> t-test,  $p < 0.001$ , between patients with MICD and those without MICD; ANOVA test

<sup>b</sup>  $p < 0.001$  within the group vs. corresponding day 0

Chewing ability between type 2 DM patients with MICD and type 2 DM patients without MICD measured during a three-week observation period is shown in Table 2. The results revealed that both groups reported chewing ability without difficulties in the period before teeth extractions.

**Table 2.** Chewing ability between type 2 diabetes mellitus patients with immediate complete denture (MICD) and type 2 diabetes mellitus patients without MICD, measured during a three-week observation period

Time of observation	Chewing ability (verbal rating scale)	
	Patients without MICD (n = 42)	Patients with MICD (n = 36)
Before extractions	1.1 $\pm$ 0.12	1.2 $\pm$ 0.02
3rd day	3.2 $\pm$ 0.14	5.14 $\pm$ 0.16**
7th day	3.8 $\pm$ 0.17	2.8 $\pm$ 0.17*
14th day	3.8 $\pm$ 0.3	1.4 $\pm$ 0.2**
21st day	3.5 $\pm$ 0.12	1.2 $\pm$ 0.3**

$\chi^2$  test between the groups – \*\*  $p < 0.01$ , \*  $p < 0.05$

During the wound healing process, the discomfort in chewing ability was the highest on the third day, and decreased in the group of patients with MICD, contrary to the patients without MICD, where the chewing ability did not change during the time. On the seventh, 14th, and 21st day, the group of patients with MICD had significantly higher chewing ability compared to the group without MICD, in contrast to the third day, when chewing ability was significantly higher in the group of patients without MICD.

Table 3 shows significantly lower number of patients who had changes in blood glucose level following less intake of food than usual, in the group of patients wearing MICD, compared to the patients without MICD. The analysis did not include age and sex as the group consisted predominantly of male participants (76%) aged between 45 and 64 years.

**Table 3.** Changes of blood glucose levels (BGL) and food intake ability in patients with/without immediate complete denture (MICD) from period before teeth extractions to three weeks after wound healing

Parameters	Frequency	
	Patients without MICD (n = 42)	Patients with MICD (n = 36)
BGL: changed	61.9% (26)	38.9% (14)*
Food intake: less than usual	73.8% (31)	47.2% (17)*

$\chi^2$  test – \* p < 0.05

## DISCUSSION

The obtained data indicate that during the wound healing period, type 2 DM patients with MICD had slower reduction of socket opening diameter, higher chewing ability and in higher percentage had maintained blood glucose level and food intake ability in comparison to type 2 DM patients without MICD.

One of the most debilitating complications in diabetes is impaired wound healing attributed to microvascular changes [17]. Microvascular abnormalities lead to reduced response to tissue injury causing underperfusion during tissue stress and hypoxia followed by peripheral neuropathy [18, 19]. Immediate denture over the postextraction sites induces the mechanical stress in underlying tissues and impairs hypoxic condition. Having in mind that deficiency of oxygen alters wound healing phases such as collagen deposition, the decreased reduction of socket opening diameter during wound healing in patients with MICD was

expected. Furthermore, presence of denture might lead to mucosal and tissue ulcerations especially in diabetics, which is shown in studies reporting that denture stomatitis and tissue lesions are commonly found in diabetic denture wearers [20]. Denture-related lesions that commonly develop within one to two days after insertion of new dentures increase inflammatory or reactive hyperplasia, increase accumulation of plaque on dentures and cause pain with poor nutrition [21, 22]. Our result of severe chewing difficulty three days after teeth extractions in our denture wearing patients is most probably related to pain caused by teeth extractions and developed denture ulcers. The pain may adversely affect a patient's diet, glycemic control and consequently wound healing process. Therefore, during all appointments we performed all the usual procedures to reduce the pain and promote healing process in MICD denture wearers (denture adjustments of the margins, occlusal adaptation of dentures combined with instructions in home denture hygiene). The improvement in chewing ability in patients with MICD after seven days of wearing dentures is due to fact that the patients developed a pattern of functioning and a good denture fit important for mastication and denture wearing. Higher chewing ability in patients with MICD compared to the group without MICD is the reason of lower changes in food intake. In connection with this, recent studies showed statistically significant increase in nutrition during the study period after insertion of complete denture and associations between changes in dental status and dietary intake of specific nutrients [8, 9, 10]. Madhuri et al. [16] reported an increase of consumption of protein, fruits and vegetables in denture wearers after insertion of complete dentures in comparison to the period when patients were edentate. Well balanced diet obtained by adequate mastication preserves the blood glucose level, which is shown in the group of patients with MICD, contrary to the patients without MICD.

## CONCLUSION

This study revealed that immediate dentures are a good therapeutic choice for type 2 DM patients, as they provided better ability of mastication after tooth extraction, thus maintaining nutritional status and blood glucose level. To better predict life quality of type 2 DM patients during the postextraction period, more participants and clinical factors should be analyzed in further investigations.

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## Протетска рехабилитација након екстракција зуба код болесника са дијабетесом мелитусом типа 2

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### КРАТАК САДРЖАЈ

**Увод** Редовна и балансирана исхрана обезбеђена адекватном мастикацијом је значајан део терапије пацијената са дијабетесом мелитусом типа 2 (ДМ тип 2). Критичан период за ове болеснике јесте време непосредно након екстракције зуба, па за њих имедијатна протеза представља терапијски избор. Присуство имедијатне протезе и компресија коју изазива могу компромитовати процес зарастања, утицати на способност жвакања, количину унете хране, а тиме и ниво гликемије код пацијената оболелих од овог типа дијабетеса. **Циљ рада** Циљ истраживања је поређење дијаметра екстракционих алвеола (ДЕА), способности жвакања, промене количине унете хране и гликемије код ДМ типа 2 пацијената са горњом тоталном имедијатном протезом (ГТИП) и без ње. **Методе рада** Истраживање је обухватило 78 ДМ типа 2 пацијената, носилаца парцијалних плочастих протеза (42

пацијента индикована за екстракције зуба и 36 пацијената индикованих за екстракције зуба и добијање ГТИП). Током постекстракционог периода од три недеље код пацијената су праћени ДЕА, способност жвакања, промена количине унете хране и гликемије.

**Резултати** Пацијенти са ГТИП показали су значајно мању редуцију ДЕА (7, 14, 21. дана), већу способност жвакања (7, 14, 21. дана) у односу на пацијенте без ГТИП. Значајно мањи број пацијената са ГТИП имао је промене у гликемији и уношењу хране у односу на групу без ГТИП.

**Закључак** Имедијатна протеза представља терапијски избор код пацијената са ДМ типа 2, будући да омогућава добру мастикацију након екстракција, уз одржање нутриционог статуса и гликемије.

**Кључне речи:** дијабетес мелитус типа 2; имедијатна протеза; способност жвакања; уношење хране

Примљен • Received: 02/10/2015

Ревизија • Revision: 23/11/2015

Прихваћен • Accepted: 26/11/2015