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# Initial Effects of a Treatment by Fixed Partial Dentures Supported by Mini Dental Implants from a Patient's Point of View

**Sanja Peršić[1], Antonija Palac[2], Denis Vojvodić[1,3] and Asja Čelebić[1,4]**

[1] University of Zagreb, School od Dental Medicine, Department od Prosthodontics, Zagreb, Croatia
[2] University of Split, School of Dental Medicine, Department of Prosthodontics, Split, Croatia
[3] University of Zagreb, University Hospital Dubrava, Zagreb, Croatia
[4] University of Zagreb, University Hospital Centre Zagreb, Zagreb, Croatia

**A B S T R A C T**

*Mini dental implants (MDIs) in dentistry are recommended for cases with adequate bone quality and height, but a lack of alveolar bone width. Some studies well documented successful usage of MDIs for a removable denture support, but studies of MDIs supporting fixed prosthodontic restorations are scarce. We aimed to study the effect of fixed partial dentures (FPD) therapy supported by MDIs or by MDIs and natural teeth, on patients self perceived oral health related quality of life (OHRQoL), self perceived oral aesthetics and self perceived chewing function. A total of 23 patients (10 female and 13 men, age range from 54 to 78 years) were included and 61 MDIs were inserted, 10 in the maxilla and 51 in the mandible. In 14 patients FPDs were constructed only on MDIs and in 9 patients FPDs were constructed on both, MDIs and natural teeth. FPDs on MDIs were replacing mostly mandibular incisors, the second maxillary incisors and the first maxillary premolars. Those FPDs supported by both, MDIs and natural teeth had some MDIs inserted in frontal regions to allow a FPD construction. The three questionnaires: the OHIP-CRO14 for the assessment of OHRQoL, the OES-CRO for assessment of oral aesthetics and the Chewing function questionnaire (CFQ) for assessment of chewing function have been administrated twice: prior to the MDIs insertion and three months after the FPD treatment supported by MDIs had been finished. The CFQ and the OHIP summary scores significantly decreased revealing better OHRQoL and better chewing ability after treatment, and the OES scores significantly increased indicating increased self perceived oral aesthetics ($p<0.01$). Clinical examination revealed no periimplant inflammation. Patients' data supplement the initially promising clinical findings. However, further follow ups will be necessary to finally confirm the long term clinical benefit of MDIs.*

***Key words**: mini dental implants, fixed partial dentures, chewing, aesthetics, OHRQoL*

## Introduction

The selection of the implant's width has been widely speculated and the manufacturers have recently, in cases of limited bone anatomy, initiated a series of one piece mini implants of narrower diameter (1.8 to 2.9 mm). Mini dental implants (MDIs) are recommended for those cases with adequate bone quality and height, but a lack of alveolar bone width[1,2]. The MDIs for a long term use have the same surface treatment as wider implants and are manufactured from the alloy with 4 parts of vanadium to increase implants' strength. Histologically, the bone appears to be well integrated to the surface of the MDIs and bone appears to be mature and healthy[3]. The MDIs with treated surface and with diameter ranging from 1.8 to 2.9 mm undergo osseointegration comparable to that of conventional larger-diameter implants[3]. However, MDIs do not pretend to substitute conventional implants. The MDIs are suitable for patients with narrow alveolar ridges for retention of complete or partial removable dentures, as well as for a single- or multi-tooth replacement in alveolar ridges with restricted space for a larger diameter implants[4–8]. MDIs can be inserted only in places where occlusal forces have not been too high, such

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as mandibular incisors' replacements, the lateral maxillary incisor replacement or the first maxillary premolar replacement[4–8].

The advantage of MDIs also lies in minimally invasive surgical methods (flapless, initial drilling only) required for insertion. Another advantage of MDIs is immediate loading possibility in cases of a good primary stability[3,9,10]. Moreover, MDIs allow reduced cost of a treatment, which is very important for the most patients with limited budget who cannot afford expensive conventional implants or cannot afford bone augmentation procedure due to high age and/or general health problems. Survival rates reported for MDIs have been satisfactory[6,11]. The most MDIs studies reported a survival rate and a success of complete removable dentures retained by MDI's[4,12]. However, MDIs supporting fixed prosthodontic restorations have not been studied extensively.

The aim of this study was to evaluate patients treated with fixed partial dentures (FPDs) supported by MDIs or by both MDIs and natural teeth regarding the aesthetics, chewing function and a quality of life.

## Materials and Methods

### *Subjects*

A total of 23 partially edentulous patients received a fixed prosthodontic treatment (FPD) by means of mini dental implants (MDIs) or by MDIs and natural teeth during a period from April 2009 to March 2012 (10 female and 13 men, mean age 66, age range 54 to 78 years). All subjects gave the writen informed consent. The study was approved by the Ethical Committee of the School of Dental Medicine, University of Zagreb, Croatia.

### *Mini dental implants*

Most patients had inadequate bucco-lingual bone volume for normal width implants. Therefore, MDIs were inserted in the frontal region of the mandibule or the maxilla. In 14 patients FPDs were supported only by MDIs and in 9 patients FPDs were constructed both on MDIs and prepared natural teeth. In those cases MDIs enabled treatment with FPDs, otherwise removable denture would be made. The patients were thoroughly explained about implants of lesser width, the attendant risk and the possibility of augmentation procedure and the insertion of conventional width implants. Panoramic radiographs were obtained prior the therapy to assess the bone quality and quantity, to locate important anatomical landmarks, and mark placement sites. Two types of MDIs were inserted: Sendax Classic Standard (IMTEC) (6 patients) and Renew Biocare RE-Mark mini-implants (Swiss) (17 patients). The MDIs, were inserted using a minimally invasive technique which was without reflecting the mucoperiosteal flap and with only initial drilling of cortical and cancellous bone up to a few milimeters. MDIs were loaded with early loading protocol (2–4 weeks after the insertion). The diameters of the MDIs were ranging from 1.9 to 2.5 mm and the lengths were ranging from 10 to 15 mm, depending on the available height of the bone.

A total of 61 MDIs were inserted, 10 in the maxilla and 51 in the mandible. Fixed partial dentures (FPDs) on MDIs were replacing mostly mandibular incisors, and also the second maxillary incisors and the first maxillary premolars. Those FPDs supported by both, MDIs and natural teeth had some MDIs inserted in frontal regions to allow a FPD construction.

### *Questionnaires*

All participants filled in three questionnaires: the Croatian version of the OHIP14 questionnaire[13] (Oral Health Impact Profil), the Croatian version of the OES questionnaire[14] (Orofacial Esthetic Scale) and the Chewing Function Questionnaire[15] (CFQ), which represents the instrument developed by the authors for patient's self-assessment of a chewing function. The participants filled in the questionnaires first before the treatment had begun and then three months after the treatment had been finished. At the three month follow-up the patients were also clinically examined for periimplant mucosal tissue status.

### *Statistical analysis*

The data analysis was made using the SPSS statistical package (version 17.0, SPSS Inc., Chicago, IL, USA) Independent samples t-test was used to test the difference between gender. Paired samples t-test was used to test the difference between summary scores of the questionnaires before the treatment and three monthts after the treatment. P value of less than 0.05 was considered statistically significant.

## Results

Clinical examination of the mucosal tissue surrounding MDIs showed no appreciable inflammation after three months. Independent samples t-test showed no significant differences between males and females for age and any of the observed variables obtained from the questionnaires ($p>0.05$).

Mean summary scores, standard deviations, mean differences between the two observation stages and a significance of the difference of the OES, the CFQ and the OHIP14 questionnaires before treatment and three months after treatment are presented in Table 1. A statistically significant differences of the OES, the CFQ and the OHIP14 summary scores were obtained for all questionnaires three months after treatment ($p<0.01$, Table 1). The CFQ and the OHIP summary scores significantly decreased and the OES scores significantly increased ($p<0.01$).

## Discussion

The availability of MDIs from 1.8 mm to 2.9 mm in diameter, and the US Food and Drug Administration ap-

**TABLE 1**
SUMMARY SCORES OF THE OROFACIAL ESTHETIC SCALE (OES), ORAL HEALTH IMPACT PROFILE CONSISTING OF 14 QUESTIONS (OHIP14) AND CHEWING FUNCTION QUESTIONNAIRE (CFQ) BEFORE AND THREE MONTHS AFTER TREATMENT AND A SIGNIFICANCE OF THE DIFFERENCE; DF=22

| Questionnaire | Before treatment ($\overline{X}$±SD) | Three months after treatment ($\overline{X}$±SD) | Mean difference ($\overline{X}$±SD) | t | p |
|---|---|---|---|---|---|
| OES | 15.78±4.87 | 34.52±2.83 | –18.74±4.49 | –20.04 | <0.01* |
| OHIP14 | 30.74±3.12 | 4.17±1.62 | 26.57±3.70 | 34.41 | <0.01* |
| CFQ | 27.78±5.51 | 4.09±1.54 | 23.70±4.99 | 22.75 | <0.01* |

proval for removable denture support and retention, as well as for fixed prosthodontic restorations have opened new options in oral-implant rehabilitation. Clinical studies with FPDs supported by MDIs are lacking in the literature and are mostly based on case reports[16]. Therefore we studied a group of patients rehabilitated with FPDs supported only by MDIs or by both, MDIs and prepared natural teeth. Most of the implants were placed in the mandible. Our first patients received IMTEC MDIs and other patients received Renew Biocare MDIs.

Improvement of oral health related quality of life (OHRQoL) has become the main goal of contemporary dentistry[17–32]. Eliminating problems with chewing, speech, as well as improving orofacial aesthetics contribute to the improvement of oral health. Overall success of prosthodontic therapy can be assessed by patients relying on the described parameters[17–35]. Therefore the OHIP14 was used to assess OHRQoL[13], the OES to assess orofacial aesthetics[14,17] and the CFQ to assess self perceived chewing function[15]. Psychometric properties of all three questionnaires have been tested in previous studies and were proven to be satisfactory[13–16]. The OHIP14 questionnaire measures impact of several domains on the OHRQoL, such as functional, psychological and sociological factors, the OES and the CFQ represent unidimensional questionnaires measuring only aesthetic impacts[14,17] or chewing function[15]. Summary scores of the three questionnaires enabled to monitor changes of patients' orofacial aesthetics, chewing ability and a quality of life caused by fixed prosthodontic restorations on MDIs or on MDIs splinted with natural teeth.

None of the inserted MDIs was lost during the observed period of three months. Clinical examination of the mucosal tissue surrounding MDIs showed no inflammation after three months. The three month post-treatment OHIP14 and CFQ demonstrated a high and significant decrease of summary scores compared to pretreatment period, which was due to a significant increase of patients' quality of life and chewing function after the treatment. Furthermore, the OES summary scores (higher scores describing better aesthetics) significantly increased as a result of the FPD MDI therapy, demonstrating the individual's higher perception and increase of orofacial aesthetics, which was indeed expected, as the patients included in the present study suffered from anterior tooth loss prior the therapy. Considering that cost and necessity for a ridge augmentation are sometimes factors that discourage patients from implants, mini dental implants offer a more economical and definitely less invasive treatment option. The MDIs are more affordable compared to traditional implants.

The results of the present study obtained from the patients with MDIs supporting FPDs regarding improved aesthetics, masticatory function and OHRQoL supplement initial positive clinical results considering usage of MDIs for a FPD support.

The results obtained from patients with FPDs supported by MDIs reveal the high effect size of the therapy considering better self-perceived aesthetics, increased chewing function and overall quality of life at the three months clinical follow up. Initial patient self perceived results are promising, as well as clinical findings. However, further prospective follow ups will be necessary to finally confirm the long term benefit of FPDs supported by MDIs.

## Conclusion

Effects of the Fixed partial denture therapy supported by mini dental implants showed satisfactory results considering increased OHRQoL, increased chewing function and a better self perceived oral aesthetics at the 3-month observation stage.

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*S. Peršić*

*University of Zagreb, School od Dental Medicine, Gundulićeva 5, 10000 Zagreb, Croatia*
*e-mail: persic@sfzg.hr*

## EFEKT TERAPIJE FIKSNIM PROTETSKIM RADOM NA MINI DENTALNIM IMPLANTATIMA PREMA PROCJENI PACIJENATA

## S A Ž E T A K

Mini dentalni implantati (MDI) preporučuju se u stomatologiji za slučajeve s odgovarajućom kvalitetom kosti i visinom grebena, ali sa nedostatkom širine. Neki radovi dobro su dokumentirali uspješno korištenje MDI za retenciju mobilne proteze, ali nema mnogo istraživanja o MDI kao nosačima za fiksne protetske radove. Cilj rada bio je istražiti učinak terapije fiksnom djelomičnom protezom (FPD) na mini dentalnim implantatima ili na MDI u kombinaciji s brušenim prirodnim zubima, na kvalitetu života ovisnu o oralnom zdravlju (OHRQoL), oralnu estetiku i žvačnu funkciju prema procjeni samih pacijenata. Sudjelovalo je ukupno 23 pacijenata (10 žena i 13 muškaraca, u dobi od 54 do 78 godina) koji su dobili 61 MDI. Deset MDI inserirano je u gornjoj i 51 u donjoj čeljusti. U 14 pacijenata mostovi (krunice) napravljeni su samo na mini implantatima, a u devet pacijenata mostovi su napravljeni u kombinaciji na implantatima i prirodnim zubima. Fiksni radovi na MDI zamjenili su uglavnom donje sjekutiće, ili drugi gornji sjekutić i prvi gornji pretkutnjak. Kod mostova u kombinaciji mini implantata i prirodnih zuba, MDI su inserirani u frontalnim regijama čeljusti kako bi se omogućila izrada fiksnog rada umjesto mobilne proteze. Pacijenti su ispunjavali tri upitnika: OHIP-CRO14 za procjenu OHRQoL, OES-CRO za procjenu oralne estetike i CFQ za samoprocjenu žvačne funkcije. Procjene su rađene dva puta: prvi put prije MDI insercije i drugi put tri mjeseca nakon završene terapije. Zbroj bodova CFQ i OHIP upitnika ukazuje na značajno poboljšanu OHRQoL i na značajno poboljšanu žvačnu funkciju nakon tretmana, a zbroj bodova OES upitnika pokazuje značajno poboljšanje oralne estetike ($p<0,01$). Klinički pregled nije pokazao postojanje upale mukoze oko MDI nakon 3 mjeseca. Podaci dobiveni od strane samih pacijenata dopunjuju početne obećavajuće rezultate kliničkih nalaza. Međutim, potrebno je dugoročno klinički kontrolirati pacijente kako bi se konačno potvrdila dugotrajna korist fiksne terapije na mini implantatima.