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Comparison of Two Clinical Procedures in Patient Affected with Bone Deficit in Posterior Mandible

Porównanie dwóch procedur klinicznych u pacjentów z zanikiem kości w tylnej części żuchwy

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A – research concept and design; **B** – collection and/or assembly of data; **C** – data analysis and interpretation; **D** – writing the article; **E** – critical revision of the article; **F** – final approval of article

Abstract

Background. Edentulous of posterior mandible is common problem of adult patients. It is associated with atrophy of alveolar crest. Sometimes the only way to replace missing teeth are dental implants. Atrophied alveolar crest makes it impossible to use long implants lateralization or short implants are necessary. These procedures have both advantages and disadvantages, however sometimes it is the only way to treat the patients.
Objectives. The aim of this study is the comparison of two clinical procedures performed to patients with bone deficit in posterior mandible.
Material and Methods. Eighteen patients were divided into two groups depending on the performed procedure (IANL or SIMPL). Patients were between 37 and 58 years old. Before qualification to surgery, patients had CT scans done. In the article two surgical procedures were presented; implants were compared in length, diameter and placement torque, as well as in bone atrophy and complications.
Results. It was observed that there is no statistical difference between the treated groups in terms of torque, implant diameter and age of patients. Sensory disturbances after implantations were observed just in the group with IANL ($p < 0.001$); more implants could be used in IANL ($p = 0.04$); significantly greater bone loss was observed in implantation with SIMPL ($p < 0.001$).
Conclusions. Patients after IANL, exhibited better implantation results, while patients with SIMPL did not suffer from sensory disturbances **(Dent. Med. Probl. 2016, 53, 1, 22–28).**

Key words: dental implants, lateralization, short implants.

Słowa kluczowe: implanty dentystyczne, lateralizacja, krótkie implanty.

Edentulous posterior mandible is the common problem in adult patients due to the atrophy of the alveolar crest. One way to improve a patient's life is through rehabilitation using dental implants, mostly fixed restorative prosthesis. In the cases where the mandible is atrophied, the long implants cannot be used because of the neighboring position of inferior alveolar nerve (IAN) [1]. Using long or medium implants, their early loss is much less probable than in the case of short implants [2]. If dental implants are the last way for rehabilitation of edentulous mandible, the dentist has to change the position of IAN. During this procedure the IAN is exposed and pulled laterally when implants are moved in. At the end, the nerve is placed close to the previous position, next to the fixed dental implant [1]. This procedure carries advantages and disadvantages. Nonetheless, sometimes it is the only way to obtain a fixed prosthesis [3]. IAN dysfunction is the most common complication and is characterized by temporary or permanent sensory

loss [4]. The alternative treatment is short implant utilization.

The aim of this study is to present two clinical procedures in patients affected with bone deficit in posterior mandible.

Materials and Methods

A series of patients divided into two groups (with inferior alveolar nerve lateralization followed by regular long dental implants-IANL, and short implants-SIMPL) referred to the clinic with dental prosthetic problems. The first group (8 patients) that was qualified to IANL had edentulous mandible with atrophied alveolar crest and dental implants were their last chance for rehabilitation. Patients were between 37 to 58 years old. All patients had undergone a CT scan before surgery for the purpose of planning the surgical procedure. The scans revealed that the mandibular canal is located in the way of the future dental implant and the atrophied crest of mandible. The bi-cortical initial stabilization was impossible without repositioning the IAN. Implantations required IANL to avoid injuring the nerve.

A surgical approach through mucosa has been made on the crest of the mandible alveolar from the anterior part of mandible corpus to the posterior retromolar triangle with the patient in local anesthesia 4% Ubistesin Forte. A releasing incision was performed and full mucoperiosteal flap on the buccal side was dissected. Then the mental foramen was located. The position of this foramen was helpful in locating the mandible canal with nerve (foramen was not included into osteotomy). Using piezoelectric device the window was performed to exposed mandibular canal with nerve (Fig. 1b). Before implant fixation IAN was gently pulled out of the canal and held in this position (Fig. 1c). The length of the dental implants ranging from 10 mm to 16 mm (14 ± 2 mm) and the diameter ranging from 3.4–3.75 mm (3.7 ± 0.1 mm) were fixed bicortically using standard methods. The primary stabilization has been received. The dental implant body penetrating through the mandibular canal was covered by bone chips collected during osteotomy due to the separation of titanium alloy from IAN. After this, the IAN was replaced to the almost previous position. Bone window was covered by previously harvested bone block from that site (Fig. 1d). The wounds were sutured with Ethilon 4/0 or Coreflon 3/0. For the patient who had neurosensory disturbances vitamin B [Neurovit] was prescribed and laser biostimulation physiotherapy until lip sensory loss disappearance or 30 sessions [0.05 mW, 0.004 J, 120 sec] were left.

The second group (10 patients) had fixed short implants. Patients were between 35 and 70 years old. This series of patient had uni- or bi-lateral edentulous mandible.

An approach through mucosa was made in local anesthesia 4% Ubistesin Forte. The dental implants were fixed in the traditional meth-

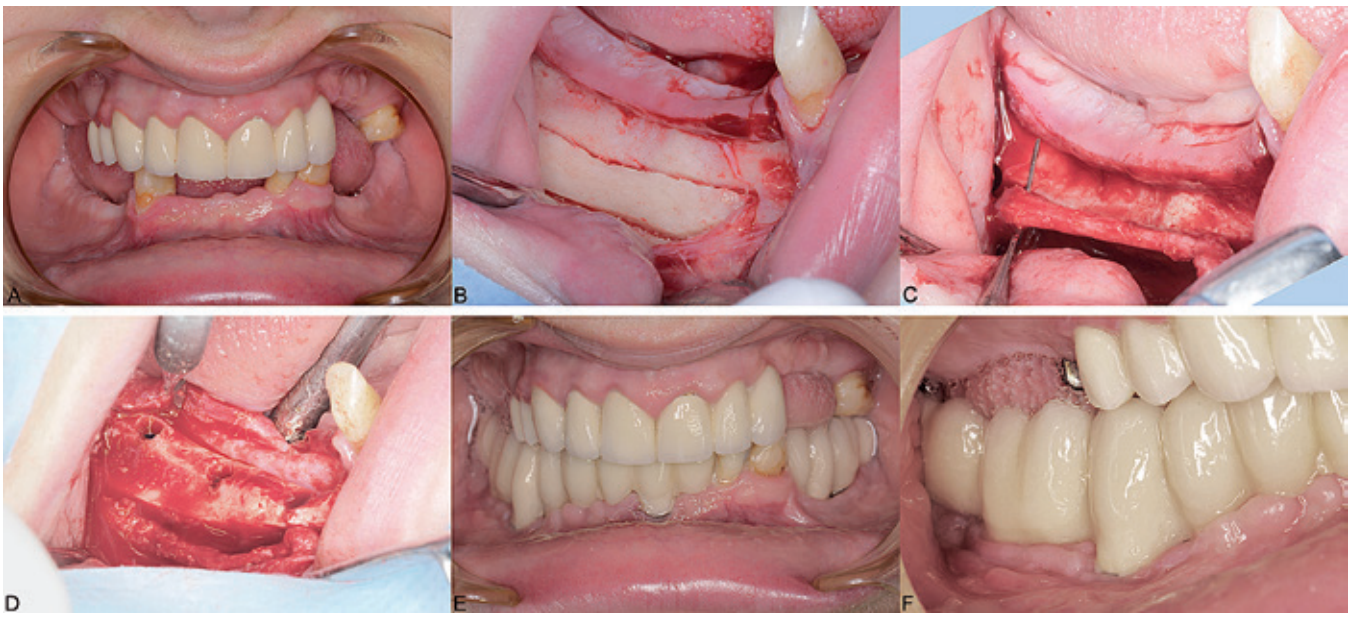

Fig. 1. Clinical procedure in inferior alveolar nerve lateralization and dental implant treatment. A – pre-operational view, B – piesoelectric preparation of the jaw window, C – inferior alveolar nerve exposed, D – dental implant insertion when the nerve is lateralized, E – final intraoral view, F – close-up to operated site. Radiological images of the same case is presented in Fig. 2

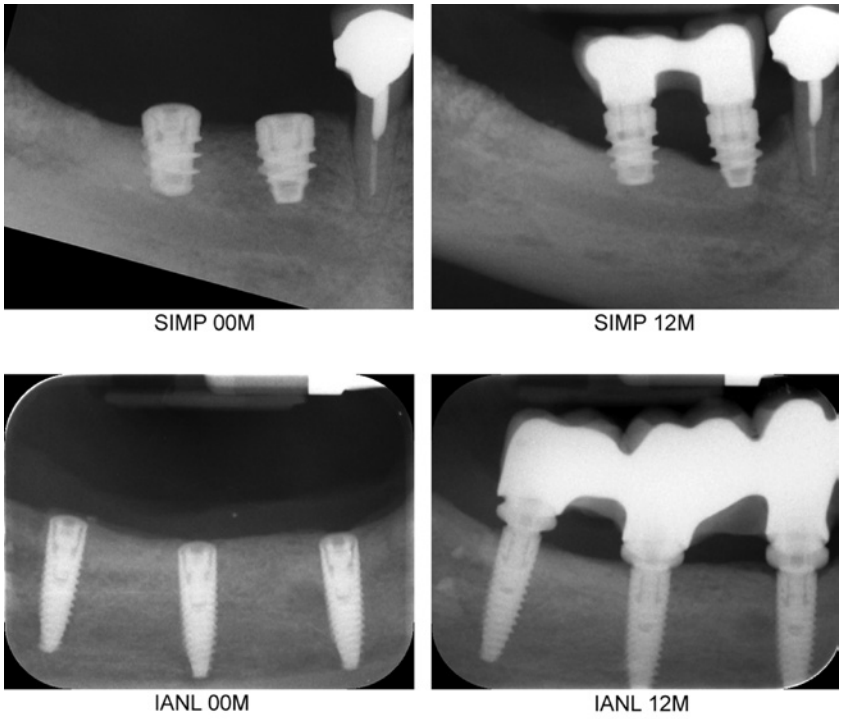

Fig. 2. Radiological imaged presenting results of application of short implants versus implantation combined with inferior alveolar nerve. During 12 months of functional loading significant marginal bone loss was recorded. Abbreviations: SIMP – short implant cases, IANL – inferior alveolar nerve lateralization and long implant cases

od. The length of implants was between 6mm to 8 mm (7 ± 1 mm) and the diameter was between 3.75 mm and 4.2 mm (3.9 ± 0.2 mm). After primary stabilization of implants, bone chips harvested during implantation were placed on the buccal side of the alveolar before suturing. None of the patients complained of neurosensory disturbance after the surgery.

Standardized, intra-oral, digital radiographs (Fig. 2) were taken [5] in both groups just before opening the implant and after 12 months of functional loading. Marginal bone loss was measured as mean of results for medial and distal side of implant neck and calculated in millimeters. Next, the obtained results were related to the total dental implant length in order to check how significant mechanically the marginal bone loss is.

Analysis of variance was performed for surgical procedure as a factor (as standard deviations in surgical groups were not differ; variance check by Levene's test) or Kruskal-Wallis test (as significant difference in standard deviations were detected). P-value lower than 0.05 was decided as statistically significant.

Results

This work included a series of patients. During four IANL's 29 dental implants were placed and in the second group 22 implants. No intra-operation injury of the IAN was observed. During IANL implants were bi-cortically fixed with torque between 10 Ncm to 70 Ncm (42 ± 18 N cm); in the group with short implants the torque was from 10 Ncm to 70 Ncm (44 ± 18 Ncm). All patients after surgery had neural sensory disturbance (lip sensory loss). These disturbances disappeared after 3–8 weeks (4.9 ± 1.7 weeks) after IANL and no disturbances after short implants. During the follow-up, the patients did not complain and the complication did not affect their everyday routine. When patients analyzed the benefits from the procedure, they would choose it again and they recommend it.

A significantly higher number of dental implants were put into the jaw in patients as inferior alveolar nerve lateralization surgical procedure applied ($p < 0.05$). Twice longer dental implants were used in patients after nerve lateralization ($p < 0.001$). Much thinner implant could be used after lateralization ($p < 0.001$). The same torque value was utilized during dental implant insertions in both comparing groups (Fig. 3). There are no cases of sensory disturbances observed in the group of short implants. Marginal bone loss observed in short implant group was higher, more than four times than in lateralization series ($p < 0.001$) (Fig. 4). And even more significant was its meaning as presented in relation to the dental implant length: maximum marginal bone loss reached 10% of the total dental implant in lateralization group versus up to 67% of implant length in the short implant group (< 0.001) (Table 1).

Discussion

The primary stabilization of the implant is very important. The cortical bone that is located superiorly to the mandible canal is of purer qual-

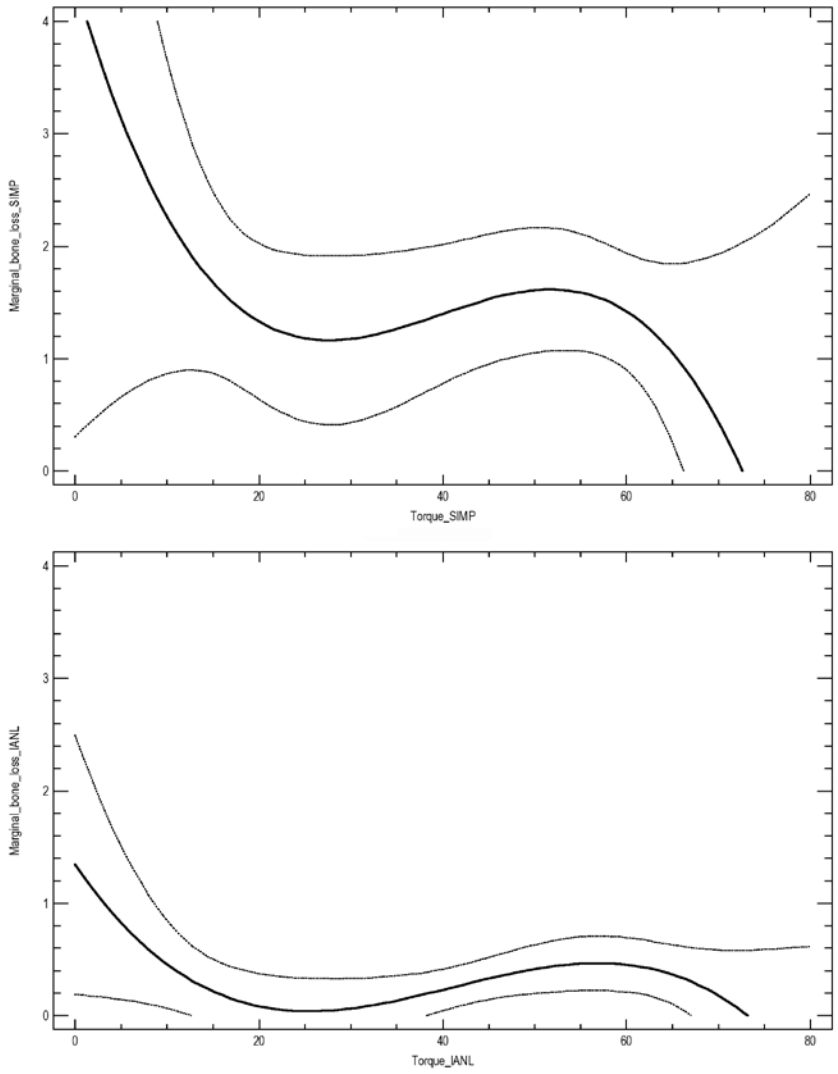

Fig. 3. Relation of marginal bone loss from torque during dental implant surgical procedure. In both groups in lower torque cases, the higher marginal bone loss is observed after 12 months of functional loading of the implants. Data are not statistically significant. Abbreviations: SIMP – short implant cases, IANL – inferior alveolar nerve lateralization and long implant cases, Solid line – third order polynomial regression line. Dash line – confidence limits

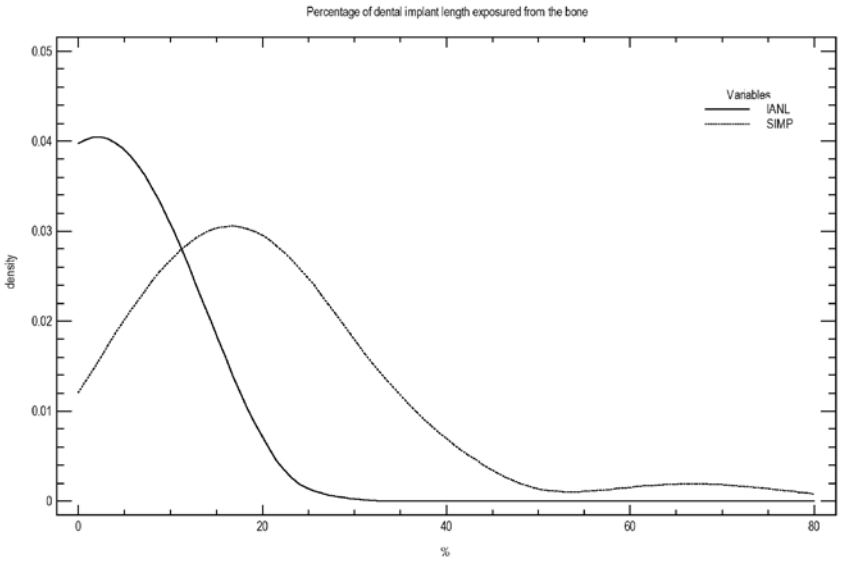

Fig. 4. Percentage of dental implant length exposure from the jaw bone, 12 month after functional loading. Average exposure is 20% of total implant length in short implant group, a 2% in inferior alveolar nerve lateralization group ($p < 0.001$)

ity than that which is under the canal [1]. That is why the IANL is a good preprosthetic option during implant fixation in a mandible affected with atrophy of the crest. The IANL may leads to better primary stabilization of dental implants [1] due to bicortical stabilization.

This procedure carries with it advantages and disadvantages. IANL brings the possibility of nerve injury. Lower lip or chin region loss of sensation can be a major complaint. Most of the patients recovered full sensation after a few days to a few months. In some cases (less than 1%) feel-

Table 1. Clinical material. Comparison (ANOVA) of dental implantations after inferior alveolar nerve lateralization [IANL] versus application of short dental implants [SIMP]

Parameter	Surgical procedure	Number of cases	Average ± standard deviation	Minimum	Maximum	p-value
Age	IANL	8	47 ± 9 years	37 years	58 years	0.47
	SIMP	10	51 ± 14 years	35 years	70 years	
Number of implants	IANL	29	3.6 ± 1.2	2	5	0.04
	SIMP	22	2.2 ± 1.4	1	4	
Length	IANL	29	14 ± 2 mm	10 mm	16 mm	< 0.001
	SIMP	22	7 ± 1 mm	6 mm	8 mm	
Diameter	IANL	29	3.7 ± 0.1 mm	3.4 mm	3.75 mm	< 0.001
	SIMP	22	3.9 ± 0.2 mm	3.75 mm	4.2 mm	
Torque	IANL	29	42 ± 18 Ncm	10 Ncm	70 Ncm	0.66
	SIMP	22	44 ± 18 Ncm	10 Ncm	70 Ncm	
Duration of lip sensory loss	IANL	8	4.9 ± 1.7 weeks	3 weeks	8 weeks	< 0.001
	SIMP	10	0 ± 0 weeks	0 weeks	0 weeks	
Marginal bone loss	IANL	29	0.3 ± 0.4 mm	0 mm	1.4 mm	< 0.001
	SIMP	22	1.4 ± 0.8 mm	0.5 mm	4.0 mm	
Marginal bone loss of implant length	IANL	29	2.2 ± 2.7%	0%	10%	< 0.001
	SIMP	22	20 ± 13%	7.5%	67%	

ing may not return [6]. Nonetheless, it is a widely-used procedure. Despite the postoperative complications, literature shows that patients can live with them [7] during rehabilitation of edentulous mandible. Literature review [7] shows and proves that IANL can be recommended despite sensory disorders which can be temporary or permanent (a small number of cases of the last one). Hirsh and Brånemark [8] show that the nerve functions returned postoperatively or during the next 3 years after the surgery and after lateralization this occurs faster than after transposition. There is an alternative surgical procedure called transposition, but lateralization versus transposition is much safer with regards to disaestesia [8].

The next postoperative complication can be fracture of the mandible. Luna et al. [9] presented the study, where female patient after IANL and fixed dental implant came back to the clinic 3 weeks after loss of the implants. The examination revealed a fracture on the right side. Afterwards, treatment includes bone graft and miniplate mandible fixation. Nowadays, as piezoelectric saws are used, the mandible fracture can be discussed as a complication of dental implant socket, not a preparation of the bone window for IANL.

Another way to cure patients is to use short implants or bone grafts [7]. Annibali et al. [10] published the review where Frieber et al. in 2000 present the results after 10 years and the cumulative survival rate was more than 90% using short dental implants. But these two techniques generate higher costs, procedure time and donor site morbidity [7]. Furthermore, patients who had fixed short implants had greater bone loss during follow-up than in longer regular implants [11]. Patients who had IANL have better occlusal conditions [12]. In our series, the author does not predict such positive long term results [in SIMPL 20% of implant length was exposed and in even near 70% of other implant was observed nude].

If the repositioning of the IAN is necessary, the surgeon can choose the method. The lateralization of the IAN is a less invasive method than transposition which required the intervention into mental foramen to move it posteriorly. Piezoelectric device is used normally in both procedures. As the paper shows, the risk degree of injury is lower than in the case of a conventional bur device. The injury of the soft tissue is much lower than in the case of bur device [13, 14].

Furthermore, to avoid more complications, there is a possibility to place a resorbable membrane, ensuring that the surface of the implant and the IAN are not in close contact. Close contact may lead to thermal injury of the nerve as a result of heat conduction through the dental implant [15]. The membrane combined with bone allograft was used by Peleg et al. [16] to avoid connection between implants and nerve. The same author recommended smoothing out the edges after osteotomy and using blunt instruments. This can protect the neurovascular bundle from inju-

ry [16]. As it causes significant amounts of bone chips in IANL, applying it again into the primary site of the mandibular canal seems the best method of dressing the body of dental implants.

In order to allow for the passive positioning of the nerve, the posterior osteotomy should be made 1 or 2 cm behind the last implant [16] as a way to protect the nerve from too excessive traction and resulting complications.

In addition to bone loss due to the use of short implants, another publication found that implants shorter than 8 mm (implanted in pre- or molar location) had the highest failure rate in contrary to short implants used in other regions of mandible [17]. The high and rapid marginal bone loss is the crucial issue in SIMP group.

Kozakiewicz et al. [5] showed that marginal bone loss is not related with torque force, which confirmed our similar results in both clinical groups. Moreover, bone loss was correlated with the age of patients and the type of prosthesis [5]. It can be considered that marginal bone loss presented in our work is correlated with surgical procedures. Choosing lateralization, bone loss is expected [5] and observed less frequently than in cases with short implants.

The above-described methods used by authors show that caution and experience of operator can affect the occurrence of procedure complications. To avoid the complication the surgeon can also use piezoelectric device and place the separation bone graft.

Dental implantation in conjunction with IANL is a confirmed and safe surgical procedure for dental implant placement for the patients with posterior lower alveolar crest. After the procedure, marginal bone loss and marginal bone loss of implant length is minimal and lower than in SIMP ($p < 0.001$) but primary stabilization was the same in both groups.

Concluding, IANL is a safe and more predictable method of treatment in posterior atrophic mandible by dental implants compared to short implant application.

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