

A comparative study of rehabilitation methods of patients with edentulous arches associated with insufficient bone volume

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Abstract

Background: The rehabilitation of patients with insufficient bone support may be difficult because of multiple disturbances from stomatognathic system and the necessity to reestablish the lost bone volume.

Material and methods: In this study were included 24 patients who were treated with conventional prosthesis (15 patients) and fixed implanting supported prosthesis (9 patients).

Results: Implant-prosthetic rehabilitation with preliminary bone augmentation has esthetic, functional and biomechanical advantages over conventional prosthesis but it is more costly, traumatic and requires a long rehabilitation period with multiple surgical procedures. However, because of their disadvantages and hard conditions these prostheses are not always functional may not fully restore the lost functions of stomatognathic system. The necessity of additional surgical procedures, a higher cost and a longer rehabilitation time limit the applicability of this method.

Conclusions: Implant supported prostheses provide a psychological comfort and prevent the progression of bone atrophy. Rehabilitation with conventional prostheses permits to restore the lost soft and hard tissue volume and patients' integration into the society. Bone grafting allows restoring of lost soft and hard tissue volume which allows inserting of implants of standard size and manufacture of functional and aesthetical restorations. The questionnaire analysis has shown that patients that wore conventional prostheses for many years are usually unsatisfied by their performance and require implant prosthetic rehabilitation with fixed restorations. The last ones are well tolerated by patients and provide a psychological comfort that cannot be achieved with conventional prostheses.

Key words: edentulous arches, insufficient bone volume.

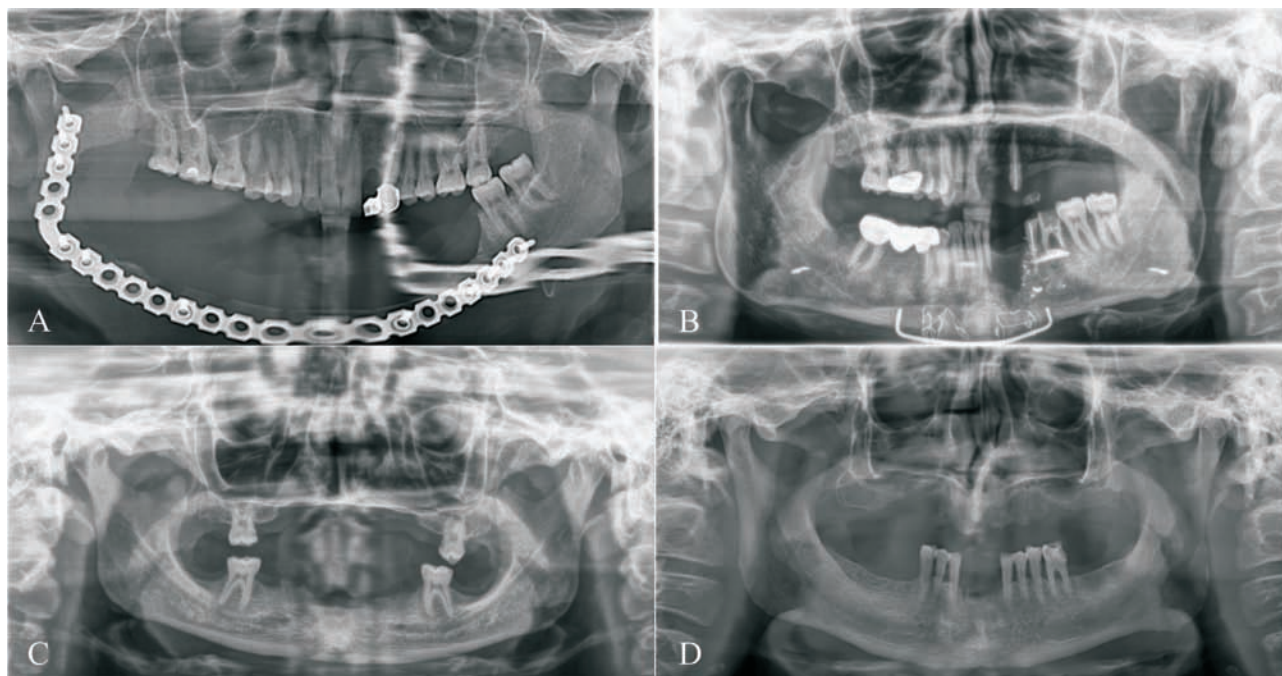
Background

The increasing demand of patients for an aesthetic and functional rehabilitation implies the necessity of a complex treatment in order to obtain the expected result. Often, the lack of bone support makes the rehabilitation difficult or even impossible.

There are many causes of insufficient bone support depending on the etiology (fig. 1) (bone atrophy, trauma, infection, tumors, traumatic extractions, periodontitis, congenital malformations, etc.). According to Atwood, teeth loss leads to bone crest loss which is manifested mainly on buccal side [1]. The rehabilitation of patients after tumor resection is often difficult to realize [2]. There have been proposed many methods for the rehabilitation of patients with insufficient bone support which have their cons and pros. According to the data of a study realized in 1990 based on 32 articles, the functional rehabilitation of patients with different forms of mandibular resections was barely obtained. In the same study it is mentioned that the expected functional and aesthetic results were obtained only in 4% of patients [3]. Even now, conventional acrylic prostheses are used to replace the extensive defects of dental arches. These prostheses are easy to be made, cheap and restore the lost bone volume. Their use leads to bone atrophy, loss of prostheses mobility and their fracture. Nowadays, implant-prosthetic rehabilitation gains popularity due to the poor performance of the conventional prostheses. According to Carl E. Misch, implant-supported prostheses provide good aesthetics; function and distribution of force, moreover, fixed implant-supported prostheses provide a psychological comfort due to their natural perception [4, 5]. In order to obtain a good aesthetic and functional result, there are some methods of implant placement in cases

of insufficient bone support: alternative methods of implant placement (short/narrow implants, tilted implants, zygomatic pterygomaxillary implants) and methods of bone grafting with implant insertion of standard sizes [6].

Alternative methods of implant placement in lateral areas with insufficient bone volume are widely used because of their advantages (low cost, minimum of surgeries, short rehabilitation time, etc.). According to the literature, short implants have a less success rate (Misch 16%, Goodacre 10%, Naert 19%) than standard or big size implants [7]. Some authors consider better to create sufficient bone volume for standard implant insertion thus avoiding overloading of the implants providing a better force distribution [8, 9]. The method is chosen by the prosthodontist together with surgeon, after a thorough analysis of parameters that can influence the rehabilitation results. According to Misch's data, it is necessary to analyze more than 60 parameters during implant treatment planning (prafunctions, crown height, masticatory dynamics, abutment position, force direction, opposing arch type, etc.) in order to obtain good functional and aesthetic results [10]. In case of insufficient bone volume, all these conditions can amplify the force applied to the prostheses and implants thus leading to their breakage, peri-implant resorption, TMJ disorders, porcelain fracture etc. [4]. Not least, patient's aesthetics influences to some extent the treatment plan, the wish to have a perfect smile especially in cases with gummy smile. Often, the lack of bone support compromises the aesthetics and the close insertion of muscles leads to mucosal dehiscence with further implant exposure. Thus, the prosthodontist's role is not only to determine the shape, position color of future prosthesis but also the position of the implants in dental arch. The adequate bone volume is necessary not only for placement of longer and



B - x-ray. Fig. 1. Insufficient bone volume in the upper and lower jaws caused by:
A) tumor resection; B) trauma; C) lack of tooth germs; D) traumatic extraction.

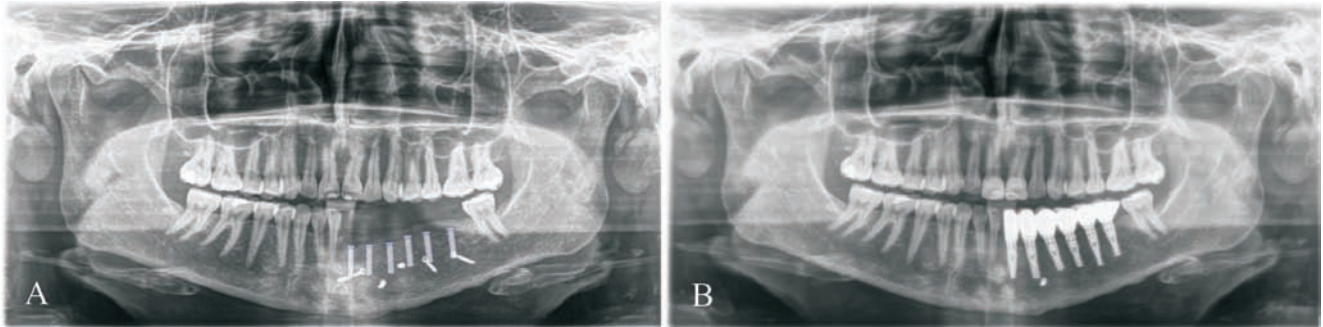


Fig. 2. Patient M.O. Implant insertion planning on OPG (A) and implant evaluation after 9 months from prosthesis delivery and 17 months postop (B).

wider implants but also for a good gingival contour and force distribution which requires 1-2 mm of cortical [11].

Aim: Evaluation of methods for patients' rehabilitation with insufficient bone support by comparative analysis of conventional and implant prosthetic methods with preliminary bone augmentation.

Material and methods

Study was based on clinical examination and treatment of 24 patients aged between 28-67 years with insufficient bone volume in the jaws of different etiology. The patients were divided in two groups according to the treatment plan. This was done in order to compare the groups and determine the advantages of each method in case of insufficient bone volume.

The first group consisted of 9 patients (mean age 38±2.77) with insufficient bone volume of the jaws. They were rehabilitated with implant supported prostheses after preliminary bone augmentation by osteodistraction (2 patients), iliac crest bone grafting (5 patients) and adjacent sites bone grafts (2 patients). 52 two stage dental implants with conventional implant loading have been inserted. Forty-five dental implants have been inserted in the lower jaw and 9 implants in the upper jaw.

The second group included 15 patients mean age 54.8±2.3, out of them 10 patients with insufficient bone support on one jaw and 5 patients on both jaws. In this group 1 patient underwent a mandibular resection. All patients from the second group have been rehabilitated with conventional acrylic prostheses. The patients came for prostheses adjustment after 2 weeks. They have been supervised for 12 months after prostheses delivery. Satisfaction degree and prostheses stability have been evaluated during the study period.

In order to choose the treatment method it is necessary to take into account the factors that might influence the long term results: the volume and shape of the bone defect, patient's motivation, concomitant disease, angulation and implant dimensions, crown height, the shape of bone crest, the soft tissue volume have been evaluated. The following criteria for group comparison have been taken: rehabilitation time, prostheses appearance and the adaptation time, prosthesis stability, bone and soft tissue status, price, patient's satisfaction degree. For

both groups have been taken panoramic X-rays (Orthophos XG3) and if necessary CBCT (Plabmeca ProMax 3D). The bone volume, before and after augmentation/implant insertion, implant angulation and their dimensions (fig. 2) have been determined on these images.

Implant stability has been determined by Periotestometry, Mombelli bleeding index has also been evaluated. Impressions have been obtained using open and closed tray technique with A or C silicone. Centric relation has been recorded with wax rims and transferred in the laboratory together with facebow records. The casts were mounted on semi-adjustable articulator (Amann Girrbach, Artex) (fig. 3a).

The mesostrucutre consisted of standard straight and angulated abutments. Plastic or metal frames of the future


<p>CLINICA STOMATOLOGICA</p>  <p style="text-align: right;">Questioner</p>	
<p>This questionnaire is anonymous, the data collected by the private clinic "Omnicent" will serve for better understanding of patients' needs and will improve the treatment quality.</p> <p>Questionnaire of patients' satisfaction:</p> <p><i>Answers to questions 1-10 must be given in numbers: 1 – the most negative, 4 – the most positive. To questions 11-13 answer only the wearers of conventional removable prostheses. To questions 11-13 answer only the wearers of implant supported prostheses.</i></p>	
1.	Do you eat with your prosthesis?
2.	Do you feel any discomfort when you chew?
3.	How well can you chew?
4.	Do you feel any changes in the food taste?
5.	Do you feel comfortable when you speak?
6.	Do you feel any unpleasant smell from your mouth?
7.	Can you easily clean your prostheses?
8.	Are you satisfied by the aesthetics of your prostheses?
9.	Do you feel that the prostheses affect your social life?
10.	How does the prostheses wearing influences your social integration?
<p>Conventional prostheses wearers</p>	
1.	Do you want to have implants in the closest future? If not, why?
2.	Did you have previously other removable prostheses?
3.	How many did you have your removable prostheses repaired?
<p>Implant supported prostheses</p>	
4.	Why did you accept implant-prosthetic rehabilitation?
5.	Why don't you want conventional removable prostheses?
6.	Did you previously wear any removable prostheses? Why do you refuse to wear them again?

Fig. 5. The sample of anonymous questionnaire used for determination of satisfaction degree.

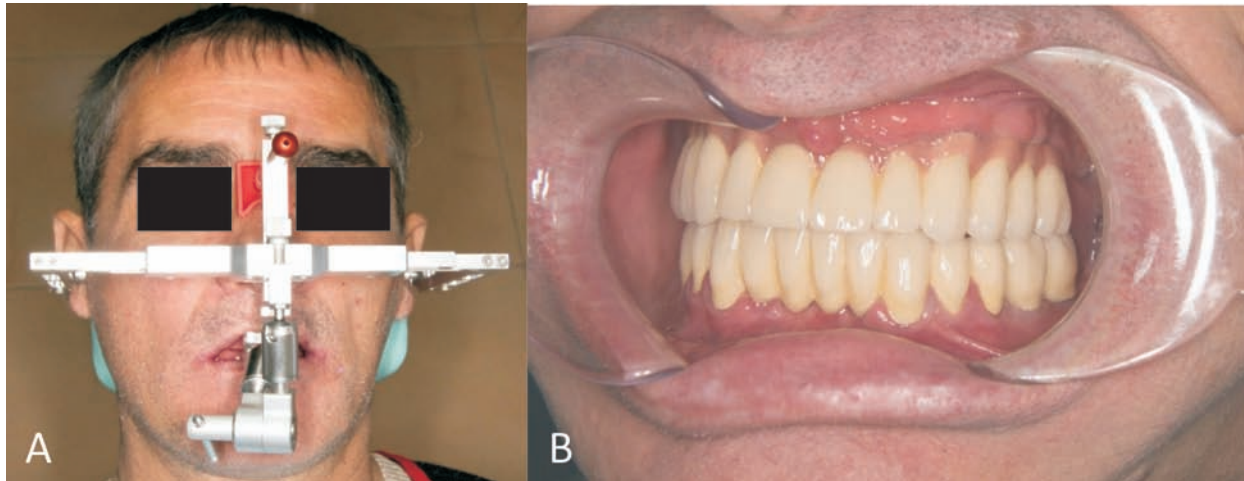


Fig. 3. A - Face-bow transfer (AmannGirrbach). B - Final prostheses.

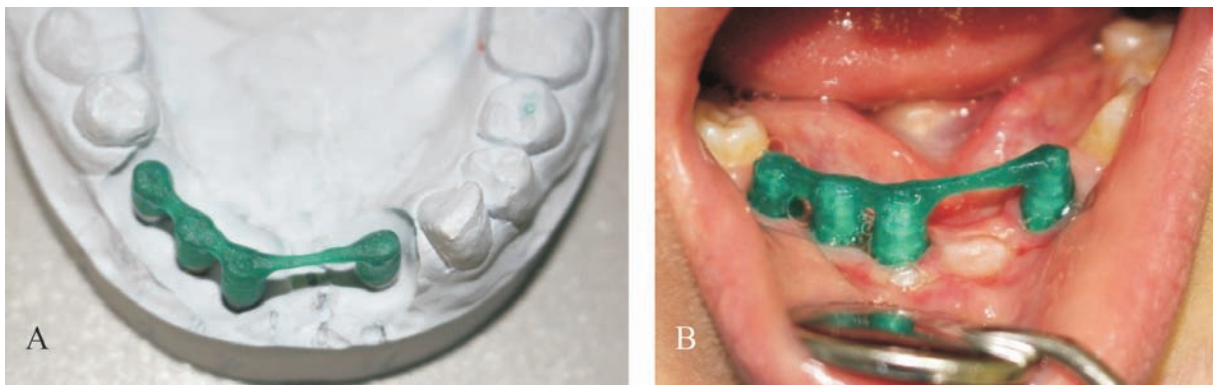


Fig. 4. Patient B. O. The aspect of plastic frame on the cast (A) and in the oral cavity (B).

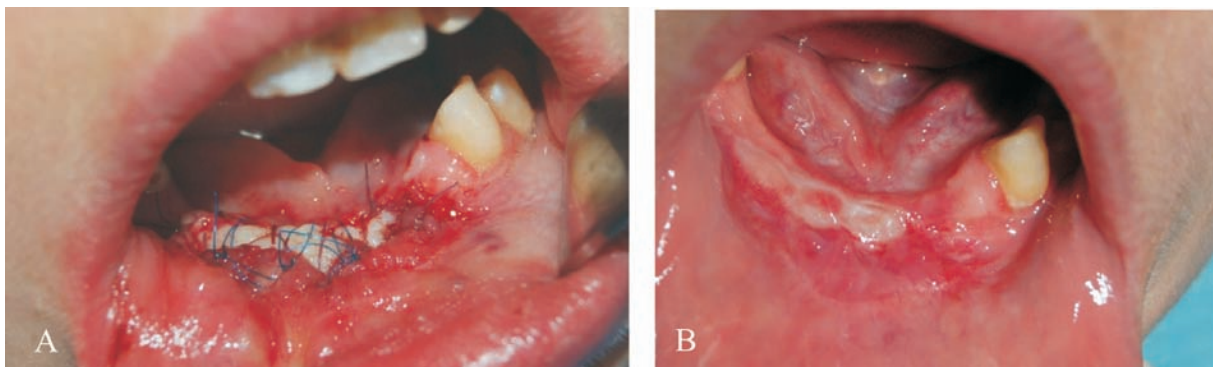


Fig. 6. Patient B. O. Free-tissue graft from hard palate: A - Intraoperator view; B - Graft aspect after 4 months.

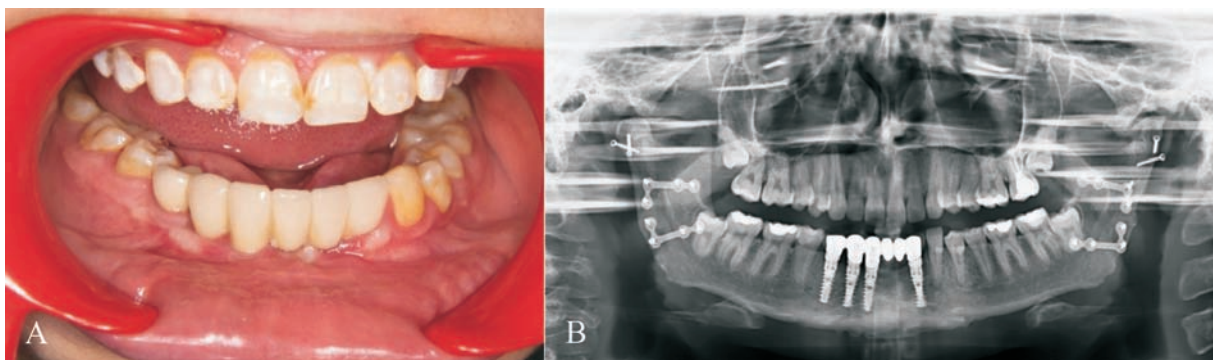


Fig. 7. Patient B. O. B - radiologic imaging. Prosthesis appearance 10 months after its delivery and 15 months after implant insertion: A - intraoral view.

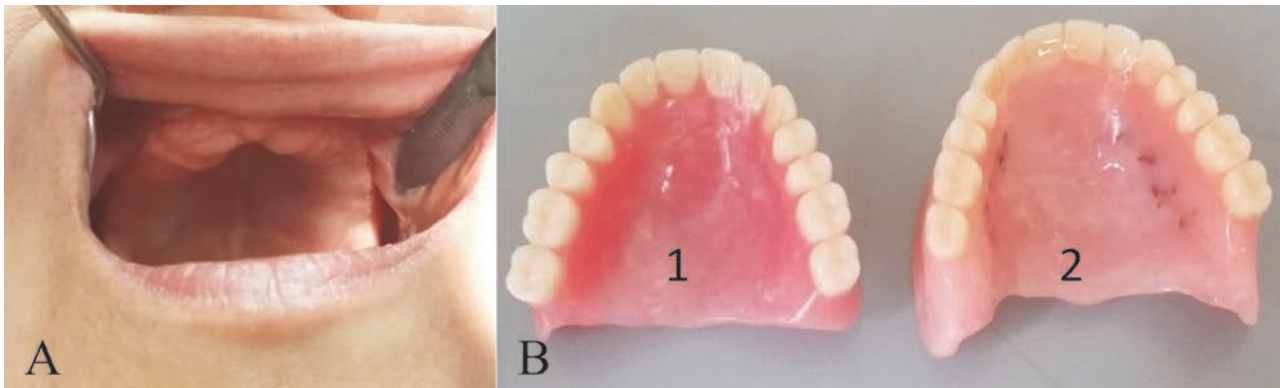


Fig. 8. Patient C. L. A – Severe atrophy in the posterior regions of maxilla. B – conventional prostheses 1- the newly made acrylic prosthesis, 2- The old prosthesis that had already been broken once and now has lost its stability.

prostheses were firstly tried in the buccal cavity with the determination of the teeth color (fig. 4).

The necessary bone volume for augmentation was calculated depending on the defect so it would allow the insertion of standard sized implants and will provide a crown length more than 8 mm and less than 15mm. All the defects implied more than 4 teeth and the inserted implant were connected together to allow a better stability and distribution of force. The manufacturing procedures of conventional prostheses is well-known and will not be described in this paper. A questionnaire consisting of 16 questions was made to determine the satisfaction degree of patients (fig. 5). The answer to first 10 questions was in form of numbers from 1 to 4 according to Linkert (1- the most negative, 4 the most positive). Questions 11-13 were for patients from group I and questions 14-16 were for patients from group II.

Results

In cases of patients from the first group, special attention was given to the necessary bone volume that would provide the possibility of standard sized implant insertion and manufacturing of fused-to-metal dental prostheses type FP1, FP2, FP3. The rehabilitation time varied depending on the chosen method and the case complexity. In 2 patients from the second group, additional procedures such as vestibuloplasty and free-tissue graft from hard palate were necessary (fig. 6).

Due to a sufficient number of implants of standard sizes, this method allows the manufacturing of functional and comfortable prostheses which are easily accepted because of their natural aspect. There has not been noticed any changes in peri-implant soft and hard tissues after 6 months (fig. 7). In one case has been noticed the exposure of implants at their crestal aspect.

The follow-up period was 12 months after prostheses delivery. At this point the bone resorption was 0.5 ± 0.08 mm mesial and 0.41 ± 0.06 mm distal. With this method it is possible to obtain good esthetic, functional and aesthetic results, also it allows to create an appropriate crown space, crown-implant ratio and insertion of implants in places which will facilitate force distribution. However, fixed implant-prosthetic reha-

bilitation with preliminary bone augmentation has some disadvantages as: long-term rehabilitation period (12.6 months in this study), the necessity of additional surgical procedures, higher price, bone graft resorption. All these limit to some extent the applicability of this method. In one case the graft was lost due to its exposure and the patient refused additional surgical procedures. In two cases it was necessary to perform additional grafting procedures to increase the volume.

Patients that refused implant-prosthetic treatment were rehabilitated with partial removable dentures that have some disadvantages as: bad prosthesis stability, trophy acceleration, low masticatory performance etc. [12, 13]. However there are many patients that choose conventional prostheses because they don't require surgeries, are cheaper and the rehabilitation time is shorter. But, according to our questionnaire, patients that wore dentures for many years are unsatisfied by their prostheses, the necessity to make a new one after a year or so (fig. 8) and usually, they accept implant prosthetic rehabilitation. Four patients from our study solicited implant prosthetic rehabilitation after wearing the conventional prostheses for many years despite the surgical risks and long rehabilitation time. Similar data have been found in a study realized by Agnieszka Koszuta et al. on 464 partially or completely edentulous patients [14].

Conclusions

1. The development of implantology permits to realize efficient and predictable results. Implant supported prostheses provide a psychological comfort and prevent the progression of bone atrophy.

2. Rehabilitation with conventional prostheses permits to restore the lost soft and hard tissue volume and patients' integration into the society. However, because of their disadvantages and hard conditions these prostheses are not always functional may not fully restore the lost functions of stomatognathic system.

3. Bone grafting allows restoring of lost soft and hard tissue volume which allows inserting of implants of standard size and manufacture of functional and aesthetic restorations. However, the necessity of additional surgical procedures, a

higher cost and a longer rehabilitation time limit the applicability of this method.

4. The questionnaire analysis has shown that patients that wore conventional prostheses for many years are usually unsatisfied by their performance and require implant prosthetic rehabilitation with fixed restorations. The last is well tolerated by patients and provide a psychological comfort that cannot be achieved with conventional prostheses.

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