

Osteo-mucous restoration and implant- supported overdenture

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The improvements of living conditions and medical care in the Western world have helped to increase the life expectancy in the population. The simultaneous evolution of prophylaxis in dentistry has also influenced the raising age, in which edentulism manifests. Nevertheless, even in the presence of undeniable improvements in dental care there is registered an increase of edentulous patients that need a full rehabilitation. Indeed, a statistical analysis carried out in the US in 1991 shows that 33.6 million people need a full denture and also points out that in 2020 this number will increase to 37.9 million people (Fig. 1).

According to the US Census Bureau, in 2005 there were 5 million senior citizens over 85 years, with a forecast of 20 million in 2020.¹ In Europe, the situation is not so different: Some authors report data assessing that among 65-year-olds there is the same number of fixed and removable rehabilitations within the population (Fig. 2). The removable prosthesis be-

comes more and more predominant as long as the patient's age is increasing, particularly in those patients that have a low socio-economic status and education.² Both the economic situation and the increase of migration flows lead us to choose rehabilitations which are better affordable from the economic point of view.

Prerequisite for stable dentures

A mucous-supported or implant-supported removable prosthesis is nowadays no longer synonymous with aging as it was in the past. Even more, one of our goals when we build prosthesis is not only to improve the masticatory function, but also be able to give the illusion of a natural dentition (Fig. 3). The functional success of full denture rehabilitation, as already seen, depends on multiple factors. Clinically, not only the correct maxillar relationship and the static positioning of the dental elements are manda-

Fig. 1: An increasing population and life expectancy in the US will lead to a growing demand for prosthetic dentistry in 2020. Currently, 40 % of those over sixty are fully edentulous.

Fig. 2: In Italy, 30 % of the population which are more than 70 years old are edentulous.

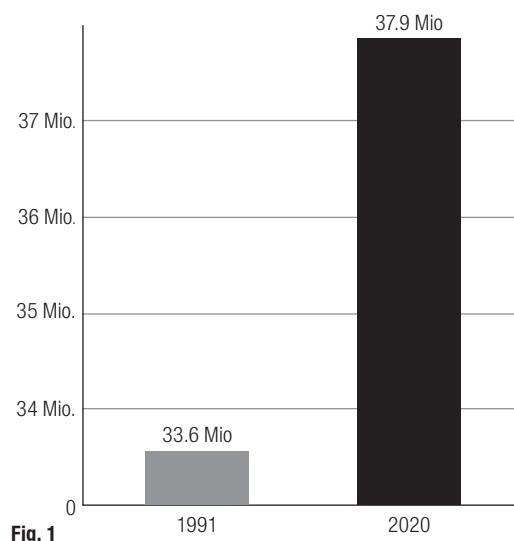


Fig. 1

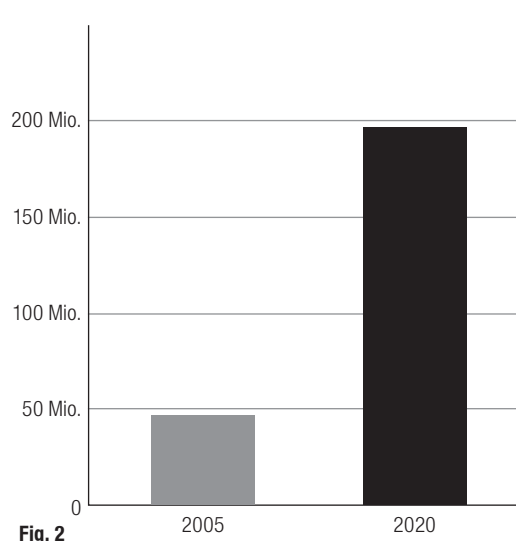
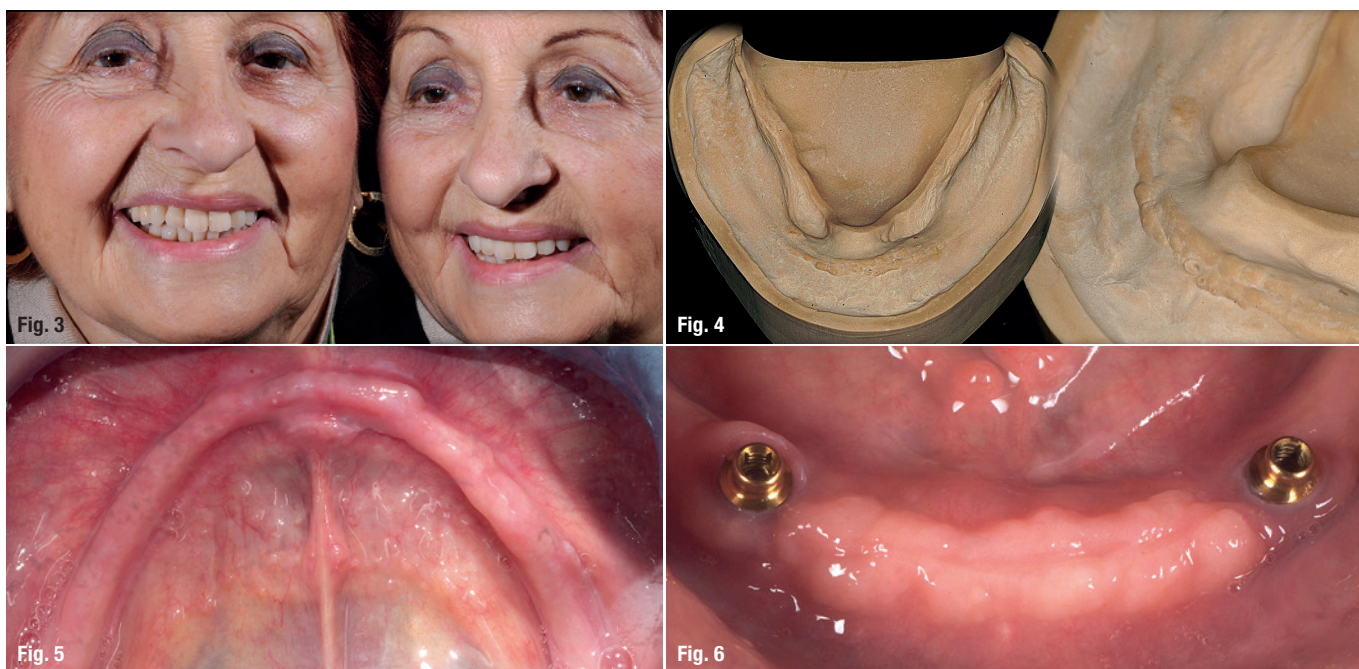


Fig. 2



tory but also the general stability of the denture is a crucial point, since it is decisive for a better patient acceptance of the prosthesis.

Generally, in an edentulous patient a large and well-preserved ridge with steep sides and a correct amount of resilient mucosa is considered to be a prerequisite for a good seal and thus stability. Indeed, a well-preserved bone crest represents a good mechanical retention to the horizontal forces that are applied to the prosthesis. With a completely flat ridge instead, the prosthesis lacks any kind of retention. In this situation, the physical mechanisms of adhesion and cohesion, and the stabilising function of the muscles become clearly predominant (Fig. 4).

These considerations suggest that the presence of physical factors distinguished in adhesion and cohesion forces are a prerequisite for a stable denture, devoid of any type of mechanical anchoring. Adhesion and cohesion forces act in the interface between prosthesis and mucosa, and reach the maximum expression when the surface of the prosthesis is as wide as possible and the space between the denture base and the mucosa is as thin as possible.

Mucous-supported dentures

The success of a treatment with an osteo-mucous-supported denture depends on the patient's acceptance and his/her sufficient adaptability to overcome unavoidable limitations that a prosthesis provides.³ Accordingly, the ability of the patient to develop newly acquired reflexes plays a key role. Anyway, this ability decreases with the increasing of age, resulting in a reduction to adapt and deal with any in-

tervention in the oral cavity. This process is a fact that can threaten their physical and mental integrity.

A number of factors like denture wearing, chewing and phonetic discomfort contribute to the patient's satisfaction or not.⁴ Often patients complain about the difficulty of eating hard foods. In consequence, they develop the habit of avoiding them, which is a well-described habit (Fig. 5). In order to increase the masticatory efficiency of the mandible, the positioning of implants represent an undeniable benefit. However, there are few objective evaluations published that suggest this to be the better solution compared to the traditional technique (Fig. 6).

Such studies would allow making more rational decisions about the best practice to put in act, in order to satisfy the patient's needs and to be in line with the widespread conviction to base a treatment on scientific evidence. The evidence of the biological success and psychosocial satisfaction lead to a general consensus that identifies the overdenture retained with two implants as the best choice for an edentulous mandible (Fig. 7).

Implant-based dentures

The opinion of implant-based denture as best practice has been questioned. Some authors, for instance, claim that this evidence does not confirm the assertion that the implants are necessary or advisable for all edentulous patients. Literature shows that the patient's acceptance of specific therapeutic modalities is modified by social and cultural influences, financial resources and adaptability. There is also no evidence of a single mode of treatment for the edentulous

Fig. 3: Priority required was not to increase stability but to restore the smile line and the lip support to achieve a younger appearance of the patient's face.

Fig. 4: Even with critical bone ridges prosthesis can be constructed with a good seal, if the supporting surface is wide enough and with a thin gap between denture base and mucosa.

Fig. 5: The masticatory efficiency depends on the stability of the prosthesis; the more stable the prosthesis is the greater can be the developed forces.

Fig. 6: The widespread success of this evidence has led to a general consensus for a standardised proposal for overdentures anchored to two implants.

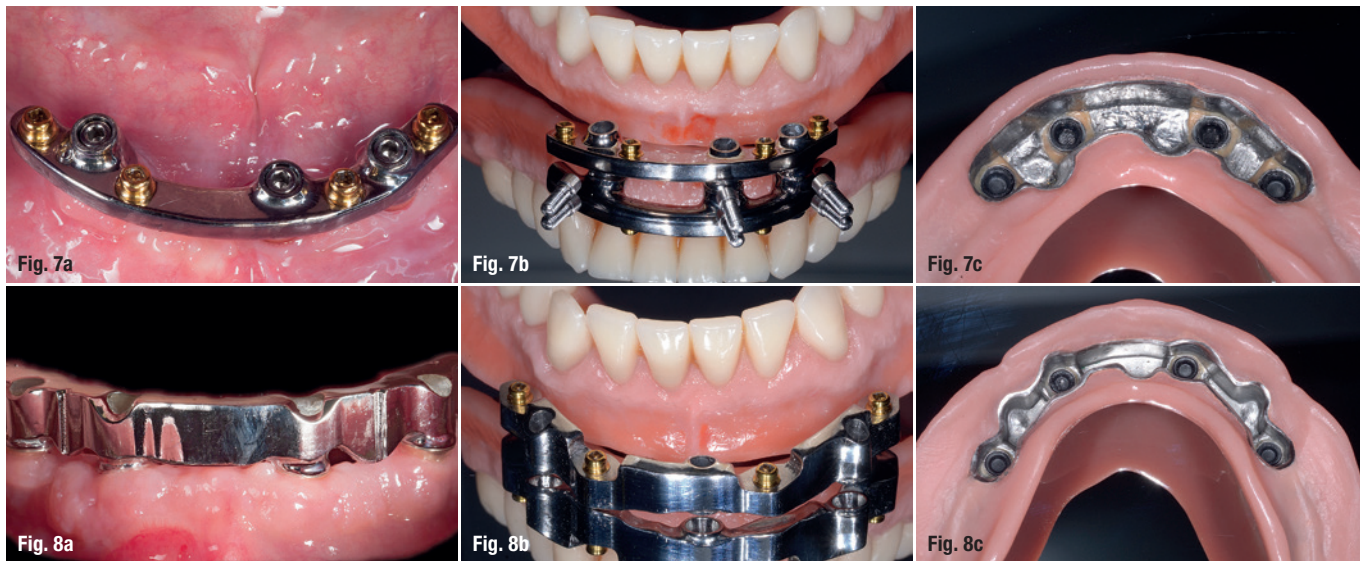


Fig. 7a

Fig. 7b

Fig. 7c

Fig. 8a

Fig. 8b

Fig. 8c

- Fig. 7a:** Implant overdenture: Attachments provide a spatial location of the prosthodontics.
- Fig. 7b:** Peripheral mucosal support provides prosthetic stability.
- Fig. 7c:** Retentive devices prevent the removal of the prosthesis from the tissues.
- Fig. 8a:** Implant-supported overdenture ensures retention and allows support during the application of the occlusal forces.
- Fig. 8b:** The insertion axis perpendicular to the occlusal plane will produce a continuous and correct relocation of the prosthodontics that avoids tensions to implant structures.
- Fig. 8c:** The peripheral seal prevents accumulation of food under the dentures.

mandible.⁸ There is no doubt that implants, particularly in the mandibular bone, allow to better anchor dentures and thus improving their stability and retention (Fig. 6).

The question that arises may be this: How many implants do we have to insert in the jaw? Better splint them or not? The satisfaction the patient declares with the simplest prosthetic project, i.e. an overdenture with two direct spherical attachments, is not significantly different from that given by two or four implants with connecting bar (Figs. 9a & b). The choice of connecting implants between bars may be the lack of parallelism; and, if in presence of bars, it is necessary to make some distinctions.

Implant-retained vs. implant-supported

A classification^{10,11} divides overdentures in implant-retained and implant-supported overdentures. The first represents the best choice for those patients that have already a complete but unstable and with no retention removable denture. In this case, both the implants (from 2 to 4) and the soft tissues contribute to the retention and stability with a more economic project compared to the milled bars and counter-bars.

Different types of attachments allow the overdenture to be retained to the implants; those resilient anchoring systems guarantee moderate vertical and rotational movements of the prosthesis (Figs. 7a-c). To achieve this kind of result, Dolder bars are usually used. Both bars and the ball attachments, not connected to each other, showed no clinical differences in the patient's satisfaction and implant survival rates.¹² Also the maintenance of the systems shows no difference between the bars and the ball attachments.¹³

The second group of overdentures are supported by implants, typically anchored on a milled bar; the latter receives all the functional loads so that there is no direct contact between the prosthesis and the soft tissues. The prosthesis is removable but seats rigidly on the bar, so that all the lateral and rotational movements are limited. In addition, the full distribution of the masticatory loads on the fixture only is useful to the preservation of the bone and also positively affects the implant integration (Figs. 8a-c). Contrary to the resilient prosthodontics supported by the mucosa and retained by the implants, a milled bar prevents rotational movement of the prosthesis.¹⁴

Aside the different conception and construction of the two types of overdenture, a further differ-



Fig. 9a

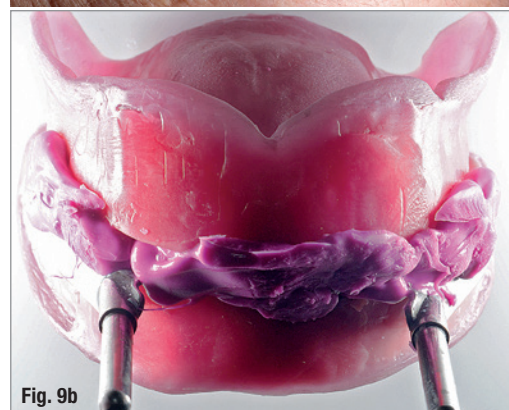


Fig. 9b

ence is the kind of maintenance to be done. The milled bars and counter-bars are more complex but they do not need the replacement of the retentive attachments. The use of an implant-supported prosthesis in the jaw can be considered a feasible option for the treatment of those patients that require clinical advantages similar to those of a fixed prosthesis but which also require the advantages of a removable denture.¹⁵ For the jaw it can be concluded that bone resorption, patient satisfaction and prosthetic complications are independent of the number of implants.

This shows that it is not possible to establish anything that is the optimal number of implants for an implant-supported overdenture.¹⁶ In addition, using implants in the lower jaw and using a conventional prosthesis in the upper jaw will likely encounter a full success. Not only the implants in the mandible have a higher success rate compared to those in the upper jaw, but also using a conventional upper prosthesis will decrease the stress that the implant prosthesis is subject to.

Conclusion

In the rehabilitation of edentulous patients we have no clinical parameters that can guide us during the treatment as we have in fixed prosthesis (Figs. 9a & b). Once positioned the front group and thereby established aesthetic and phonetic parameters of the patient, a pivotal role on the choice of the type of rehabilitation is played by the vertical dimension or, better, the available space between the arches. According to some authors, the therapeutic possibilities and the optimal type of prosthetic restoration is related to the distance between the maxillary and the mandibular arch; this proposes a classification, which considers the available vertical size for the rehabilitation, defined as the distance between the mucosa and the incisal/occlusal edge of the tooth properly positioned (prosthetic space).¹⁷

These parameters, which are often ignored during the diagnostic phase, are the key to determine success of both aesthetic and functional rehabilitation. In cases where there is a large prosthetic space (class 1 more or equal to 15 mm) available, choosing a traditional fixed prosthesis would lead to unpleasant aesthetics, i. e. long teeth and lack of lip support giving an aged expression to the patient's face. On the other hand, with a reduced prosthetic space (class 4, less than 7 mm of prosthetic space) opting for a hybrid prosthesis or an overdenture, we would not have enough space to insert the components, resulting in an alteration of the correct vertical dimension or misplacement of the occlusal plane.



Fig. 10

According to this, the diagnostic phase becomes the most important step in which the implant position is determined as well as the resulting kind of anchorage. It may be useful to choose between two methods:

1. Detection of the impressions for the preliminary models and the mounting in the articulator with the occlusal rims. The latter will also provide the smile line and the occlusal plane parallel to the Camper plane.
2. Using the existing dentures it should be analysed, if the vertical dimension and the smile line are correct; using the Gutowsky caliper, the distance between the occlusal plane and gum from the inside of the reconstructions should also be measured (Fig. 10).

It is therefore clear that the initial diagnostic process is essential to prevent complications during treatment.

Fig. 9a: The correct detection of the intermaxillary relationship is one of the decisive factors for maintaining the implants' and prosthesis' stability.

Fig. 9b: The detection of the centric relation can be established with two methods: First, operator-dependent, where the clinician guides the mandible in centric position; second, non-operator-dependent, where the patient performs limited movements and thereby determines the centric position.

Fig. 10: The space available between the arches is defined by the distance of mucosa and incisal/occlusal edge of the teeth once properly positioned.



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