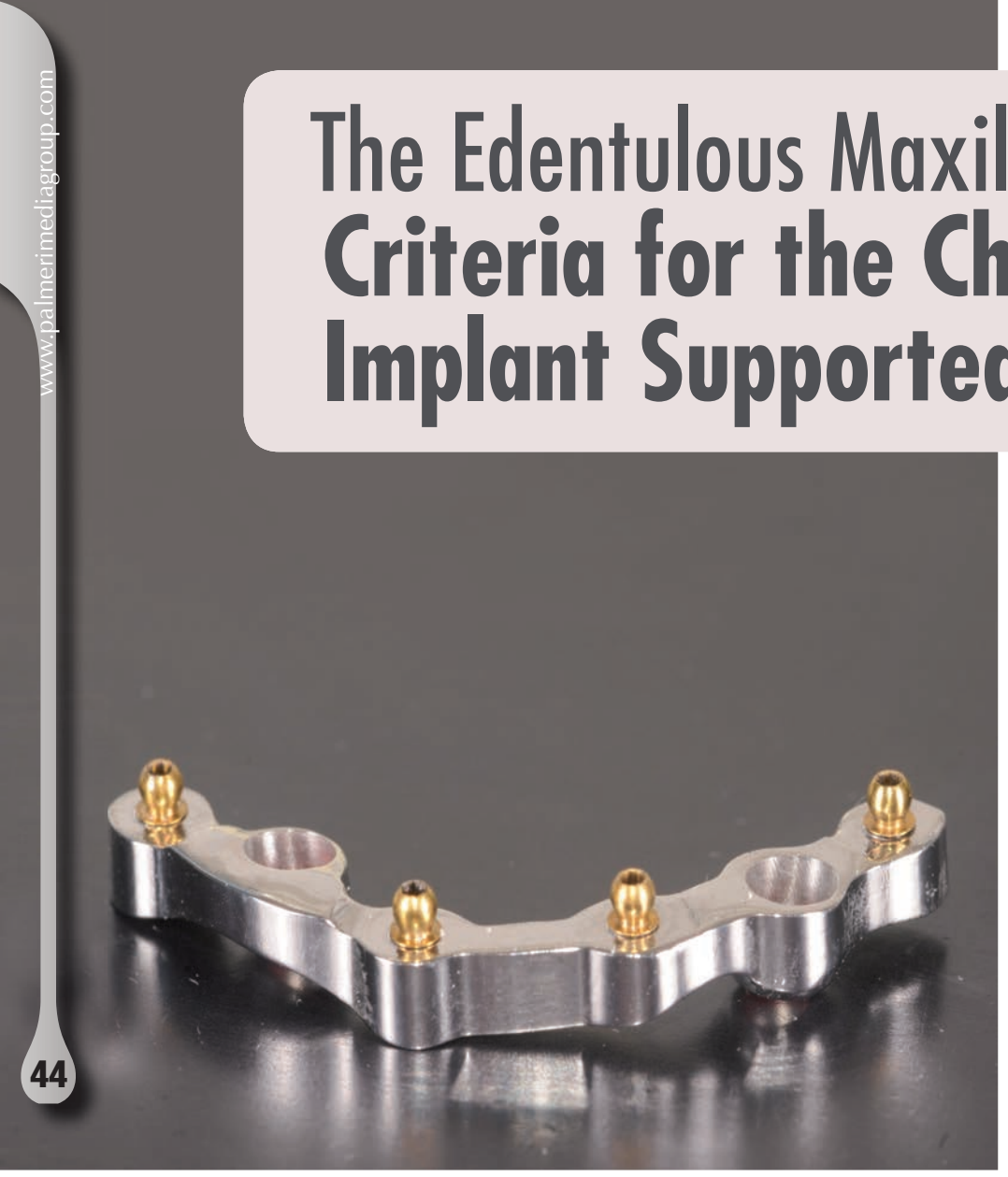
The Edentulous Maxillary Arch: Criteria for the Choice of Implant Supported Prosthetics

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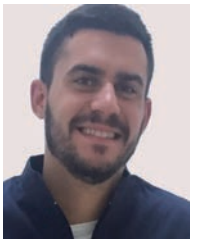
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The term minimal invasive dentistry (MI) should be made redundant as this should be the normative philosophy of all dentists. This paper outlines the pitfalls of integration of MI and how to overcome these along with suggestions for practitioners on how to integrate and apply MI into practice.

Introduction

The aim of this introduction is to outline the factors that guide the authors in the formulation of the treatment plan for a more suitable implant prosthetic for the patient with a totally edentulous maxillary arch. The selection criteria for the prosthesis will be based on fixed prosthetics on implants and on removable overdenture prosthetics on implants. Facial aesthetics that can be influenced by both types of prosthetics will be analyzed.

Implant therapy has increased in recent years and has become an important part of modern treatment plans, both for edentulous patients and for those with partial or mono-edentulous arches. Dentists, now aware that the biological process of osseointegration is a scientifically proven, irrefutable reality, have shifted their interest to the creation of implant-supported prostheses that restore natural function and aesthetics.

For the completely edentulous patient, the implant approach is considered the first choice in rehabilitation therapy. The most modern implantology aims to provide the edentulous patient, who is already a wearer of totally removable prostheses or with inevitably compromised residual teeth, with a fixed prosthetic therapy (Fig. from 1 to 5). Frequently, the same patient thinks that an implant supported fixed prosthesis can solve


Fig. 1


Fig. 2


Fig. 3

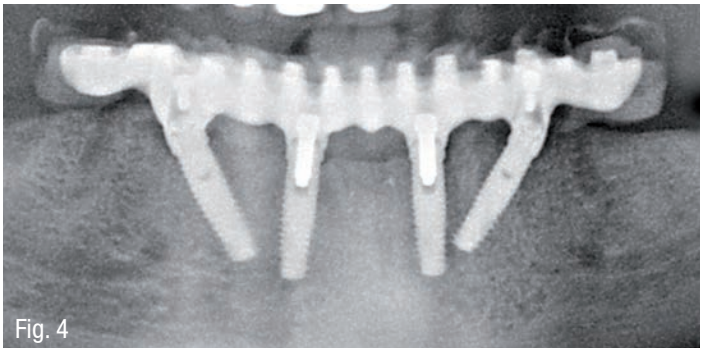
Fig. 4


Fig. 5

his/her aesthetic and social problems, that is, comfort, function and sense of well-being: is this always true? The authors contend that in some clinical situations, a removable implant supported prosthesis (overdenture) is still a preferable and feasible therapeutic option. It can be regarded as the first choice of implant prosthetic treatment, particularly in cases where there is severe loss of supporting bone and/or in cases where the aesthetics of the face need support.

We will discuss the anatomical aspects involved in facial aesthetics along with guidelines for the choice and design of a complete implant supported prosthesis in an edentulous maxillary arch, or one with irreparably compromised teeth. We will compare the options that influence our decision to select a fixed prosthesis or removable overdenture and the clinical and technical procedures for the realization of these therapies.

Aesthetics of the face: role of the lips

The dentist who has a modern vision of the Profession of Dentistry must be aware that any rehabilitation therapies that he/she performs, have effects not just confined to the oral cavity alone but can definitively affect the aesthetic, functional and psychological balance of the patient.


Fig. 6

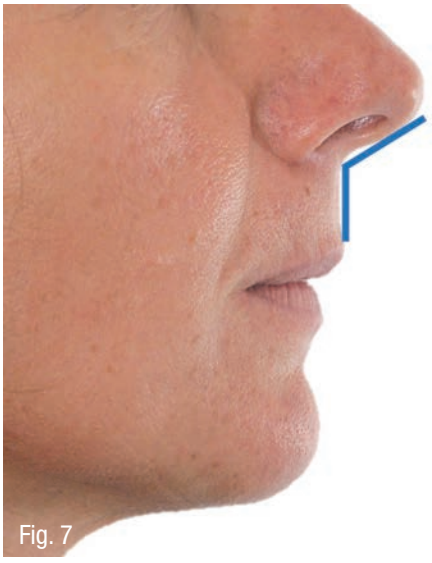
Fig. 7


Fig. 8

For example, facial beauty is a complex concept that affects people's lives and can be influenced by prosthetic therapy provided by the dentist.

Knowing the fundamental principles of facial aesthetics, and knowing how to diagnose the negative etiological factors for aesthetics is necessary in order to evaluate the different therapeutic options in the field of rehabilitation prosthetics. When it comes to the aesthetics of the face, the shape and harmony of the mouth, more generally that of the smile, along with toned and well-supported peri-oral tissues are synonymous with beauty (Fig. 6).

The lips are one of the aesthetic focal points of the face. The pleasantness of the smile and the shape and volume of the lips depends not only on the genetic characteristics of the individual but also on the presence or lack of teeth and their spatial position in the context of the maxillary arch.

Clinical analysis of the shape and size of the lips must is recorded from both the frontal and sagittal planes. On the frontal plane, the thickness is evaluated on volume, the amount of visible vermilion, and the shape of the labial commissures (very important aspect to clinically determining the correct vertical size). The average height of a male's upper vermilion is about 7.4 mm – for females, it is about 7.7 mm. The average vertical of the lower vermilion is about 10 mm. The harmonious relationship between the height of the upper and lower vermilion is about 0.80 so the lower lip is about 30% greater than the superior.

On the sagittal plane, the volume, the amount of visible vermilion, and the tone of the tissues is observed but the most important aspect, not to be overlooked, is the shape and support of the lip philtrum (Fig. 7). This anatomical area is defined, on the basis of an observation on the sagittal plane, as a labial nose angle - that is - the angle formed by the tangent of the base of the nose and the line formed by the outer edge of the upper lip (Fig. 8). The nasolabial angle should be about 90 degrees, even if it is extremely variable depending on the skeletal class. Generally higher angular values (greater than 90°) indicate a retreat of the lip philtrum which, consequentially, can worsen the profile of the patient.

An additional diagnostic means of analyzing the nasolabial angle, is lateral teleradiography, which allows for the study of soft and hard tissues of the cranium, which are so important for facial aesthetics (Fig. 9). Teleradiography must be of high technical quality to highlight the soft tissues of the profile, whose morphology is strictly dependent on the underlying bone and teeth. More specifically, the study of teleradiography aims to relate the spatial position of the upper central incisor with the lip and the maxillary bone base. We will see later how the clinician can use the data extrapolated from the analysis of this radiographic examination.


Fig. 9


Fig. 10


Fig. 11

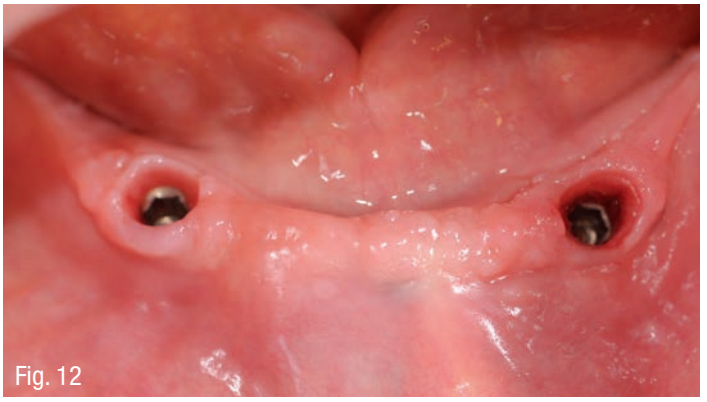
Fig. 12


Fig. 13


Fig. 14

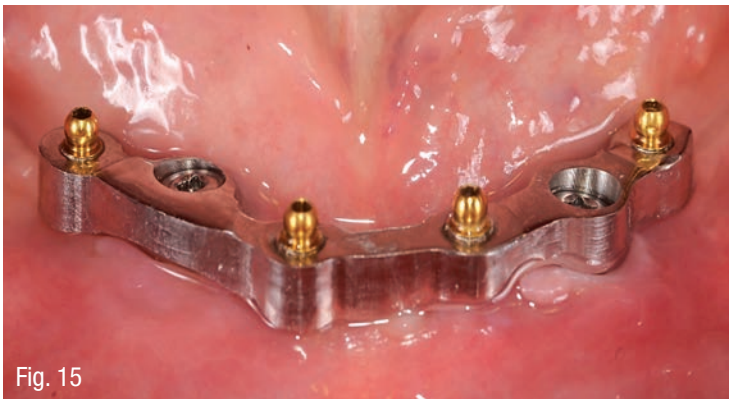
Fig. 15

In the completely edentulous patient, the bone resorption of the maxilla is centripetal and occurs continuously between one to three years in the patient who wears a removable prosthesis. It is this loss of bone structure that often means an alteration of the nasolabial angle and loss of normal anatomy on the sagittal plane, with severe impairment of the aesthetics of the patient's profile (Fig. 10). In a case where the prosthesis does not support the philtrum area, you may observe a "ducklike" appearance of the superior lip (symptom of a broken labial sulcus) which is pejorative to the overall aesthetics of the lower third of the face (Fig. 11).

Implant therapy for the completely edentulous patient will result in a well-shaped nasolabial angle thanks to the support provided by the underlying anatomical tissues or by ideal prosthetic reconstruction. If the restoration of lost bone volumes through complex reconstructive surgeries cannot be achieved or if surgery is rejected by the patient, the implant prosthesis remains the only means by which to achieve the above objectives.

Prosthetic typology

Today's state of the art modalities assumes that the dentist has at his/her disposal numerous prosthetic options to rehabilitate the edentulous maxilla with the help of endosseous implants.

Implant supported prostheses can be divided into several classifications - both fixed and removable. According to the Misch Classification, we can distinguish the following types of prosthetics:

1. **FP1:** Fixed prosthesis that restores only the crown of the tooth and has the appearance of natural dentition.
2. **FP2:** Fixed prosthesis in which a small portion of root is also restored
3. **FP3:** Fixed prosthesis that reproduces the natural dentition and a share, more or less extensive, of pink tissue (orthopedic component).
4. **RP4:** Removable prosthesis with complete implant support.
5. **RP5:** Removable prosthesis with mucous and implant support.

The most suitable prosthetic type for the patient must be chosen after careful evaluation of clinical and radiographic factors. Our philosophy is that it is not the patient who adapts to a prosthetic protocol but that the therapy responds, in the best possible way, to the patient's aesthetic and functional requirements.

Selection criteria for a fixed prosthesis or a removable implant supported prosthesis

Any prosthesis must be comfortable, retentive, functional with a pleasant appearance and with a positive influence on the peri-oral soft tissues and the patient's phonatory and masticatory abilities (Fig. 12 to 15).

From the patient's point of view, a fixed prosthetic restoration is sometimes preferred, especially for those who have experienced unstable removable dentures or genuine pharyngeal reflex. In these patients, there will be the natural propensity to exclude removable implant supported overdentures that, although stable, are still considered

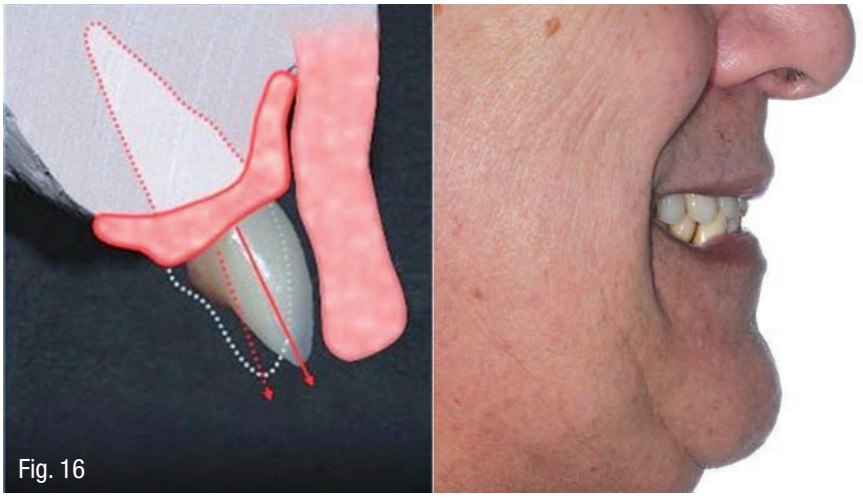
Fig. 16

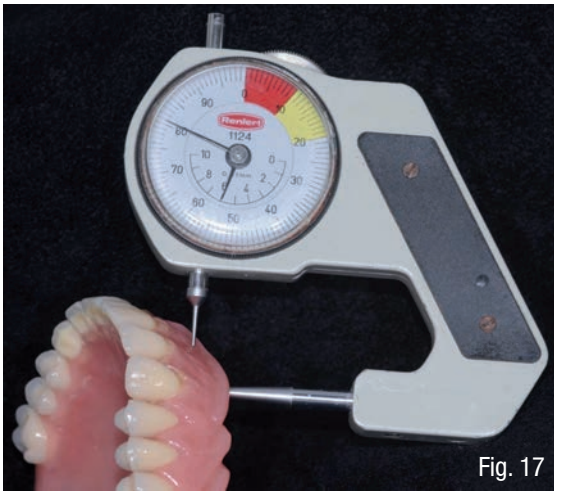
Fig. 17

similar to the previous therapies undertaken. Literature, however, agrees that RP4 and RP5 prostheses, when constructed correctly, do not alter the patient's phonatory abilities. Also, if the treatment plan has been correctly formulated, both in surgical aspects (position and number of implants) and in prosthetic aspects, the upper overdenture prosthesis will have a very limited final footprint with an improvement in comfort.

The presence of an irrecoverable residual dentition is also a psychological stimulus for the patient to request a fixed rehabilitation on implants. It is the task of the clinic to show the patient the advantages and the disadvantages of each type of prosthetic, customizing the therapy and not trying to adapt the patient to standardized therapeutic protocols.

The dentist will be faced with different clinical situations on the basis of the degree of atrophy of the upper jaw or on the presence or absence of anterior maxillary teeth. We can classify patients into two types:

- Edentulous patients with mild, moderate and severe maxillary atrophy
- Patients with residual teeth.

The selection criteria are many and must all be traced back to the final position of the maxillary central incisors. The authors believe that this aspect is the most important in the formulation of the treatment plan. In the diagnostic phase, the dentist should ideally position the upper central incisors and analyze the relationship between the acquired position and the surrounding anatomy such as maxillary bone and lip (Fig. 16). This diagnostic analysis is done with the help of well-shaped provisionals, a dedicated cephalometric study and photographs of the face.

Clinical protocol - Edentulous patients

The task of the dentist is to try to determine, following a careful clinical examination, if the aesthetics provided by the prosthesis and worn by the patient are acceptable or if improvement is needed. The factors that are taken into account are:

- visibility of the teeth and correct relationship with the lower lip (front plane);
- vertical dimension of teeth;
- support of soft tissues, especially the lip philtrum and vermilion.

In the event that the patient has an unsatisfactory removable prosthesis or is not in possession of it, it is advisable, before embarking on any therapeutic surgery, to build a provisional that allows for the evaluations listed above. It would be a very serious error to proceed with the surgical insertion of the implants at this stage, without having any parameter that guides their placement.

If the removable prosthesis properly supports the peri-oral soft tissues, in particular, the lip philtrum, the thickness of the prosthetic resin flange (Fig. 17) must be measured in order to understand how much mucosal tissue and bone has been lost and to find the appropriate therapeutic modality to the rehabilitation of this patient.

In cases of mild maxillary atrophy, the thickness of the prosthetic flange will be reduced and a fixed implant rehabilitation will be possible. In these cases, the location of the implants will be very similar to that of the roots of natural teeth with a satisfactory prosthetic result from the point of view of the patient's comfort.

In cases of moderate or severe maxillary atrophy the prosthetic treatment plan is a crucial stage of all implant prosthetic therapy. The choice of a fixed prosthesis, without preventive reconstructive surgery, could lead to a lack of support of the peri-oral soft tissues and labia, the presence of long teeth and an orthopedic component which does not facilitate hygienic home care. With a removable restoration, which allows you to choose appropriate tooth sizes and have a compensation flange, a better result could be achieved on all points.

In these cases, what diagnostic protocol can we apply to make the correct prosthetic choice with some confidence?

For these patients, we perform a clinical evaluation of the lip philtrum


Fig. 18

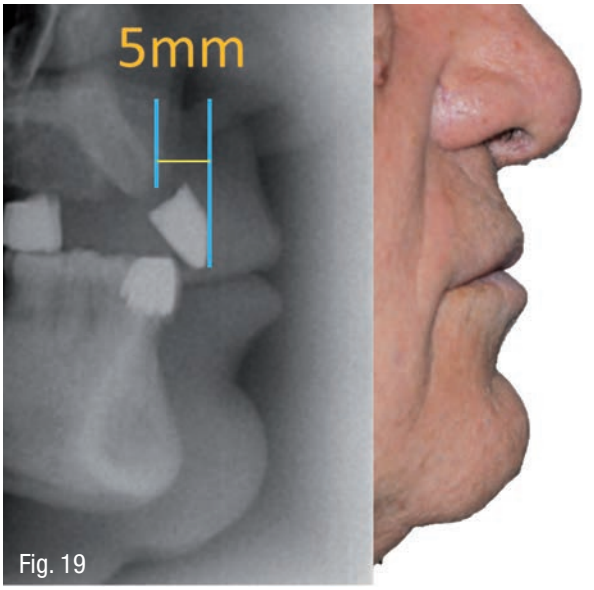

Fig. 19


Fig. 20

and the face, from the sagittal view, with the patient wearing and not wearing a removable prosthesis to verify the correct volumes. To be even more confident of the therapeutic protocol to be followed you could eliminate the resin flange to understand how important it is for the overall aesthetics of the face. In addition, for many years, the authors have been using lateral teleradiography to verify the possibility of inserting a fixed or removable prosthesis.

In these cases, the upper central incisors of the existing or temporary removable prosthesis are sprinkled with a mixture of barium and resin liquid acrylic polishing (glaze) to highlight its position during the X-ray examination (Fig. 18 and 19). After examination, the distance between the vestibular face of the incisors and the part more anterior to the maxillary bone is measured. If this distance is greater than 5mm it is advisable to treat the patient with a removable overdenture type of prosthesis. Shorter distances are compatible with a fixed implant supported prosthesis (Fig. 20).

Patients with impaired residual teeth

In these patients, the same diagnostic test is performed as for edentulous patients even if the patient presents without a pre-existing removable prosthesis. The position and state of the lips


Fig. 21

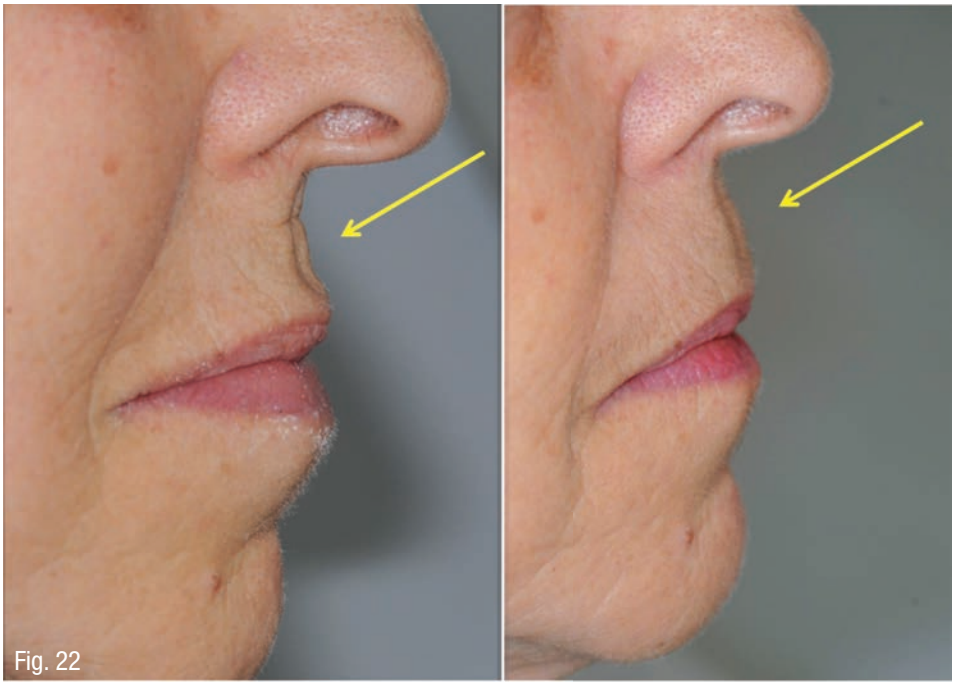
Fig. 22


Fig. 23

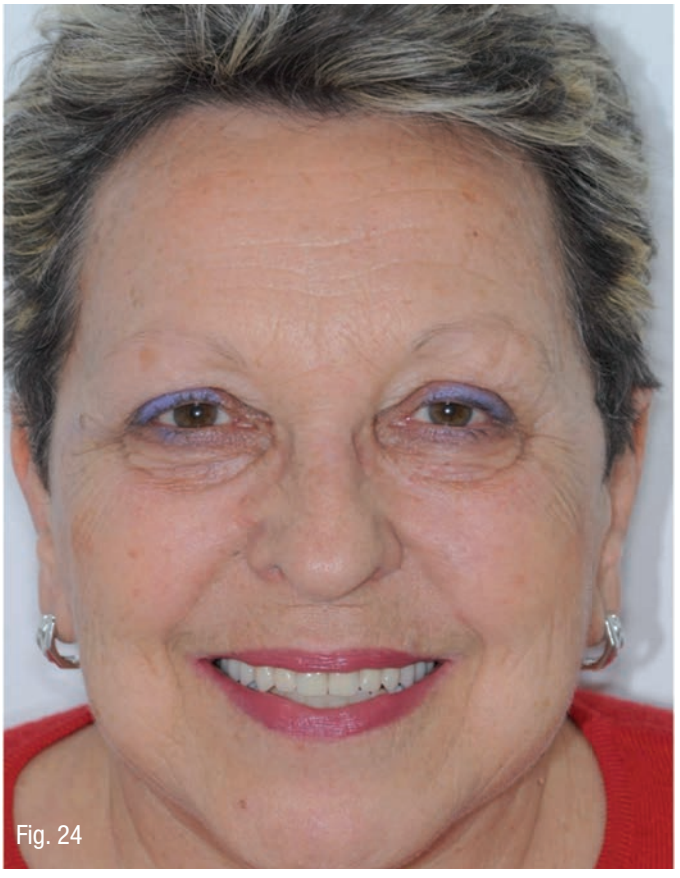
Fig. 24

and the philtrum is observed - which are often improved with the removal of the natural teeth, due to secondary occlusal trauma. In these patients you can opt for the extraction of all the teeth and the insertion of a temporary removable prosthesis or opt to keep the teeth until the time of implant surgery. Choice is often based on the experience of the clinician, and the evaluation of peri-oral soft tissues. If they are toned, lips voluminous and bone structure still preserved, the dentist can take the route of construction of a fixed prosthesis. In a case where the residual teeth have lost all bone support, it is advisable to extract the dentition in advance and insert a removable temporary prosthesis for aesthetic evaluation of the case, after healing.

In Conclusion:

Implant prosthetic rehabilitation of an edentulous maxilla requires the development of a complex treatment plan in which the choice of prosthetic typology is strictly dependent on the following factors:

- Patient needs
- Peri-oral soft tissue status
- Degree of centripetal resorption of the maxillary bone

The purpose of this article was to highlight the selection criteria for a correct implant supported prosthesis, while considering the need or not to support the peri-oral soft tissues and in particular, the lip philtrum.

For patients suffering from severe bone loss and mucosal volumes in which complex it reconstructive surgery is not possible, it is essential to design a removable prosthesis with a flange that restores the aesthetics of the patient's face.

Fixed implant supported prostheses are to be reserved for those patients who exhibit mild or moderate bone loss and who do not require an improvement of the tissues involved in the aesthetics of the smile (Fig. from 21 to 24). Sd