

**REVIEW ARTICLE**

**ALL-ON-FOUR - DIAGNOSIS AND TREATMENT PLANNING**

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**INTRODUCTION**

In spite of the increasing numbers of edentulous or soon-to-be edentulous patients, there still appears to be many reasons why patients avoid treatment with dental implants. These reasons could include:

- The fear of wearing a removable appliance in the transitional phase.
- The notion that the proposed treatment is time consuming and unpredictable.
- The number of visits involved and the fear of pain.
- Cost.

Most patients will look toward an implant rehabilitation hoping to acquire a fixed prosthesis. Treatment planning of edentulous patients with fixed restorations on dental implants has undergone a paradigm shift since the introduction of graft less solutions, and in particular, the All-on-four method.<sup>TM</sup> Today, patients have options whereby in the right indication complete rehabilitation can be accomplished by the use of four implants per arch. The huge advantage of this procedure is reduced number of implants and the ability to bypass extensive grafting procedures. This rehabilitation not only satisfies esthetics and function but also considerably reduces costs for the patient. This ultimately results in increased patient acceptance and an increased number of patients treated. Very few patients today are able to afford extensive implant rehabilitations on six to eight implants, and the All on 4 or graftless protocol is gaining popularity as being the treatment of choice for the edentulous patient.

**TREATMENT PROTOCOL**

The treatment protocol for graftless solutions involves a number of requirements.

1. It has a reduced number of implants
2. The protocol has been popularized by the All on 4<sup>TM</sup> solution (Nobel Biocare). Clinicians should be aware

that the graftless protocols may involve placement of more than four implants.

3. Anterior implants are placed straight
4. Posterior implants are tilted to avoid grafting procedures
5. The patient is provided with fixed rigid acrylic prosthesis which splints all the implants and provides cross arch stabilization
6. The prosthesis is immediately loaded.

This type of prosthesis is indicated for patients:

1. In which good lip support can be provided without a flange.
2. In which patient does not want to go through grafting procedures.
3. In which sinus is a limit posteriorly.
4. In which cost is a factor.

**PATIENT REQUIREMENTS**

There are certain requirements that must be adhered to ensure clinical success. The patient must be in good overall health. The patient must have a good understanding of the prosthesis design. In particular, the patient must be made aware that there will be pink acrylic replacing lost hard and soft tissue. For edentulous patients, this may be something they have become accustomed to. For dentate patients, they must be made aware that alveolectomy will be performed and the lost tissue will be replaced by pink acrylic.

**PRACTITIONER REQUIREMENTS**

All practitioners involved must have undergone significant hands-on training and be comfortable with immediate function procedures. Practitioners must have adequate inventory to ensure clinical success. This includes having additional implants, abutments and temporary cylinders on hand should they be required. Inventory planning should be carried out way ahead of time.

**DENTAL LABORATORY SUPPORT**

From a laboratory perspective, the provisional complete

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denture must be ready. Denture base resin must be available and adequate instrumentation to finish and polish the prosthesis. It is the dental technician's responsibility to complete all the nonclinical phases of treatment after the clinician has indexed the prosthesis intra-orally.

**DIAGNOSTICS**

When a patient presents who is a candidate for graftless solutions, a comprehensive clinical and radiographic examination must be undertaken. This should include CBCT scan, periapical and panoramic radiography. Time must be spent on diagnosis and treatment planning to ensure a predictable outcome. Key diagnostic determinants that the clinician must focus on are:

- Hard and soft tissue missing.
- Ridge display during smiling.
- Bone quantity and quality.
- Restorative space required.

**Panoramic radiograph:** On evaluation of the panoramic radiograph, the following can be found: failing dentition with recurrent caries beneath multiple restorations, low sinus floor, posterior mandibular resorption limiting implant placement in this region and a high mental nerve. On evaluation of the panoramic radiograph, it was apparent that there was bone availability in zones 1 and 2. CBCT: This provides the clinician with more accurate anatomical measurements and 3-D topography of the osseous architecture. A safe guideline in terms of osseous requirements is that there should be 5 mm of bone width and 10 mm of bone height in the maxilla and 5 mm of bone width and 8 mm of bone height in the mandible.

**CLINICAL EVALUATION**

The clinical evaluation

- Facial and lip support
- Smile line and lip length:

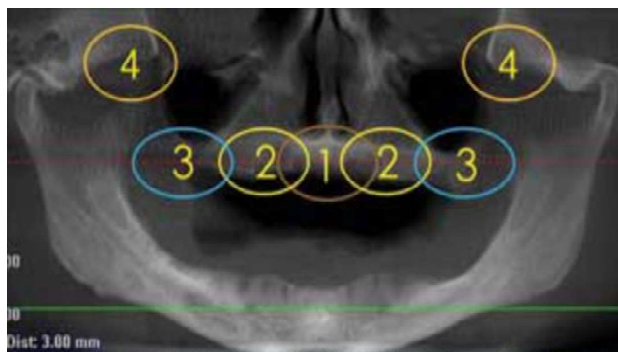


Fig. 1

- Incisal edge position: Conventional prosthodontic guidelines dictate that the incisal edge position should be determined by esthetics and phonetics. The incisal edge should be positioned just palatal to the vermilion border of the lower lip. Esthetically, there should be 2-3 mm of the incisor visible when the patient is in repose; this display is less for an elderly patient. Other guidelines for incisal edge position include the "S" position and the "F" sound. In this particular patient, it appeared the incisal edge flared forwards and over-erupted.
- Interarch space

**GAINING RESTORATIVE SPACE**

In patients who require extensive restorative therapy, restorative space constraints frequently arise. The treating clinician must decide how to gain space so restorations with adequate mechanical integrity can be fabricated. There are a few techniques to gain space

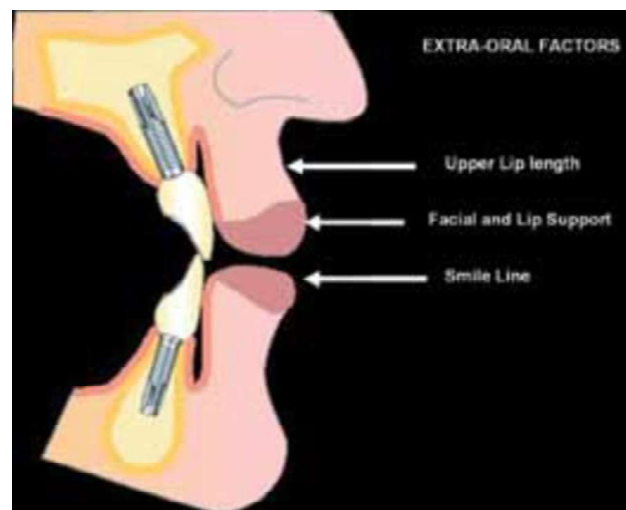


Fig. 2

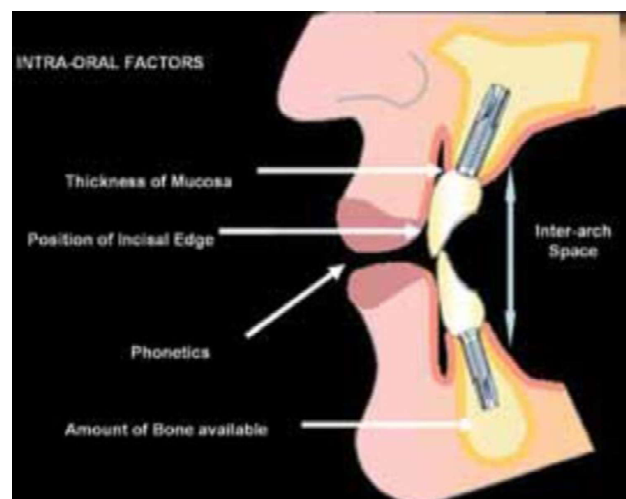


Fig. 3

for the patient about to undergo full-mouth extractions and implant placement:

- Restoration of the vertical dimension of occlusion
- Alveolectomy
- Combination of the above.

**RESTORATION OF THE VERTICAL DIMENSION OF OCCLUSION:**

This assumes the patient has lost vertical dimension, when in reality they may not have. Physiological adaptations to alterations in OVD (Occlusal Vertical Dimension) are highly individual. It can be extremely unstable in some patients but successful in others. We cannot predict in which patient it is likely to be successful; there are no scientific guidelines to do this. There is just clinician experience over time. Guidelines were established by Di Pietro<sup>1</sup>, who discussed the significance of the Frankfort Mandibular Plane Angle and its relevance to restorative dentistry. He mentioned in his article that patients with a low FMA are predisposed to a decrease in OVD; these patients are more likely to return to their former occlusions if the OVD is opened. Patients with high FMA angles are the opposite and can tolerate an increase in OVD.

Clinicians are divided in theories regarding alteration of OVD. Some believe we cannot alter it, and if we do, it will go back to its pre-treatment position. Others believe we can alter it as much as we need, and it will be stable.<sup>3,4</sup> There is a consensus that if OVD alteration is required, it is altered as little as possible to achieve the clinician’s restorative objectives. To summarize, it is possible to alter the OVD and from a muscular perspective and not suffer negative sequelae as long as the alteration occurs within the patient’s physiologically adaptable range. Alveolectomy is often required when teeth have over-erupted and there is an excess of bone, which compromises the restorative space.

**TREATMENT SEQUENCE**

**Visit 1** - At the first visit, the following is required:

- a. Pre-operative and extra-oral photos.
- b. Preliminary impressions; these should capture the full depth of the sulcus and all anatomical landmarks.
- c. Smile line evaluation.
- d. Lip support and lip length evaluation.
- e. Vertical dimension evaluation.
- f. Inter-arch relationships.

**Visit 2** - At this visit, jaw relationships are established using conventional prosthodontic guidelines.

The following is required:

- a. Smile line, midline and canine lines.
- b. Lip support.
- c. Occlusal plane.
- d. Occlusal vertical dimension.
- e. Centric relations.
- f. Tooth shape, mould and shade.

**Visit 3** - If the patient is fully dentate, a try-in appointment is not feasible. As clinicians, we use anatomical landmarks to position teeth and orientate the occlusal plane. If the patient is edentulous, the following needs to be evaluated at the diagnostic tooth set-up:

- a. Smile line, mid-line and canine lines.
- b. Lip support.
- c. Occlusal plane.
- d. Occlusal vertical dimension.
- e. Centric relations.
- f. Tooth shade and shape selection.

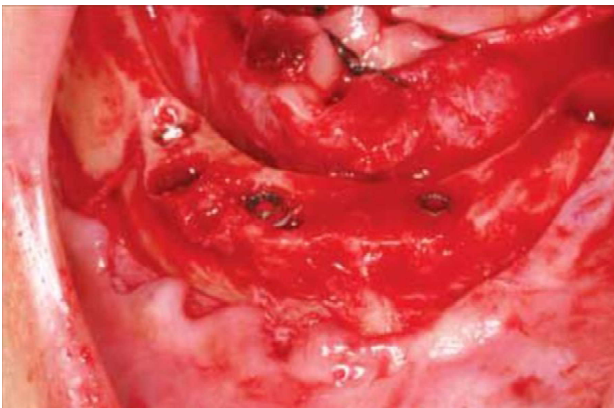
**Visit 4-** At this visit, the provisional complete dentures for the immediate load should be ready. It is critical that the restorative dentist meets with the surgeon to communicate bone reduction for restorative space, anteroposterior spread of implants and multi-unit abutment angulations required. It is recommended that the restorative dentist provide the surgeon with a duplicate denture of clear acrylic resin with the palate removed. This will allow the surgeon to visualize the abutment angulations in relation to the immediate load prosthesis.

**IMPLANT SURGERY**

The goal of implant surgery includes:

1. Extraction of all of the remaining teeth
2. Alveolectomy.
3. Immediate implant placement to achieve a primary stability of 35 N/cm. This is achieved by under-preparation of the osteotomy site; use of longer implants to achieve greater bone-to-implant contact; and use of an implant design and surface that is conducive to increased biological stability.
4. Implants all placed at the same level. The posterior implants are placed tilted and parallel to the anterior wall of the maxillary sinus. The anterior implants are placed so that the transition line will not be visible.
5. Multi-unit abutments placed to correct the angulations of the tilted implants. The selection of the healing abutments is such that after suturing, the crestal incision 1 mm of abutment is above the

soft tissue line. If alveolectomy has been performed, tissue is trimmed. Plastic caps are placed on the multi-unit abutments. The surgeon then approximates the tissue around the caps so the restorative dentist can operate at a supragingival position. In the mandible, the surgical goals are the same. Teeth are extracted, alveolectomy performed and the implants are placed. The posterior implants are tilted and the anterior implants are straight. The surgeon's goal is to achieve as much of an antero-posterior spread as possible within the limitations imposed by the loop of the inferior alveolar nerve exiting the mental foramen.



**Fig. 4**

### PROSTHETIC CONSIDERATIONS FOR IMMEDIATE LOADING

There is an abundance of literature that supports immediate loading of the edentulous patient.<sup>5</sup> Immediate loading is defined as a protocol whereby the implants are placed and put into immediate function the day of surgery. There are a number of prosthetic considerations that must be understood prior to embarking upon the immediate load process. Meticulous attention to detail is required for the process to be successful. An important prerequisite for predictable healing is absence of micromotion. Favorable loading conditions can be achieved by splinting the implants together immediately after placement. Micromotion at the bone implant interface is limited, thus facilitating the healing process. The prosthesis should satisfy the following requirements:

1. Provide cross-arch stabilization with a screw retained rigid prosthesis with no cantilevers.
2. No premature occlusal contacts.
3. No interferences in lateral excursion.
4. Minimal vertical and horizon horizontal overlap.
5. Provide adequate esthetics.

### POSTOPERATIVE PROTOCOL

Steps of the postoperative protocol:

1. Soft diet is recommended for the first eight to 10 weeks. Biologically, this is when the osseointegration phase is at most risk.
2. Appropriate pain medication and antibiotics are prescribed.
3. Patient is asked to rinse with 0.12 percent Chlorhexidine gluconate mouthwash and clean with a soft brush.
4. Occlusion is evaluated at 24 hours and minor adjustments may need to be made to satisfy the protocol above. The occlusion is checked at one week, one month and three months postoperative appointments.
5. Patient is asked to report any complications immediately.
6. Once the initial healing has occurred and the surgical site has healed, the oral hygiene regimen should include the use of an oral water jet appliance twice daily.

Graftless solutions protocols are designed to provide immediate rehabilitation of completely edentulous patients using dental implants. The scientific literature shows that this procedure has an excellent prognosis.<sup>7,8</sup>

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