



CONSEQUENCES OF INSUFFICIENT TREATMENT PLANNING FOR FLAPLESS IMPLANT SURGERY FOR A MANDIBULAR OVERDENTURE: A CLINICAL REPORT

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Flapless implant surgery is an emerging modality of treatment in implant dentistry that is known to offer several advantages. However, this procedure is inadvisable for situations where there is an absence of labial/buccal bone, reduced width of alveolar ridge, or a need for alveoloplasty to create prosthetic space. This clinical report describes the biologic and prosthodontic consequences of placing implants through flapless surgery and without preoperative treatment planning. Importance of proper treatment planning and a detailed discussion of prosthetic/restorative space analysis are discussed. (J Prosthet Dent 2011;105:286-291)

The success of mandibular implant-retained overdentures in the prosthodontic rehabilitation of an edentulous patient is well established.¹⁻⁴ The overdenture retained by 2 implants is often regarded as the standard of care for the edentulous mandible.^{4,5} Edentulous patients often seek dental implants to improve function, self-confidence, and quality of life. However, before providing implants to these patients, it is imperative that additional treatment planning procedures are followed. This helps to provide information on the choice of prosthetic design (bar or individual attachments), number of implants, position of implants, amount of prosthetic/restorative space needed, choice of implant system, and choice of attachment system.

Flapless implant surgery for edentulous patients has gained popularity in recent years.⁶⁻⁸ An obvious advantage of this technique is the elimination of the need to surgically raise a flap and expose underlying bone to place the implant. This has been reported to increase patient comfort and acceptance, and to minimize the loss of soft tissues that heal faster with minimal complications.⁶ Other advantages include reduced pain, swelling, and reduced surgical procedure time.⁶ Disadvantages of this procedure include increased expense for

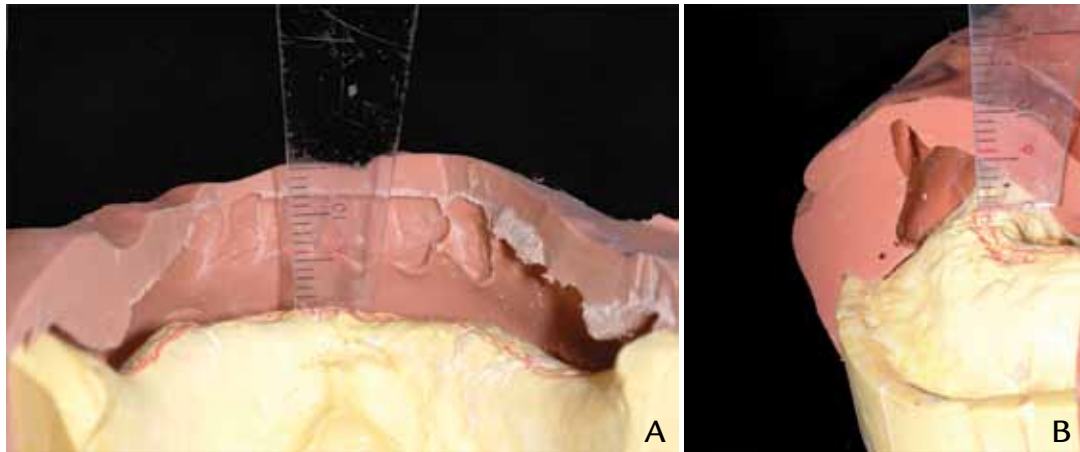
treatment planning using cone beam computed tomography, and fabrication of a stereolithographic surgical guide.⁸ Additionally, it cannot be used in situations where there is an absence of labial/buccal bone, or there is insufficient width of alveolar ridge.⁶ Flapless implant surgery is contraindicated if there is a need for alveoloplasty during implant placement to gain prosthetic space.

Prosthetic space or restorative space can be defined as the 3-dimensional space required in the oral cavity to receive the planned fixed or removable prosthesis and its associated components.^{9,10} Few reports have addressed issues of inadequate prosthetic space for implant-supported prostheses.⁹⁻¹² The amount of prosthetic space required is dictated by: 1) the position of planned prosthetic teeth, 2) the design of the prosthesis, and 3) the establishment of proper occlusal plane and occlusal vertical dimension (OVD). Sometimes, additional prosthetic space is necessary if the implant has a metal collar projecting above the bone level. Inadequate prosthetic space can result in problems such as an over contoured prosthesis, compromise in the neutral zone and tongue space, fractured prosthetic teeth, fractured prostheses, excessive OVD, and need for additional corrective surgeries.^{10,11} Furthermore, it can

impede the fabrication of the prosthesis itself.¹⁰ Alveoloplasty procedures are often necessary to provide the required prosthetic space before implant placement and eventually to accommodate the ideal prosthesis. Sometimes, removal of an existing implant and placement of new implants is needed after the required alveoloplasty procedures.^{10,11}

Various methods have been adopted to determine prosthetic space.⁹⁻¹³ The most common is the fabrication of an optimal diagnostic denture/trial denture, followed by creation of a putty/stone matrix overlying the cast that covers the incisal and occlusal surfaces of the teeth. The vertical space is then measured from the indentations of the occlusal surfaces on the matrix to the crest of the residual ridge.⁹ This measurement technique can be sufficient to determine prosthetic space in the posterior region as the prosthetic components and teeth are located directly above the crest of the residual ridge. Contrary to some reports,^{9,13} this measurement technique is not appropriate for the anterior region because the anterior denture teeth are generally positioned slightly labial to the crest of the residual ridge, and prosthetic components are, therefore, located lingually to the anterior teeth. Consequently, measuring from the indentations of incisal edges on the

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1 A, Measurement from crest of residual ridge to incisal edges of matrix incorrectly dictates availability of 12 mm of prosthetic space. B, Measurement from crest of residual ridge to surface of planned prosthesis, where implants and attachments would be placed, reveals only 5 mm of available prosthetic space. This illustrates importance of using cross-sectional matrix for prosthetic space analysis.

matrix to the crest of the ridge can provide the clinician with incorrect information about the availability of adequate prosthetic space (Fig. 1A).

To avoid this situation, a cross-sectional putty/stone matrix can assist sites where implants are planned.¹² (Figure 1B) This can help the clinician determine accurately if adequate space exists directly below the region of the denture that overlies the crest of the residual ridge; that is, where the implant and prosthetic components would be located. Failure to do so might result in incorrectly assessing the available prosthetic space and potential encroachment of the neutral zone. This is because the areas lingual to the denture teeth might be excessively thick in the final prosthesis once adequate encasement of the attachments has been provided. Another advantage of the cross-sectional putty/stone matrix is that it provides information on the amount of horizontal prosthetic space. This is especially advantageous when choosing the appropriate type of attachment system as some attachments can provide a low vertical profile but have a wider horizontal profile (Locator; Zest Anchors LLC, Escondido, Calif).

The amount of prosthetic space from the soft tissue level for a mandibular overdenture retained by 2 implants consists of space for: 1) pol-

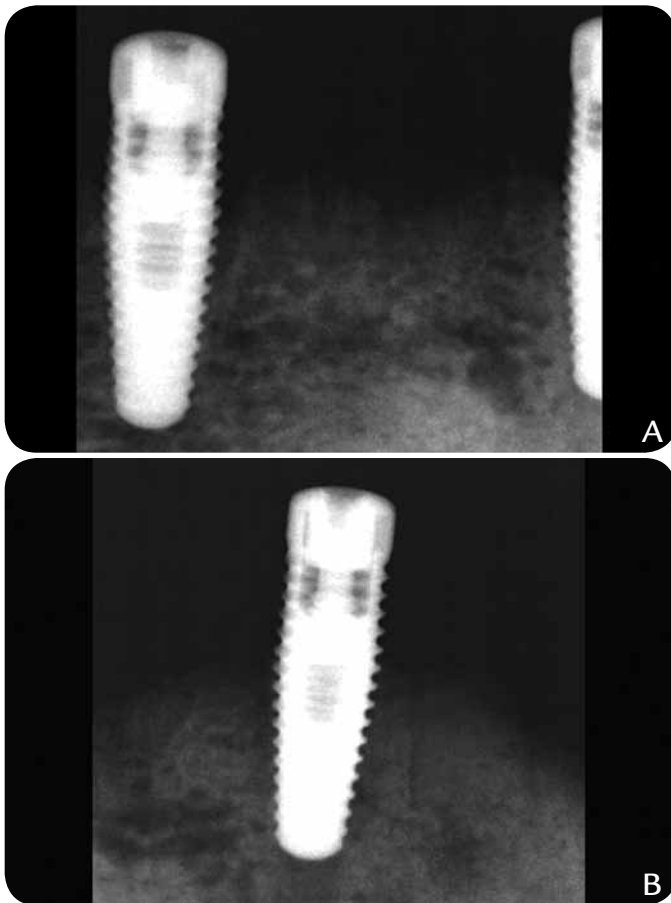
ished collar of the implant, if any; 2) height of the abutment; 3) additional height of the attachment components that seat over the abutment and 4) thickness of the acrylic resin to encase the attachment adequately. Space analyzed in this manner is actually independent of the incisal edge positions of the anterior teeth. Therefore, measurement from the incisal edges to the crest of the residual ridge is unwarranted. This also explains why increasing the OVD is not a solution for 2-implant overdentures when prosthetic space is compromised. In most situations, a prosthetic space of 10 mm or greater from the soft tissue ridge to the superior surface of the prosthesis, will provide adequate prosthetic space. This amount of space allows the clinician to choose from a wide range of attachment systems, and provide a denture with sufficient thickness of acrylic resin to encase the attachment without compromising the neutral zone. However, for a bar-supported overdenture, additional space for hygiene is necessary. The prosthetic space must allow for sufficient thickness of the bar and also space underneath.^{12,13} This clinical report describes the biologic and prosthodontic consequences of insufficient treatment planning for flapless implant surgery for a mandibular overdenture retained by 2 implants.

CLINICAL REPORT

An 83-year-old edentulous woman was referred to a prosthodontist for evaluation and fabrication of a mandibular overdenture and a maxillary complete denture (Fig. 2). Evaluation of the patient's history revealed that the patient had been edentulous for several years and was wearing conventional complete dentures on both arches. A few months before the prosthodontic consultation, the patient had 2 dental implants placed in the anterior region of the mandible, as she hoped to improve her existing situation. Analysis of the patient's records revealed that the 2 implants had been placed through a flapless implant surgery in the lateral incisor regions. There were no records of pretreatment radiographs, treatment planning, or prosthetic space analysis. Intraoral clinical examination revealed that the patient had soft and hard tissue loss in the buccal areas, exposing multiple threads of the rough surface of the implants. Radiographic examination revealed that both implants had approximately 40% to 50% bone loss (Fig. 3A, Fig. 3B). The implants were 4.3 × 13 mm in dimension (Replace Select; Nobel Biocare USA, Yorba Linda, Calif) and were placed at different vertical levels of the bone. The soft tissues around the implants



2 Frontal view of edentulous residual ridges and implants at initial presentation. Note exposure of multiple threads of implant surface due to loss of hard and soft tissues after flapless implant surgery.



3 A, Periapical radiograph of implant in mandibular right lateral incisor region reveals approximately 40% bone loss. B, Periapical radiograph of implant in mandibular left lateral incisor region reveals about 50% bone loss.

showed inflammation and appeared non-keratinized. It was thought that either the implants had not been fully enclosed by bone, or the buccal bone was thin when the flapless implant surgery was performed. Consequent-

ly, as the bone remodeled, there was a loss of hard and soft tissue on the buccal surface. None of the implants demonstrated mobility or clinical signs of infection.

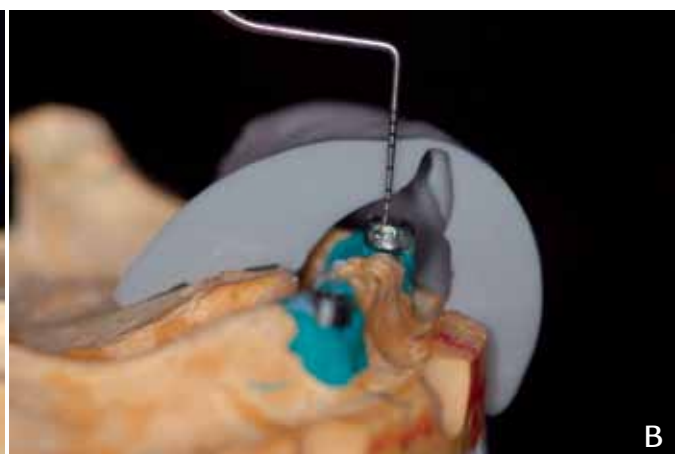
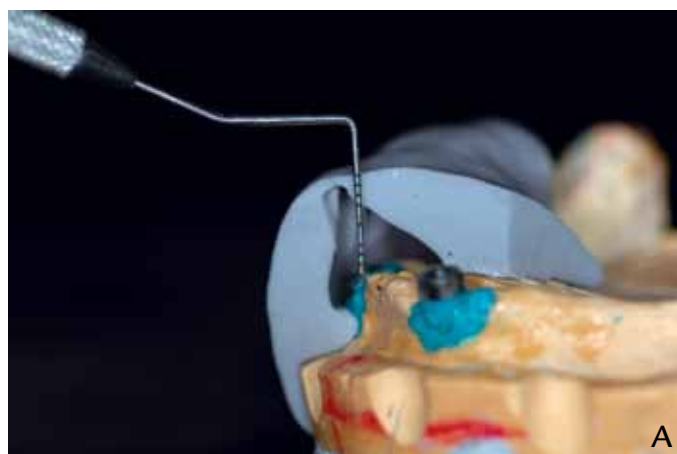
Based on the clinical situation and

the patient's expectations, a treatment plan was developed to fabricate an implant-retained overdenture in the mandible and a complete denture in the maxilla. The patient declined any additional surgeries to correct the situation with respect to the implants. Preliminary and final impressions were made for both arches. For the mandible, it was predicted that there would be issues with prosthetic space due to the projected appearance of the implants. Therefore, after border molding, an implant-level impression was made using polyether impression material (Impregum Pentasoft; 3M ESPE Dental Products, St. Paul, Minn). A definitive mandibular cast was fabricated from this impression using Type IV dental stone (Denstone; Heraeus Kulzer, South Bend, Ind). (Figure 4). Standard prosthodontic principles¹⁴ were followed, and an ideal plane for the maxillary denture was developed based on esthetics and phonetics. The positions of the mandibular teeth were then determined based on maxillary tooth positions. The trial dentures were evaluated intraorally and were considered satisfactory by the patient and the clinician.

Indices were made on the mandibular definitive cast, and a putty matrix was fabricated over the mandibular trial dentures with condensation silicone putty material (Trixa Laboratory Putty; Dentsply, York, Pa). Cross-sectional cuts were made at sites corresponding to the implant analogs. Assessment of the putty matrix revealed that there were 7 mm of vertical prosthetic space on the right side and 2.5 mm of vertical space on the left side (Fig. 5A, Fig. 5B). Prosthetic space was considered compromised on the left side, making the left implant unusable for retentive purposes; it was therefore planned to use this implant only for vertical support. A titanium ball abutment of 2.25 mm in diameter and 1 mm in cuff height (Ball Abutment-Titanium; Nobel Biocare USA) was hand tightened on the right implant analog. A gold matrix attachment (Cendres+Metaux, Bienne, Switzerland) was placed on



4 Mandibular definitive cast prepared from implant-level final impression.



5 Measurement from cross-sectional putty matrix reveals 7 mm of vertical prosthetic space on right implant. (A) and only 2.5 mm of vertical prosthetic space on left implant (B)



6 Intaglio surface of finished mandibular overdenture shows incorporation of attachment on right side and indentation on left side.



7 Frontal view of anterior mandibular residual ridge, showing ball abutment on right implant and cover screw on left implant. Note similar vertical levels of implants. Compare with Figure 2.

the ball abutment to confirm if adequate space existed for acrylic resin to encase the attachment.

The patient was informed of the treatment plan to use only 1 of the 2 implants for retentive purposes.

Thereafter, standard prosthodontic procedures were followed, and the dentures were processed in heat-polymerized acrylic resin (Lucitone; Dentsply). The gold matrix attachment was incorporated into the den-

ture during processing, and the final dentures were finished and polished (Fig. 6). The titanium ball abutment was then torqued intraorally over the right implant, at the manufacturer recommended torque of 35 Ncm; the



8 Frontal view of definitive maxillary complete denture and mandibular single implant-retained overdenture.

healing abutment over the left implant was replaced with a cover screw (Nobel Biocare USA) (Fig. 7). The mandibular denture was adjusted on the intaglio surface to establish contact with the cover screw, and the left implant was used for vertical support. Final occlusal adjustments were made to conform to the planned lingualized occlusal scheme, and the dentures were inserted (Fig. 8). The patient was given post-operative instructions for maintenance of the prosthesis, implants, and surrounding tissues. An ultra-soft brush (Biotene SuperSoft; GlaxoSmithKline, Aiken, SC) was recommended for cleaning around the exposed rough surfaces of the implant, and the patient was placed on a 6-month follow-up program. At a 3-year follow-up, the patient continued to wear both dentures, and no further complications were noted with respect to the implants and the prostheses.

DISCUSSION

The optimal treatment plan for this patient at the time of initial presentation would have been fabrication of optimal diagnostic dentures, followed by radiographic imaging, prosthetic space analysis, fabrication of a surgical guide, alveoplasty, and placement of implants through traditional surgery. This patient was not an appropriate candidate for flapless im-

plant surgery due to the required alveoplasty, and possibly an absence of bone in the facial region that resulted in exposure of multiple threads of the implant.

The final treatment plan chosen for this patient was based on a confluence of factors. The option of providing the patient with an overcontoured prosthesis to accommodate an abutment and attachment on the left implant was eliminated. Such overcontouring would have encroached upon the neutral zone and space for the tongue, resulting in the patient's discomfort and dissatisfaction. The patient was offered the option to remove both implants, followed by alveoplasty and placement of new implants at optimal levels. However, the patient refused this option due to age and pre-existing medical comorbidities and saved it as an option if she experienced problems with the treatment selected. The final mandibular prosthesis for this patient was similar to a single implant-retained overdenture with only vertical support provided by the second implant. Single implant-retained overdentures have been shown to be superior to conventional dentures in the mandible.¹⁵ A ball abutment system was selected to provide rotational freedom for the overdenture, that was retained by a single implant, and potentially prevent excessive wear of the attachment. Furthermore, a recent in-

vitro study of single implant overdentures demonstrated that the retention obtained from a 2.25 mm ball abutment-attachment system was significantly higher than the Locator system (Zest Anchors LLC).¹⁶ A cover screw replaced the healing abutment of the left implant as it had the lowest vertical height. This allowed both implants to be at the same level, which deterred potentially detrimental fulcrum lines.

SUMMARY

This clinical report described the biologic and prosthodontic consequences of improper patient selection and insufficient treatment planning with regard to flapless implant surgery for a mandibular overdenture. Inappropriate implant positioning resulted in loss of hard and soft tissues and compromised prosthetic space. This resulted in the fabrication of a less than optimal overdenture, which used only 1 of the patient's 2 implants for retention. However, flapless implant surgery is an emerging and attractive treatment where careful patient selection and treatment planning is necessary to prevent similar situations. Optimal 3-dimensional positioning of the implants is more important than the surgical technique adopted for their placement.

REFERENCES

1. Raghoobar GM, Meijer HJ, van't Hof M, Stegenga B, Vissink A. A randomized prospective clinical trial on the effectiveness of three treatment modalities for patients with lower denture problems. A 10-year follow-up study on patient satisfaction. *Int J Oral Maxillofac Surg* 2003;32:498-503.
2. Meijer HJ, Raghoobar GM, van't Hof MA. Patient satisfaction with mandibular implant overdentures and conventional dentures: a 10-year prospective study of clinical aspects and patient satisfaction. *Int J Oral Maxillofac Implants* 2003;18:879-85.
3. Sadowsky SJ. Mandibular implant-retained overdentures: a literature review. *J Prosthet Dent* 2001;86:468-73.
4. Ma S, Tawse-Smith A, Thomson WM, Payne AG. Marginal bone loss with mandibular two-implant overdentures using different loading protocols and attachment systems: 10-year outcomes. *Int J Prosthodont* 2010;23:321-32.

5. Feine JS, Carlsson GE, Awad MA, Chehade A, Duncan WJ, Gizani S, et al. The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. Montreal, Quebec, May 24-25, 2002. *Int J Oral Maxillofac Implants* 2002;17:601-2.
6. Campelo LD, Camara JR. Flapless implant surgery: a 10-year clinical retrospective analysis. *Int J Oral Maxillofac Implants* 2002;17:271-6.
7. Esposito M, Grusovin MG, Maghaireh H, Coulthard P, Worthington HV. Interventions for replacing missing teeth: management of soft tissues for dental implants. *Cochrane Database Syst Rev* 2007;18:CD006697.
8. Brodala N. Flapless surgery and its effect on dental implant outcomes. *Int J Oral Maxillofac Implants* 2009;24 Suppl:118-25.
9. Ahuja S, Cagna DR. Defining available restorative space for implant dentures. *J Prosthet Dent* 2010;104:133-6.
10. Bidra AS. Surgical and prosthodontic consequences of inadequate treatment planning for a fixed implant-supported prosthesis in the edentulous mandible. *J Oral Maxillofac Surg* 2010;68:2528-36.
11. Lee CK, Agar JR. Surgical and prosthetic planning for a two-implant-retained mandibular overdenture: a clinical report. *J Prosthet Dent* 2006;95:102-5.
12. Phillips K, Wong KM. Space requirements for implant-retained bar-and-clip overdentures. *Compend Contin Educ Dent* 2001;22:516-22.
13. Misch CE. *Contemporary Implant Dentistry*. 3rd ed. St Louis: Mosby; 2007. p. 296-297.
14. Zarb GA, Bolender CL. *Prosthodontic treatment for edentulous patients*. 12th ed. St. Louis: Mosby; 2004. p. 263.
15. Liddel G, Henry P. The immediately loaded single implant-retained mandibular overdenture: a 36-month prospective study. *Int J Prosthodont* 2010;23:13-21.
16. Alsabeeha N, Atieh M, Swain MV, Payne AG. Attachment systems for mandibular single-implant overdentures: an in vitro retention force investigation on different designs. *Int J Prosthodont* 2010;23:160-6.

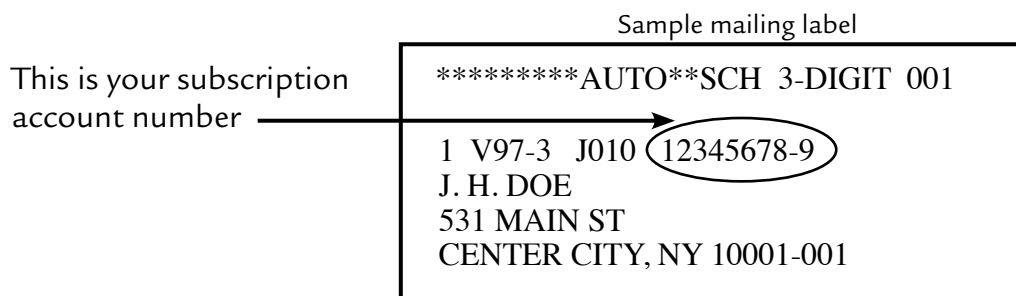
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