Dental implants and the partially edentulous patient
Diagnosis and treatment planning

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This article will focus on developing a logical and sequential approach to treatment planning for the partially edentulous implant patient. In addition it will highlight some of the uses of radiographs as a diagnostic aid.

The demonstrated long-term clinical success with osseointegrated implants1 now allows (dare I say obligates) dentists to inform their patients about implants in cases where the restorative results would be more idealized. Indeed now that many partially edentulous patients are expressing great interest in implants, there are factors which must be considered that do not apply to the completely edentulous patient. Firstly, the periodontal status of the remaining natural teeth must be incorporated into the overall periodontal - implant treatment plan. Secondly, the incorporation of implants into the treatment will sometimes modify the periodontal treatment plan. As an example, a questionable tooth that would otherwise be maintained (even if only for a few years) might be extracted if the anatomic area that the tooth occupied would be better served to allow placement of an osseointegrated implant. Readers interested in related periodontal guidelines are referred to the bibliography for information concerning: Periodontal Assessment Forms2, Periodontal Examination1, Periodontal Prognosis3 Periodontal Treatment Planning3, and finally, Periodontal Considerations as pertaining to the tissue surrounding the implants themselves8.

Dentists who plan to incorporate implantology into their practice must be properly trained. Readers are referred to Table I, which stipulates the R.C.D.S. guidelines for the utilization of dental implants as of June 1988.

This article will focus on developing a logical and sequential approach to treatment planning for the partially edentulous implant patient. In addition, this article will highlight some of the uses of radiographs as a diagnostic aid. Future articles will deal with several other aspects of treating the implant patient.

Getting organized
It is advisable to incorporate an implant charting system such as the one that can be purchased from The International Congress of Oral Implantologists developed by Dr. C.E. Misch6. You may decide to develop your own form which should function as a flow sheet. See Table II for an example of the chart designed by the author and Dr. Leonard Schwartz.

When the team approach is being used, the restorative dentist and surgical specialist must co-ordinate the diagnostic, treatment plan and maintenance phases to assure clinical success. Pre-surgically, the restorative dentist is responsible for the prosthodontic evaluation, management of the interim prostheses and surgical stent fabrication. The surgical specialist is responsible pre-surgically for the medical, surgical evaluations, radiographs, tracings and implant type, number and position. Post-surgically, the restorative dentist is responsible for the interim prosthetic alterations, final prosthodontic treatment and maintenance. The surgical specialist post-surgically is responsible for soft-tissue evaluation, bone - implant interface evaluation, radiographic follow-up and periodontal maintenance.

Initial appointment and consultation
The initial appointment and consultation should cover the following:
1. general discussion on implant restorative potential
2. patient expectations
3. rough cost estimate (cannot be specific at this point)

If the patient expresses an interest in knowing more about implants, then a thorough diagnosis (Table III) should be the next step. Once all the diagnostic data has been gathered and analysed, the dentist will formulate a treatment plan (Table IV). As mentioned in the beginning of this article, the dentist must formulate a comprehensive treatment plan incorporating the implant phases in proper sequence with the periodontal, prosthetic and maintenance phases. (Tables II & III).

Radiographic evaluation
As noted in Table III the radiograp-
hic examination is an indispensable diagnostic tool for the implant patient. Radiographs are needed to detect pathology, anatomical structures and bone quality, quantity and location.

The lateral cephalometric radiograph can be helpful for viewing the pre-maxilla and symphysis. However, it is limited and as such is utilized at times as an adjunctive view. Dr. D. Clepper describes an interesting technique whereby he utilized an extra-oral periapical film in the symphysis area that produces results similar to what the cephalometric film would yield. He places a No. 2 periapical film sagittally on the lateral aspect of the symphysis for the extraoral view.

The panoramic radiograph is valuable and commonly used to view the maxilla and mandible. This radiograph does have several limitations including overlapping images and non-uniform magnification. Different parts of the radiograph show different degrees of error and there is no single corrective factor. Additionally, one cannot make an accurate assessment of bone density or relative measurement from the panoramic radiograph. Clinically, we may apply a magnification factor of, e.g., 25% depending on the type of machine, however, at times adjunctive periapicals or tomography is indicated.

For the partially edentulous patient, most commonly a full mouth series of periapicals, bite-wings and a panoramic view are taken for periodontal and implant purposes. Tomography should be considered for the atrophic maxilla and posterior mandible where pneumatized sinuses exist and the surgical specialist anticipates a sinus elevation in conjunction with implant placement.

Tomography is a radiographic technique where a ‘slice’ of the structure is filmed. In the mandible or maxilla, this allows the dentist to view a coronal or sagittal ‘slice’ to assess the layer of cortical bone, trabecular bone, quality and quantity of bone, location and dimension of the anatomical structures. Tomography however should be prescribed judiciously due to the expense and amount of radiation involved, although one might also consider tomography in the maxilla and posterior mandible where the ridges seem clinically narrow. Alternatively, the width of the osseous ridge can be assessed at the time of surgery or via a pre-surgical exploratory flap. The obvious disadvantage with the flap approach is that the patient is subjected to a surgical procedure where implants may not be placed. Another diagnostic approach is bone sounding with a sharp-pointed bone caliper, however, in the opinion of the author, this technique has limited accuracy.

It may be worthwhile to consider fabricating a ‘radiographic-surgical stent’ prior to the panoramic radiograph. A stent (made out of acrylic material) is fabricated from the diagnostic cast. Holes are drilled into the stent at the previously marked ideal implant positions and a radiopaque object is secured in the holes. The patient then wears the stent while the radiograph is taken. This same stent can be modified and utilized as a guide for the surgical placement of the implants. The stent allows a more accurate assessment of the desired implant locations as they relate to the anatomic structures.

**Table 1**

**Guidelines for the utilization of dental implants**

**The Royal College of Dental Surgeons of Ontario**

<table>
<thead>
<tr>
<th>Educational Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is recommended that, prior to performing any implant procedure, a dentist takes a comprehensive course which adheres as closely as possible to the following criteria. The course should be:</td>
</tr>
<tr>
<td>1. conducted by persons who have had formal training and experience in dental implants;</td>
</tr>
<tr>
<td>2. one that has a participation component;</td>
</tr>
<tr>
<td>3. one that teaches methods that have been shown to be successful as a result of investigative basic science and by longitudinal scientific studies;</td>
</tr>
<tr>
<td>4. one whose duration is equivalent to not less than one full day of instruction for each of the surgical and prostho- dentics phases. The time for each phase should be divided equally between didactic and clinical teaching.</td>
</tr>
</tbody>
</table>

**Professional Responsibilities**

Records should include:

1. documentation showing that "informed consent" was received after an adequate explanation of the treatment plan, prognosis and risks was provided;
2. radiographs which provide optimal imaging of the surgical site;
3. study casts and other diagnostic aids as indicated;
4. detailed clinical notes relative to surgical procedures, temporization, type, size, number and location of implants, including post operative notes;
5. documentation of ongoing clinical and radiographic monitoring.

Comprehensive training programs in the utilization of dental implants will serve to protect the public of Ontario as well as afford protection for the practitioners. Lack of adequate training may place a practitioner at risk in the event if there are adverse results due to the treatment rendered. Patients may also be subjected to a review by the College if unsatisfactory results or patient complaints come to light.

**Bibliography**

7. Patient Dental-Medical Implant Evaluation Form, The International Congress of Oral Implantologists, Developed by the Mishack Institute, Copyright ICOI, 1987
8. 8. The Masters Series Video Tapes, Video Study Club, Dr. Doug Clepper, Tape #3 - Examination, Consultation and Financial Arrangements For Implant Dentistry, 3553 Wheeler Road, Augusta, Georgia, 30909
### Table II

**Implant treatment sequence**

<table>
<thead>
<tr>
<th>Patient:</th>
<th>Date of Birth:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referring Dentist:</td>
<td>Restorative Dentist:</td>
</tr>
</tbody>
</table>

**A) Preliminary Assessment**

- general status evaluation: [ ] medical [ ] dental [ ] psychological [ ] patient expectations
- overview of surgical & prosthetic phases and potential
- overview of costs: [ ] surgical [ ] educational [ ] models [ ] brochures [ ] video tape [ ] consent form to patient
- communication with: [ ] referring dentist [ ] restorative dentist

**B) Pre-Surgical Phase**

- comprehensive [ ] health assessment
- clinical exam [ ] treatment plan [ ] estimate
- comprehensive radiographical exam [ ] panoramic [ ] intraoral [ ] analysis [ ] tracing [ ] depth of bone
- study models: [ ] poured [ ] trimmed [ ] mounted
- diagnostic wax-up
- selection of tentative fixture sites:
- verification of tentative prosthetic plan with restorative dentist

**In-Depth Consult, Patient Agreement**

- comprehensive dental treatment plan [ ] estimate
- anticipated fixtures costs and cost [ ] estimate
- anticipated restorative plan and cost [ ] estimate from restorative dentist
- estimate and consent forms signed and returned to dentist [ ] surgical [ ] prosthetic
- photographs [ ] extraradial [ ] intraoral
- pre-op orders [ ] Rx:
  - surgical stent [ ] repair template [ ] received [ ] not needed
- radiographs with template: [ ] panorex [ ] intraorals [ ] not needed [ ] completed

**C) Surgical Phase I**

- pre-op instructions followed
- fixture operation:
  - post-operative instructions given:
  - interim prosthesis modification:
  - not needed [ ] immediate post-op.
  - suture removal (7-10 days)
  - post-op soft tissue evaluation [ ] 1-2 weeks
  - post-op, radiographic evaluation

**D) Surgical Phase II**

- fixture uncovering
- verification of osseointegration
- placement of healing caps/abutments
- modification of interim prosthesis:
  - not needed
  - post-op evaluation (1-2 weeks)
  - all necessary "other" dental treatment completed, or
- communication with restorative dentist about fixture details

**E) Final Prosthetic Phase**

- oral hygiene aids: [ ] brush [ ] chlorhexidine
- post-care [ ] proxa-brush [ ] rubber tip
- co-ordination of appointments with:
  - restorative dentist [ ] referring dentist
  - maintenance plan:

**G) Notes**

### Table III

#### Diagnosis

**A) Health Assessment**

1. Past medical history
   - any metabolic diseases [ ]
   - psychiatric or psychological problems [ ]
   - allergies [ ]

2. Present medical status
   - infections present [ ]
   - current medications [ ]

**B) Clinical Examination**

1. Partially edentulous
   - oral cancer screen [ ]
   - dental carries [ ]
   - periodontal status [ ]
   - occlusion/parafunction [ ]
   - TMJ [ ]

2. Totally edentulous
   - oral cancer screen [ ]
   - identity anatomical landmarks, e.g., mental foramen, sinus [ ]

**C) Radiographic examination**

1. pathology present [ ]
2. quantity of bone [ ]
3. quality of bone [ ]

**NOTE**: perisplasms, occlusals, panorex, lateral cephalometric, tomographs as indicated

**D) Diagnostic Models**

1. assess ridge width [ ]
2. may be mounted [ ]
3. may be used for diagnostic wax up [ ]
4. may be used for surgical and prosthetic stent fabrication

### Table IV

#### Treatment planning sequence

**Refer also to Table II**

**A) Initial Therapy**

1. periodontal [ ]
2. eliminate other oral pathology [ ]
3. tentative implant restorative treatment plan [ ]

**B) Periodontal re-evaluation**

**C) Final periodontal treatment**

(in light of the tentative periodontal and restorative treatment plan)

1. periodontal surgery [ ]
2. strategic extractions [ ]
3. periodontal maintenance [ ]

**D) Implant evaluation and selection**

1. type, number, diameter and length [ ]
2. dependent on:
   - bone quantity [ ]
   - bone quality [ ]
   - type of prosthesis desired [ ]

**E) Implant surgery**

**F) Prosthetic treatment**

**G) Maintenance phase**