Dental Implant Therapy for the Completely Edentulous Patient

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Treatment Planning and Clinical Considerations:

Determine the Patient Expectations

Completely Edentulous Key Factors:

- Functional demands: is minimal movement of their denture Okay (tissue supported implant retained overdenture therapy), or are they expecting the new overdenture to be very stable (multiple implants for implant supported and retained overdenture therapy)?
- Oral hygiene.
- Financial commitment.
- Treatment phases/time frame.
- Aesthetics.
- Phonetics.

Health History Contraindications:

- Immunosuppression (chemotherapy, HIV, etc).
- Antimetabolic treatment.
- Poorly controlled diabetes.
- Poorly controlled cardiovascular problems.
- Active pharmacodependency.
- Psychiatric disorders.
- Bisphosphonates-intravenous: contraindicated.
- Bisphosphonates-oral: informed consent.
- Smoking: informed consent.

Implant Placement

Available Bone:

- Minimum implant length 10 mm.
- Ideal length: 12/13 mm.
- Maximum length: 15 mm.

Bone Quality:

- Type I/II - Mandibular anterior and posterior sites. Require minimum of 1.5-2 mm of bone surrounding the dental implant.
- Type III/IV - Maxillary anterior and posterior sites. Require minimum of 2 mm of
surrounding the dental implant.

**Prosthetic Design:**
*Dependent on...*
- Patient expectations.
- Bone quality/quantity/biomechanical considerations.
- Number of implants.
- Position of implants.

**Prosthetic Option Breakdown: Two Groups**

**Group A:** Stress-broken
- Fewer implants.
- Biomechanical considerations.
- Bar and/or solitary attachment systems: tissue supported overdentures, implant retained.

**Group B:** Rigid
- Multiple implants required.
- Number of implants dependent on bone quality/biomechanical considerations, including parafunctional activity.
- Position of implants: even/wide spread.
- Milled bar overdentures: implant supported and retained.
- Fixed-detachable: implant supported.

**Bar Overdentures:**

**Advantages:**
- Requires less specific implant placement compared to fixed prosthesis.
- Prosthetic stability and retention (psychologically satisfying for patients).
- Maintain facial esthetics and minimize bone loss after extraction of teeth.
- Maxillary implant overdentures with or without the palate enable patients to produce more intelligible speech than fixed protheses.
- Improved oral hygiene.
- Bars: *implants splinted together* are capable of withstanding off axis loads better than free standing (not connected with a bar) solitary anchor systems (e.g.; ball or stud abutment/attachment designs).

**Criteria:**
- Minimum vertical distance: 13-14 mm from implant platform to incisal edges (4 mm for bar, 1 mm below bar for hygiene, then clip and acrylic tooth housing).
- Span/Length:
  - No more than 18 mm with a 2 mm vertical stiffener.
- Bar-clip requires minimum of 10-12 mm between implants, otherwise a milled bar.
with friction fit superstructure is required (Group B rigid design, multiple implants).

**Disadvantages:**
- **Maintenance:** regular attachment mechanism replacements.
- **Maxillary Satisfaction Rating Studies:**
  - Patients with chronic problems with their maxillary dentures may prefer an overdenture to the fixed design.
  - If the patient had a satisfactory experience with their complete Maxillary denture, the satisfaction with implant supported prostheses was not significantly higher than conventional maxillary prostheses (denture). This suggests that maxillary implant prostheses should not be considered as a general treatment of choice in patients with good bony support for maxillary conventional prostheses.
- **Maxillary Arch Complications:**
  - Retrospective studies report higher frequency of complications compared with implant fixed prostheses.
  - Hyperplasia adjacent to the bar.
  - Higher rate of stomatitis as compared with the mandible.
  - Lack of in compliance when removing the overdenture when sleeping.
  - Higher mucosal and mechanical complications when compared with mandibular overdentures.
- **Relining:** With Group A stress-broken, implant retained overdentures, functional loads are distributed to the edentulous areas. Bone resorption will continue to occur and relining of tissue-bearing areas will be required every 2-3 years.

**Implant Biomechanics**
- Implant dentistry requires a “baseline” working knowledge of the key factors of the biomechanics and how they affect the treatment plan.
- Minimize bending moments (lateral forces).
- For Group A stress-broken bar-overdentures, the retentive components need to be designed to allow rotation anteriorly/posteriorly to prevent overloading of the implants and allow transfer of forces to the edentulous areas.

**Bar Types:**
- **Dolder bar:** egg-shaped cross section. Allows transactional (slight vertical) and rotational movement. When used in frontal areas (linear) only, the Dolder Bar Joint with its three different degrees of space freedom, loads the abutments least of all, regardless of the number of abutments.
- **Round Bar:** permits rotational movement only.
- **Dolder bar, “U” shaped cross-section:** No rotational freedom. For Group B rigid implant supported and retained overdentures only.
Solitary Anchor Systems: Ball-Socket and Stud Attachment Systems
- Allow for 360 degrees of freedom and vertical movement.
- Designed for Group A stress broken, tissue supported and implant retained prostheses only.

Cantilever Guidelines:
Mandible:
Cantilever lengths with implants in Type I Bone: equal to the anterior-posterior spread of implants multiplied by 1.5. Guideline only. Only recommended in low biomechanical risk patients (e.g., when there is an opposing denture).

Maxilla:
Poor bone quality, and considering bars with distal cantilevers tend to increase loads on terminal implants by more than 3 times, cantilevers should be minimized or avoided (keep them no more than 8 mm in length, irrespective of anterior-posterior spread or number of implants, with cross-arch stabilization). Guideline only.

Cantilevers are contraindicated in parafunctioning patients, and should be minimized or avoided when opposing a natural dentition or rigid implant restoration.

Rigid designs with cantilevers function best long-term when the opposing occlusion is a complete denture.

Maxillary Arch Multiple Implants (minimum 4 – case selection, 6-8 ideal).

Milled Bar-Overdentures:
Implants can be placed in an axial or inclined direction, with or without sinus augmentation procedures.
When implants placed are posteriorly in the first molar position (following sinus augmentation, as required, total of 6 implants), a wide A-P (anterior-posterior) spread can be achieved.

Advantages:
- No cantilevers present. Improved biomechanical/stress-transfer.
- Rigid design. Infrastructure provides the same rigidity as a fixed prosthesis (precise fit to the superstructure, which is removable).
- Offers benefits of both fixed and removable restorations.
- Access to oral hygiene.
- Prosthetic - closed adaptation to soft tissue. Improved phonetics.

Treatment Planning: Number of Implants

The following breakdown of restorative treatment options have been developed by Dr. Aldo Leopardi. These options can be effectively communicated to the patient.
Implant Restorative Options:
The type of restoration made to attach and/or be supported by the dental implants will depend on the number and position of the implants placed.

The restorative options for the Mandibular (lower) jaw are as follows:

1. **Two Anterior Implants, Ball abutment (trailer-hitch style abutment) on implants, and attachment inside the overdenture.** Group A: Stress-broken. This denture is implant retained only. This means that the denture is designed to move slightly when biting in order to avoid overloading (stressing) the two implants. All biting forces are transferred directly to the supporting gum-tissue/bone of the lower jaw (as in a conventional denture). The implants retain the denture improving its stability and comfort. Mastication and confidence is therefore enhanced.

   **Maintenance:** The silicone/plastic ring-inserts inside the denture will require replacement every 6 months to a year. The overdenture will require a laboratory hard reline every 2-3 years. Metal attachment housings will require intra-oral re-attachment following the laboratory reline procedure. A new overdenture will be made every 7 to 10 years.

   **Advantages:** Cost savings - this is the least expensive implant option since there are only two implants and these are kept separate (not connected with a bar). **Disadvantages:** Slight vertical movement in the posterior/back zone during heavy clenching is necessary in order to avoid implant overload. The attachments inside the denture also need to be replaced on a regular (6 month/yearly) basis. Because the overdenture is supported by the bone/gum tissue, the bone resorption process continues in the posterior regions.

2. **Two Anterior Implants, Gold Bar and Clip Assembly Overdenture.** Group A: Stress-broken. This denture is implant retained only. This means that the denture is designed to move slightly when biting in order to avoid overloading (stressing) the two implants. All biting forces are transferred directly to the supporting bone of the lower jaw (as in a conventional denture). The implants retain the denture improving its stability and comfort. Mastication and confidence is therefore enhanced.

   **Maintenance:** The clips inside the lower overdenture will need to be replaced as needed (varies from every year for plastic and 3-5 years for gold clips). The overdenture will require a reline in 2-3 years, and a new overdenture in 7-10 years. However, the original gold/metal bar remains as is and is utilized again (unless damaged/worn-out).
Advantages: Retention and stability is improved.
Disadvantages: The lower denture is still supported primarily by the underlying bone and gum tissue. The bone behind the implants (posterior jaw) provide support. Therefore, the bone will continue to resorb slowly over time.

3. Three Anterior Implants, Ball abutment (trailer-hitch style abutment) on implants, and attachment inside existing denture. Group A: Stress-broken. This is the same as 1 above, except the third implant adds additional retention and helps to preserve additional bone in the anterior/front region. The advantages and disadvantages are the same as option 1 and 2 above.

Maintenance: The silicone/plastic ring-inserts inside the denture will require replacement every 6 months/year. The overdenture will require a laboratory hard reline every 2-3 years. A new overdenture will be made every 7 to 10 years.

4. Four Implants, Gold/Metal Bar and Clip Assembly Overdenture. Combination Group A/B. This is the same as above, except the four implants allow for the construction of a more securely retained overdenture. The denture is still predominantly implant retained with additional implant support. That is, it is still stress broken and has some built-in vertical give under significant pressure. If implant spread is ideal, and implant supported/rigid (little to no movement) overdenture can be constructed, as long as the number of teeth on the posterior portion of the denture is minimized to prevent implant overload (Cantilever length in type I bone = A-P spread X 1.5).

5. Four to Five Implants (Anterior/Chin Zone), Fixed-Detachable Hybrid Bridge. Group B: Rigid. This is a fixed bridge. It is screw-retained. Either acrylic fused to gold/metal or porcelain fused to gold/metal or Zirconium.

Maintenance: Regular 6 month cleaning with the hygienist. Occasionally, screws may come loose which will involve replacement and occlusal adjustment. Acrylic teeth, if utilized, will need to be replaced every 7 or more years, depending on the rate of wear. The gold substructure, if not damaged, can be re-utilized. Less episodes of problems/maintenance with porcelain fused to gold.

6. Seven/Eight or More Implants, Fixed Porcelain fused to Gold Bridge (Fixed Partial Denture) or Zirconium. Group B: Rigid. Implants can be placed in molar region. For metal-ceramics, the prosthetic can be divided into two or more sections to accommodate possible jaw flexure. Metal-ceramics require less maintenance than an acrylic fused to metal hybrid prosthesis. Aesthetics are also optimized due to the porcelain. Zirconia is another option, although proving
to be a viable option, less long-term data is available.

The restorative options for the Maxillary (upper) jaw are as follows:

1. **Four Implants, Stress-broken Bar Overdenture.** Group A: Stress-broken. This denture is palate free (horse-shoe shaped). It is a combination of implant and tissue supported, stress-broken design. With the same advantages and disadvantages as described above.

2. **Four Implants, Fixed.** Group B: Rigid. Posterior implants are often inclined to improve A-P spread. Recommend minimizing or avoiding cantilevers in high biomechanical risk patients. Contraindicated in parafunctioning patients. Otherwise 6-8 implants. Case selection is key.

3. **Six to eight Implants, Milled Gold/Metal Bar (laboratory or CAD-CAM) and Clip Assembly Overdenture.** Group B: Rigid. This denture is palate free (horse-shoe shaped). It is implant supported and retained. A milled gold/metal bar is attached to the implants, and a corresponding milled component and/or clip assembly is placed inside the denture and attaches to the gold/metal bar.

   *Maintenance*: The clips inside the overdenture will need to be replaced as needed (varies from every year to three years depending on the design utilized). The overdenture will require new teeth and/or revised superstructure/overdenture every seven-ten years. However, if the original gold/metal implant-bar remains in good condition, it can be utilized again (unless damaged/worn-out).

   *Advantages*: Retention and stability is improved considerably. Open palate.
   *Disadvantages*: Removable, not fixed. Clip maintenance.

4. **Six to Eight, Fixed-Detachable (Acrylic fused to Metal) Hybrid Bridge (laboratory or CAD-CAM).** Group B: Rigid. This is a fixed prosthesis. It is screw or cement-retained. Acrylic fused to gold/metal hybrid.

   *Maintenance*: The teeth will need to be replaced every 7-10 or more years, depending on the rate of wear. The gold/metal substructure, if not damaged, can be re-utilized.

   *Advantages*: The restoration is fixed and rigid. Aesthetics and mastication is excellent.
   *Disadvantages*: 
Phonetics is more challenging at first and takes time to adjust. The prosthesis needs to be cleaned at least once per day, and there is a learning/dexterity curve for cleaning. The plastic teeth lose luster over time and require periodic polishing.

Please Note: when fixed acrylic restorations are opposing a rigid opposing occlusion, they are subject to high rates of wear, fatigue fractures and therefore significant maintenance. With continued wear comes a loss of vertical dimension over time, locking of opposing teeth and high lateral loads on inherently week acrylic materials. These problems are exacerbated in parafunctioning patients. Consequently, not recommended in high risk biomechanical patients. A ceramic solution is recommended.

5. **Six to Eight Implants, Fixed All-Ceramic Zirconium Porcelain or Porcelain fused to Gold Bridge (Fixed Partial Denture).** This is the same as 2 above, except that the materials used to construct the bridge include all-ceramic porcelain or porcelain over/fused to gold. This bridge requires less maintenance than the acrylic fused to metal hybrid bridge. Porcelain is less/non-porous and therefore does not stain, nor does it loose its luster as readily as acrylic. Therefore, aesthetics is optimized.

**Advantages:** The restoration is fixed and rigid. Aesthetics and mastication is excellent. Porcelain is non-porous (does not stain as readily as plastic) and maintains its luster long-term compared with plastic. Porcelain is resistant to wear and therefore maintains vertical dimension. Consequently, less maintenance and an opportunity for a longer life restoration: 10 to 20 years, depending on individual wear and tear, parafunional habits (grinding, etc.), oral hygiene, and incidence of trauma.

**Disadvantages:** Phonetics is more challenging at first and takes time to adjust. The prosthesis needs to be cleaned at least once per day, and there is a learning/dexterity curve for cleaning. Porcelain is brittle and subject to chipping/fracture. When this occurs, the teeth can be smoothed or individual teeth replaced (depending on prosthetic design).

Maxillary (upper) Arch Fixed Solutions Summary:

**Six to Eight Implants, Fixed (retained by screws) Bridge (Fixed Partial Denture).**

- **Option A:** Acrylic fused to metal.
- **Option B:** Zirconium Porcelain.
- **Option C:** Porcelain fused to Gold.

The advantage of Acrylic is lower overall cost. The disadvantages include wear (loss of
vertical height over time), stain and greater incidence of tooth fracture. The teeth will also need to be replaced every 8 years due to wear over time. Consequently, overall maintenance is greatest with acrylic when compared to the other two restorative options.

The advantage of Zirconium is resistance to wear. Therefore, vertical dimension (vertical face height) is maintained. The teeth do not need to be replaced every 8 years as with the Acrylic option. However, Zirconium is less translucent (less aesthetic) than either acrylic or the porcelain fused to gold option. The Zirconium teeth, if layered with veneering porcelain, are also subject to chipping and/or fracture. Overall, less maintenance that Acrylic. Monolithic Zirconium has the potential for minimal chipping/fracture. These bridges therefore have the potential of long-term use (10-20 year plus prosthesis).

Porcelain fused to gold has the longest clinical data available. It has the same advantages as Zirconium, with less disadvantages. However, the cost is greatest when compared to the other two options.

The bridges (all three options) are cleaned professionally by the hygienist every 6 months. The Acrylic option is removed every 2 to 5 years to check screws (check for screw loosening) and professional cleaning. The Zirconium and Porcelain option is removed as needed (average 5 or more years) for professional cleaning and screw assessment or repair (as needed).

**Immediate Implant Placement and Fixed Teeth in a day (Provisionals/Temporaries)**
For group B rigid options. Case selection and patient desire.

**Mandibular, Group B Fixed-Detachable Acrylic Fused to Gold/Metal Prosthesis**
- Require ideally 15-17 mm of vertical restorative room from implant platform to incisal edges of future prosthetic table/teeth. However, it is possible with less vertical dimension with screw-retained designs depending on individual patient presentation.
- Recommend abutment level design. Transmucosal abutments therefore required.
- Splinted open-tray impression technique, incorporating retromolar pads and posterior ridge anatomy.
- Laboratory gold or CAD-CAM metal framework fabrication.
- Convex surfaces: light or no contact with tissues.
- Posterior cantilever lengths: no more than 1.5 X A-P spread for mandibular prostheses in low biomechanical risk patients.
- Delayed/conventional or Immediate Load.
Immediate Load Criteria:
- Minimum 4-5 implants in the pre-symphyseal region of the mandible.
- Minimum 10 mm length implants.
- Primary implant stability.
- Abutment level provisional prosthesis.
- Cross-arch stabilization.
- Minimal (less than 1 X A-P spread) or no cantilevers.
- Soft diet for 6 weeks.

Maxillary, Group B Fixed-Detachable Acrylic Fused to Gold/Metal Prosthesis
- Number of recommended implants: minimum 4 with wide A-P spread, 6 ideal and 8 maximum.
- Splinted open-tray impression technique, transmucosal abutment level.
- Convex surfaces.
- Anterior modified ridge lap design from region 5/6 to 11/12, with light contact on tissue to maximize phonetics.
- Avoid cantilevers (if needed, no more than 8 mm cantilevers, with cross-arch stabilization).
- Implant placement for 6 implants: spread from molar, premolar and lateral incisor regions.
- Implant placement for 8 implants: either spread or molar to canine bilaterally.
- Frameworks: custom gold or CAD-CAM metal.
- Immediate Load Criteria:
  - Minimum 4-8 implants, with wide anterior-posterior spread (molar to molar).
  - Minimum 10 mm length implants.
  - Primary implant stability.
  - Abutment level provisional prosthesis.
  - Cross-arch stabilization.
  - No cantilevers.
  - Soft diet for 6 weeks.

Group B Fixed Zirconium.
- Zirconium with layered feldspathic porcelain are more aesthetic than monolithic Zirconium. However, layered designs are subject to high rates of chipping.
- Monolithic designs have strength and are not subject to chipping. However, lack of translucence can compromise aesthetics, especially in high value ceramics.
- Lack of long-term data available. However, a promising prosthetic solution for Group B rigid designs.

References:


Malchiodo L et. al. (Immediate Load, 6-7 years) Int J Oral Maxillofac Implants 2011;26:373-384.


Anterior Mandible: Immediate Load:

Implant Placement, Graftless, in the Edentulous Arch:


Sinus Graft:
   Jensen OT, et al. 1998;13(Suppl):11-45


Immediate Load, 4 Implants, Tilted, Fixed:


