Current Treatment Planning Concepts
And
Restorative Procedures for Dental Implant Restorations

“Truth in Treatment Planning”
Dr. James A. Rivers (email: riversj@musc.edu)
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Dr. Peter Dawson quote: “Dr. L.D. Pankey wrote that only 2% of dentist ever reach the status of master. A dentist can interview, diagnosis, treatment plan and motivate patients to proceed with a comprehensive treatment plan but most important of all he or she can execute the services needed with a high degree of predictive success.” Functional

Occlusion From TMJ to Smile Design
Dr. Peter E. Dawson; Mosby, Inc. 2007

Oral Rehabilitation:
“Oral rehabilitation is generally viewed as the complete restoration of a severely damaged dentition. However, restorations involving the occlusal surface of a few teeth may also be considered a reconstruction. The selection and use of proper materials is important. Managing the occlusal forces on the teeth and materials will assure long-term success.”

Evidence-Based Dental Practice: “Provides science for expected outcomes”
The loss of the dentition and replacement by a prosthesis should be considered in terms of the impairment induced in the related biologic and social activities.

First Endosseous Implant
“Recovered in Ulloa Valley of Honduras in 1931. It is from a female about 20 years old in the 7th century. It was made from the shell of a Bivalve Molluse.”

Longterm Success Requires
• Delicate tissue handling
• Precise surface science
• Scientific knowledge of treatment modality
• Correct treatment plan
• Correct surgical and restorative procedures
• Longterm maintenance by patient and doctor

All Excellent Treatment Plans begin with an Excellent Exam.

Fundamental Principles of Treatment Planning
• What are the problems?
• What are the causes?
• Can you treat the problem and does patient want treatment
• Visualize The End Result
• Sequence

Three most important skills for a dentist:
• Be able to perform a comprehensive exam
• Be able to treatment plan
• Communicate
“Which patient should receive the treatment and deciding when to do the treatment is essential for success!” Dr. Rutledge Coleman, Pvt. Practice, Jacksonville, Fl.

Treatment Considerations

- No TMD component
  - Teeth – worn, broken, missing or poor alignment
  - Periodontal disease – treatable or non-treatable
  - Esthetics – color, shape, position
- With TMD Component
  - All factors as if no TMD component
  - Pain – intracapsular or extracapsular
  - Limitation – range of motion and function

Goal of Occlusal Reconstruction:
Create the lowest level of muscle activity during both function and parafunction

How do we achieve that goal?
“Complete seating of the condyles into centric relation during maximal intercuspation results in minimal electromyographic activity of the inferior head of the lateral pterygoid.”

Goals for natural or restored dentition:
- Restore in CR position (condyle seated in glenoid fossa)
- Anterior guidance
- Posterior separation
- No balancing side contacts to include crossover position

Posterior Tooth Replacement
- Options for Single Posterior Tooth Replacement
  - Removable partial denture
  - Resin-bonded prosthesis
  - Space maintainer
  - Fixed partial denture
  - Implant prosthesis
  - No treatment
  - Discuss with patient for informed consent


Tooth Supported Fixed Partial Denture: Prediction for success
- Abutment teeth are periodontally sound
- Edentulous span is short and straight
- Retainers are well designed and executed
- Treatment is reserved for patients are motivated and can afford treatment
Fixed Partial Denture Abutment Evaluation:
- The abutment condition is critical to the long-term success of FPD
- Endodontically treated teeth can be used but may offer some compromise
- Teeth that have been pulp capped should not be used until endo is done because of the risk for endo later which will cause destruction of retentive tooth structure and the retainer.
- The surrounding tissue must be healthy and free of inflammation
- Abutment teeth should not have any mobility

Root Configuration:
- Multiple teeth with wide separation will offer best support
- Conical roots should be used for short spans
- A root with a perfect taper is a poor abutment; curvature in apical third improves prognosis

Periodontal Ligament area:
- Supporting bone loss from periodontal disease has a direct influence on abutments
- “Millimeter per millimeter, the loss of periodontal support from root resorption is only one-third to one-half as critical as the loss of alveolar crestal bone.”
- Mobile teeth can be used successfully if they are splinted, plaque is controlled and the patient is motivated

Length of Span:
- Condition of abutment teeth may limit length of span
- FPD replacing more than two teeth should be considered high risk but often are successful if all factors are taken into consideration.
- Examples: Maxillary canine to canine or canine to second molar in the maxillary
- Failures from abnormal stress comes from leverage and torque rather than overload (occlusion).
- Failure of long span bridges frequently comes from biomechanical factors and material failure.

Endo or Extract? What is required for each?
If tooth is extracted does space meet requirements for implant success?

Managing the Cracked Tooth
Condition: Cracked or incompletely fractured
Direction of Crack: Horizontal or vertical
Incidence of cracked teeth:
- Primarily in adult dentition
- Associated with intracoronal restorations
- Most prevalent in mandibular molars
Maxillary molars and premolars have similar incidence
Mandibular premolars least susceptible
Distolingual cusp of mandibular molars most common fracture

Management of Cracked Teeth
- Recognize predisposing factors
- Recognize signs and symptoms
- Provide restorations that protect the tooth
- Early diagnosis is essential to prevent microleakage and additional fractures
- Determine if pain is dentin, pulpal or periodontal

Treatment of Cracked Teeth
- Cracks into the pulp will require a root canal
- Cracks into dentin can usually be treated with restorative material
- Cracks into periodontal ligament will require perio surgery or extraction
- Cuspal coverage or crown is best for posterior cracked tooth

Vertical Root Fracture
- Single rooted teeth should be extracted as soon as possible to prevent bone loss
- Multirooted teeth may have root amp or hemisection
- Consider root amp and hemisection carefully

- 5 year retention 94%
- 10 year retention 68%

Restoration of Endodontically Treated Teeth
“The restoration of nonvital teeth has completely evolved from a completely empirical approach to biomechanically driven concepts. The conservation of tissue and adhesion being the most relevant elements for improved long-term success.”

What is one of the most important features for long-term success for endodontically treated teeth?
1.5-2.0mm Ferrule Height

**Very difficult to have clinically controlled studies with post and core success and failure due to factors such as caries, occlusion, parafunctions and techniques used for treatment.

Crown Lengthening for endodontically treated teeth to receive post and core:
- Requires 1.5-2.0 mm tooth structure from edge of core to finish line
- Biologic width requires 3.0mm from finish line to bone
- Therefore requires 5.0mm of total length from core to bone
- Do not damage adjacent healthy teeth to save tooth

Should We Splint Implant Restorations?
- Good question with no documented answer
- It is a clinical decision
- Biomechanical support is critical to long term success

Occlusal Loads May Increase Stress on Implants:
- Bending moment on implant
- Implant body fracture
- Broken components and restorations
• Crestal bone loss around implant
• Bone loss resulting in soft tissue problems

**Short Dental Implants: A Literature Review and Rationale for Use**
• Splinted implants decrease the force to the bone implant interface
• Splinted implants compensate for less bone density
• Esthetics is rarely improved by single implants in the posterior
• Individual crowns are easier to floss but only 10-20% floss
• Rarely is implant loss due to a lack of using dental floss in comparison to overload of the restoration

**Reference:**
**Dental Implant Prosthetics**
Dr. Carl E. Misch: Mosby Publishing 2005

**Force Factors**
• Severe bruxism is most significant
• Second most significant is severe clenching
• Third is cantilevers and crown height
• Fourth is masticatory muscle dynamics
• Fifth is position of implant in the arch

**Address force by modifying treatment plan:**
• Abutment number
• Abutment position
• Implant size
• Implant design

**Force Factors**
• Abutment Number
  √ Stress is reduced by increasing area where it is applied == most
effective method is to increase number of implants
  *Bidez and Misch* demonstrate less force to crestal bone with
  3 implants than 2 implants:
  √ The results only applied “when implants were splinted”

**Therefore:**
When stress is high increase number of implants, decrease number of pontics and splint implants

**When to Splint Multiple Unit Restorations (Rivers Rule?)**
• It may be acceptable to construct single units in the following situations:
  o Implants are placed in good quality bone – the surgeon should advise
    restorative dentist of bone quality (Mx posterior??)
  o Implants are in ideal placement
  o Crowns do not create cantilever effect on implants
  o Patient has a healthy physiologic occlusion

**Occlusal Guidelines**
• Centric stops on implants should be lighter than on natural teeth
• Avoid contact in lateral excursion, if possible
• If patient demonstrates occlusal stress, construct occlusal splint
• Avoid cantilever pontics, if possible
• Make final occlusal adjustments on implant crowns by having patient put maximum force on teeth and move into excursions
• Check occlusion on hygiene recall visits

Abutments for Final Restorations
• Titanium (or other type metal)
• Zirconia
• Patient Specific. CAD/CAM Technology (Zimmer Zfx)
• Custom made with casting and porcelain

Zirconia Abutments:
Improving Darkened Anterior Peri-implant Tissue Color with Zirconia Custom Implant Abutments Watkins & Kerstein
Compendium May 2008 Vol.29, No.4
“Zirconia abutments combined with ceramic crowns can improve appearance of peri-implant tissue”

Which Custom Abutment and Why?
Reference: Grant Bullis, MBA, Director of Implant R&D and Digital Manufacturing Glidewell Laboratories)
• Titanium or Zirconia
• Affordable choice for cement-retained restorations
• CAD/CAM technology
• Three primary configurations
  ➢ Titanium
  ➢ Zirconia
  ➢ Zirconia with titanium prosthetic connection

Where to use each type;
• Titanium: Long history of success and can be used anywhere. Gray color can be a problem.
• Zirconia: Excellent esthetics. Use in anterior. Can use with thin biotype tissue. Excellent hygiene properties. Can have pink or other color porcelain fired on surface. Cannot be etched for bonding to resin.
• Zirconia abutment with titanium core: strong and esthetic. Works the same as a titanium abutment at implant interface.
• ****Custom PFM abutment. Made in lab by casting a core as a metal abutment and then adding porcelain. Can accept bonding. Very strong and esthetic. Can be shaded for characterization. Very costly but esthetic, versatile and strong.

Selection:
“Must be made by the clinician based on functional requirements and esthetic needs”.
• Location
• Occlusion
• Soft tissue condition and thickness
• Esthetic demands
Why Use Screw Retained Restorations

- Predictable retention and retrieval
- Frequently a personal choice by clinician
- Use in high risk situations

Screw Retained Restorations:
- Advantages
  - Ease of removal
  - No subgingival cement
  - Easy to retighten screw
  - Excellent for OD bars
    - Disadvantages of Screw Retained Restorations
  - Esthetics at screw access
  - Position of screw access
  - More difficult to deliver multiple unit single restorations
  - May weaken restorative material

Screw Retained Multiple Unit Restorations
- May connect directly to implant by using non-engaging cast-to-gold abutments
- May connect to tapered abutments
  - Abutments are attached to the implants and the prosthesis is then attached with screws to the abutments

Material to cover screw access:
- Matrix Tape purchase at Cognident.com
- Cover with temp material or composite
  - EZ Temp by Cosmodent
  - Telio by Ivoclar
  - Clip by Voco

“Cement and Screw-Retained Implant-Supported Prostheses: Up to 10 Years of Follow-up of a New Design”

**Conclusion**
The ease of retrievability, allied with the security of seating and appearance, makes the combined screw and cement-retained prosthesis valuable in implant prosthodontics.

**Why Use a Torque Wrench?**
Critical Bending Moment of Four Implant-Abutment Interface Designs
Conclusion: “Torque levels recommended by manufacturer should be followed to assure screw joint integrity.”

Torque Wrench
- Torque required for screw tightening varies with manufacture
- Primary reason for screw loosening is failure to tighten abutment screw
- Tightening with hand and implant tool provides 16-23 Ncm (depends on dimensions of wrench)
- Some torque wrenches are adjustable
“Primary reason for screw loosening is the failure to adequately tighten the abutment screw”
How much force do you apply with your fingers? (unpublished report)
Female average: 16.5 Ncm
Male average: 23.2 Ncm

Ideal Implant Esthetics
- Soft tissue
- Hard tissue
- Implant placement
- Restoration
- Natural parameters from patient

Esthetic Zone is Where The Patient Perceives It to Be
- Important factors
  - Vertical height of the alveolar process and its relationship to the proposed position of the final restoration
  - Correct mesiodistal space for each implant
  - Adjacent teeth and soft tissue
  - Careful planning and attention to detail will give predictable results

BONE supports soft tissue
3061 implants were reviewed and it was determined that 2mm of bone is needed to prevent bone change.

Esthetic Problem
- Failure to recognize, intercept and reconstruct inadequate ridge form or size in combination with a reduced quality of keratinized gingival tissue
- Bone is the dictate factor for implant success and esthetics

Single Tooth Implant Guidelines
- Ideal placement required
  - Soft tissue esthetics
  - Implant platform location
  - Buccal-lingual position
  - May require bone graft

Zimmer 3.1mmD Implant: Eztetic™ Implant System
- 2 piece implant: Implant and abutment

Dr. James A. Rivers, April 29, 2016
3mm apical to CEJ at midfacial 1.5-2.0 mm space

Multiple Unit Esthetic Concerns
“Management of the soft tissue and papilla can be difficult with multiple unit restorations in the esthetic areas.”

The Effect of Inter-Implant distance on the Height of Inter-Implant Bone Crest
- Bone loss between implants 2mm apart after 2-stage surgery was 1.04mm
- Bone loss between implants 3mm apart after 2-stage surgery was 0.45mm
Therefore, smaller diameter implants may be beneficial to provide space in the esthetic zone.

Enhancing Esthetics with Provisional Restorations

Esthetic Concerns

Patient Expectations
Low Expectations (OK)
High Expectations (Concern - Remember all potential problems for esthetics)

Smile Line
Dental (OK)
Gingival (Concern)

Gingiva
Thick (OK)

Adjacent Papillae
Thin (Concern)
Thick and Short (OK)

Adjacent Natural Teeth
Thin and Long (Concern)
Squared (OK)

Position of Interproximal Contact
<5mm Above Bone (OK)
>5mm Above Bone (Concern)
Proximal contact to crestal bone for papilla fill
- Tooth to Tooth - 5mm (Tarnow)
- Tooth to Implant – 4.5mm (Grunder)

Provisional Restorations
Abutment options for provisional restorations:
- √ Fixture Mount/Transfer
- √ Hex-Lock Plastic Temporary Abutment
- √ Contour Provisional Coping

Plastic Temporary Abutments:
- √ Material (PEEK) polyether-ether-ketone
  - Straight or angled with long or short screw
  - Indication: up to 180 days in mouth
  - Will not bond to acrylic or composite

Cement Retained vs. Screw Retained Provisional
Advantage of cement retention:
- √ Cement retention does not interfere with esthetics
- √ Standard fixed pros procedure
Advantage of screw retention:
- √ No subgingival cement
- √ No cement wash out
- √ Usually no anesthesia to place provisional and no cement to clean at margin

Disadvantage of cement retained:
- √ Subgingival cement at margin may irritate tissue
- √ Frequently requires anesthesia to remove subgingival cement
- √ Cement may wash out
Disadvantage of screw retention:
- √ Screw retained crown may require screw exit in esthetic area

Matrix Tape
- √ Cognident.com/matrix-tape

Fixture Mount/Transfer can be used as a temp abutment
- √ Strong
- √ Xray to confirm seating
- √ Tighten with torque wrench

Abutment Holder (ABTH)
- √ Instrument used to hold any component being prepped
- √ Match to analog
- √ Use high speed metal cutting bur
- √ Can use slow speed metal cutting lab bur
Immediate Implant Provisional Restorations

Two Stage Implant surgery procedures have strong evidence of success

Purpose of two stage surgery
• Minimize risk of infection
• Prevent apical downgrowth of epithelium
• Eliminate early loading of implant

Immediate Implant Loading: Current Status From Available Literature
Avila, Galindo, Rios, Wang
Implant Dentistry 2007;16:235-245
• Immediate occlusal loading: load within 2 weeks of implant placement
• Early occlusal loading: load between 2 weeks and 3 months
• Non-functional immediate restoration: temp restoration within 2 weeks with no occlusal load
• Delayed occlusal loading: load more than 3 months after implant insertion

Conclusion:
“Immediate implant loading achieved similar success as the conventional approach.”

Important Note: Requirements for success
• Careful case selection required
• Proper treatment plan
• Meticulous surgery and properly designed prosthetics

Implant Placement Biological Response:
• Activity responsive to Environmental factors:
  • Micromovement at interface
  • Local vascular supply
  • Release of growth factors
• Remodeling process begins to occur in about 3 WEEKS
• This develops a stronger or more mature layer of bone
• After surgical placement there is a “Dip” in retention between 2 and 4 weeks.

Survival Rate of Immediately vs Delayed Loaded Implants: Analysis of the Current Literature
Success Criteria: “The parameter most often associated with the success of immediately loaded implants as reported in the literature was adequate implant stability of the implants.”

Advantages of Placing Provisional Restoration at First Stage Surgery
• Patient satisfaction with esthetics
• Preservation of interdental bone
• Maintenance of soft tissue
Develop sound biologic width
Decrease patient treatment time

**Options:**
- Metal Temp Abutment or Plastic Temporary Abutment

**Provisional can be made direct or indirect**
- Implant analog
- Selected Abutment
- Impression material and tray
- Fast set stone (Whipmix Snap Stone)
- Prep burs or stones, abutment holder (ABTH) from Zimmer
- Provisional material

**Implant and Immediate Provisional Restoration**
- Essix Retainer may be used for temp after extraction
- Place implant (must be stable 32+Ncm)
- Approximate tissue around fixture mount
- Use elastic impression material and make impression
- Remove impression and fixture mount
- Construct provisional

**Ovate Pontics:**
\[\sqrt{\sqrt{\sqrt{\text{Use to shape tissue after extraction or other surgery}}}}\]

**Managing tissue with ovate pontics and flapless surgery**
When a tooth must be extracted and grafted the natural architecture is lost. An interim removable prosthesis is a very efficient way to help re-create this architecture overtime. The following timetable is suggested for transitioning of an interim prosthesis from a space filler only into a useful tool for site development via ovate pontics. (Conte 2008)

**Reference**
Dr. Monica Cayouette, Associate Professor and Chair, CDM, MUSC

- **0-3 months** ----- Keep pontic 1-2 mm away from the grafted site. Any pressure at this point will lead to incomplete bone formation.
- **3 months** -------- Transition to an ovate pontic for tissue development. Use a tissue depth of approximately 3mm. (Kois)
- **4 months**-------- Site is ready for Implant Placement

**Placement of Immediate Implants and a Fixed Provisional Restoration to Replace the Four Mandibular Incisors**
Richard B. Smith, DDS; Dennis P. Tarnow; et.al. Compendium; September 2009; Vol. 30#7.

Conclusion: “Four mandibular incisors replaced with two implants immediately non-occlusally loaded show high success.” This report showed 10 consecutively treated cases and followed for 6 years with 100% success.

**Immediate Implant Placement and Temporization: Literature Review And Case Studies**
Andre P. Saadoun,DDS,MS & Philippe Sebbag,DDS,MS
Compendium Vol.25,No.4;April 2004

“It appears that it is not early loading that creates the effect of fibrous
encapsulation, but rather micromovement at the bone-implant interface resulting from inadequate primary stability”

**Articles:**

**Correlation Between Placement Torque and Survival of Single-Tooth Implants**
Judith Maria Pinheiro Ottoni, MSc, et.al.
*International Journal of Oral and Maxillofacial Implants*
Vol. 20, No. 5, 2005, p. 769-776

**Conclusion:**
“Immediate loading in single-tooth indications should only be considered if the implant can be placed with an insertion torque greater than 32 Ncm.”

**Conclusion:** “Within the limits of this study immediate implants with immediate restorations can be a predictable option for replacing teeth in the esthetic zone.”

**Immediate Provisionalization of Single-Tooth Implants in Fresh-Extraction Sites At The Maxillary Esthetic Zone: Up to 6 Years of Follow-Up**

**Conclusion:** Non-functional immediate loading of implants in fresh extraction sites can be successful.
- Eliminate centric and excursive movement contacts
- Soft diet 2-6 weeks or more
- Occlusal splint if necessary
- Do not remove provisional for 8-10 weeks

**Gingival Margin Changes in Maxillary Anterior Sites After Single Immediate Implant**
Placement and Provisionalization: A 5-Year Retrospective Study of 47 Patients
Scott B. Ross, DDS et.al. *IJOMI 2014;29;127-134*

“Concern for marginal gingival recession after the final restoration”

**Five Keys for Success:**
1. Location of implant platform in the buccopalatal dimension.
2. Maintenance of the buccal bone and horizontal defect dimension.
3. Pre-existing gingival biotype.
4. Use of minimally invasive surgery.
5. Use of immediate provisional.

**RECOMMENDATIONS:**
1. Thin biotype and wider implants can be a problem.
2. 3.5 diameter implant had less recession than 4.3.
3. Implant should be 1-2mm palatal in extraction sockets.
4. Thin biotype has more recession than thick biotype.
5. Contoured customized anatomical provisional restoration is essential.
6. Buccal contour of provisional should be flat and under-contoured at the emergence profile.
7. Wait minimum of 3 months for gingival contours to stabilize.

**Patient Requirements for Immediate Provisionalization**

*Dr. James A. Rivers, April 29, 2016*
• Good health
• Attention to detail
• Patient must know risk/benefit
• Smokers and bruxers increase risk of failure
• Manage occlusion
• Implant must have primary stability
• Patient must be available for recall

Managing Implant Restorations in The Adolescent and Young Adult
“Placing implants in this age group is an excellent service, but great care must be taken in the treatment planning and treatment process.”

Young Adult and Congenitally Missing Teeth
• Tooth position
• Ridge width and height
• Vestibular concavity
• Skeletal growth must be complete

Frequency of Missing Teeth
• 5% of the population
• Mandibular second premolar
• Maxillary lateral incisor
• Maxillary second premolar

“Implants, unlike teeth are not capable of compensatory eruption or other physiologic movement” Orterle, Cronin, Ranly
“The amount of the defect depends upon the amount of facial growth after ankylosis.”

RECOMMENDATIONS:
• Evaluate age development: do not place implant until growth is complete
• Do not generalize results from other reports
• Evaluate space and bone support

What is the recommended age?
• Varies – Must evaluate each individual
• Never too old
• Can be too young

Facial Development, Continuous Tooth Eruption and Mesial Drift as Compromising Factors for Implant Placement
• Growth completion varies widely
• Growth spurt varies
• Problematic Age Period
  o Girls: 9-15 years
  o Boys: 11-17 years
  o Face types must be considered

Suggested guidelines for implant placement
• Female Age 16
• Male  Age 18
• Maxillary growth must be complete
• Mandible can be treated at younger age

Maxillary Lateral Incisors Can Be Difficult!

** Reference Article:

Maxillary Lateral Incisor Implants: Planning with the aid of Orthodontics

Problems:
• Deficient alveolar ridge
• Inadequate interproximal space
• Adjacent interproximal roots too close or poor alignment
• Short Papillae
• Uneven gingival levels
• Patient too young

Implant space:
• Implant space factors to consider: Esthetics and Occlusion
• Mx lateral should be two-thirds width of central
• Centrals average 9mm so lateral averages 6mm
• Two-piece small diameter implants are 3.2-3.3mm (One-piece is 3.0mm)
• This gives 1.3-1.4 mm between implant and tooth
• This small space has potential risk of bone loss

**Occlusion may dictate space

**Orthodontist must correct problem or NO IMPLANT
• Zimmer 3mm One-piece Implant

Orthodontic Site Development:
• “Canine erupts adjacent to central and is then moved distally”
• Can be accomplished in any part of the ridge
• After completion bone is stable for 4 yrs. (< than 1% loss over 4 yrs.)
• Normal extraction of lateral will narrow 34% in 5 yrs:

Correcting Loss Of a Papilla During Space Opening:
• Young patient has growth potential and tooth eruption
• Formation of papilla is predictable with growth
• Adult will not have eruption after ortho
• Therefore formation of papilla is unpredictable
• Surgeon must create papilla

Orthodontic positioning of teeth
• Adequate interproximal space 6.3 – 7mm
• Parallel roots
• Physiologic occlusion
• Team evaluation before ortho band removal

Congenitally Missing Mandibular 2nd Premolar
• Primary molar becomes ankylosed – Extract
• Primary molar erupts – alter mesial-distal dimensions
• Permanent dentition may be altered by ankylosed primary teeth
  o Primary tooth may have to be restored to prevent changes of adjacent teeth
Immediate Provisionalization and Restoration of the Edentulous Arch

Why do patients go to a dentist?
- Dental problems that need treatment
- They want it now
- No body wants surgery
- They want predictable solutions
- It should be scientifically based

Prosthetic Options:
- Metal Ceramic Restoration
- Fixed Zirconia Restoration
- Fixed Hybrid Restoration
- Removable Overdenture

Names for procedure:
- Zimmer RevitaliZe Solutions
- 3i DIEM2 Solutions
- Nobel “All-on-Four” Procedure
- Teeth in a day
  ***** Graftless surgery but not necessarily “flapless” surgery
  ***** All-on-four does not mean you are limited to four implants.

How do we decide which treatment?
- Patient desire
- Are there teeth present? Treatable/Hopeless
- No teeth and not wearing dentures
- No teeth and wearing dentures. How long?
- Patient health
- Financial concerns/ Total treatment time
- Fixed or removable restoration
- Ability and willingness of team to provide a selected treatment

Hybrid Prosthesis: “A denture tooth and acrylic design with a milled bar or cast metal substructure”.
- Fixed Detachable Prosthesis (Hybrid Denture)
- 4-6 implants are placed in the interforaminal region (Mandible)
- Removable by the dentist but not by the patient (screw retained)
- Exhibits distal extensions (resulting in cantilever)
- Implant supported restoration with occlusion to 1st molar

Advantages:
• Excellent stability and function
• Provides patient psychological support

Disadvantages:
• Difficult oral hygiene
• May not provide facial tissue support
• Cantilever stress due to distal extensions

Esthetics:
• Classic design was high off tissue due to limited components
• Modern design is esthetic and conforms to tissue

Tapered Abutments as an interface between implants and prosthesis will improve the restoration and make maintenance easier at recall appointments.

Maxillary Hybrid Prosthesis:
• More difficult than mandible
• Unrealistic expectations
• Hygiene can be difficult
• Esthetics may be difficult
• Phonetics can be a problem
• May not provide lip support
• May require excess acrylic

Treatment Planning and Case Design:
• Bone Preservation
• Function
• Expense

Fixed-Prosthetic implant Restorations of the Edentulous Maxilla:
Excellent Reference For

Prosthetic Concepts
Prosthetic Concepts for the edentulous arch:
√ Metal Ceramic Restoration/Zirconia (pure or veneered)
√ Fixed Hybrid Restoration
√ Removable Overdenture

Key Determinates for successful treatment of the completely edentulous arch:
• Presence or absence of composite defect
• Visibility of edentulous ridge at high smile line
• Amount of bone loss

√ Composite Defect: Missing teeth, soft tissue and bone

√ PFM restoration required
• no bone or soft tissue defect
• only replacing clinical crown

Prosthetic space requirements:
• How much space is required for prosthesis?
• How thick is tissue over bone? Can it be reduced?
• Plan on 3mm of tissue over bone.
• It is essential to know the patient’s VDO.

**Required space from crest of tissue to opposing occlusion at vertical dimension of occlusion for prosthesis. Add 3mm for tissue thickness over bone.**

*Quote from Henry Martin CDT Restorative Arts Dental Lab from experience of over 1000 cases: “The number one problem I have in restoring hybrid cases is inadequate occlusal space.”*

**Requirements:**
- Porcelain fused to metal 9mm + 3(tissue) = 12mm
- Zirconia (depends on lab) 12+3 = 15mm
- Hybrid prosthesis 12+3 = 15mm
- Bar overdenture 12+3 = 15mm
- Locator retained overdenture 6mm occlusal space

**A-P Spread:** The distance from the center of the most anterior implant to a line joining the distal aspect of the two most distal implants. This provides an indication for the amount of cantilever that can be planned.
With 5 implants it should not exceed 2.5 times the A-P spread if all stress factors are low.

*Dental Implant Prosthodontics; Carl E. Misch,DDS,MDS; Copyright 2005, Mosby, Inc. Page 168*

“1.5 A-P Spread” English Rule; Charles E. English, DDS
Using 4 implants. Consider exceptions to rule such as length of implants and jaw relationship.


Can we increase the AP Spread? Yes if implants are moved distal!

Problems with placing posterior implants to decrease cantilever:
- √ Mandibular canal
- √ Mental loop
- √ Maxillary sinus
Things to consider for treatment planning:
- Available space
- Anatomy and anatomical structures
- Amount and quality of bone
- Ridge relationship
- Mounted diagnostic casts are essential
- Patient expectations

- If patient has any teeth and occlusion is correct use it.
- If patients has some teeth but occlusion is incorrect bond composite on them and make landmarks even if teeth are failing and will be extracted.
- If patient has existing dentures and they are correct use them to mount study case.
- If dentures are incorrect modify to correct occlusion (add acrylic).
- If no teeth or denture take case through esthetic try-in step for correct occlusion and esthetics. Use wax setup for records

A Lange Denture Duplicator is great to duplicate dentures in clear acrylic to view tissue position and make guides.

One complication was prosthesis fracture after 2 years and prosthetic bar fracture after 3 years. Significant trimming of the bar was required to adjust interocclusal space for rehabilitation.
“It should be argued that a deficiency in the interocclusal space can be considered a limitation to treatment.”

**How many implants do you really need??????????**

Important considerations when treatment planning:
- √ Time: Patient wants it now
- √ Surgery: Nobody wants surgery
- √ Cost: Lower cost makes it available to more patients
- √ Success: Must be scientifically based

Treatment Goals:
- **Reduce treatment time**
- **Reduce the amount of needed surgery**
• Control cost
• Have a high rate of success

Can we change the A-P spread without surgery? YES

Use Tilted Implants
Reference text:
IMPLANT TREATMENT PLANNING FOR THE EDENTULOUS PATIENT
Dr. Edmond Bedrossian (Reference Text)
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Mosby Elsevier 3251 Riverport Lane
St. Louis, Missouri 63043

Why use tilted implants?
• can use longer implants to increase implant bone contact
• increase load distribution
• increase AP spread and reduce cantilevers in the prosthesis
• eliminate need for sinus lift
• reduce need for crestal bone grafts
*Reduce cost to patient

Tilted implants will provide for graftless surgery and Not necessarily flapless surgery.

Important Facts:
• 15-16mm from crest of bone to opposing occlusion
• Surgeon is responsible for creating vertical space
• Frequently requires bone removal
• Responsibility of restorative doctor to evaluate space with diagnostic casts, oral eval and examination
• Restorative doctor should discuss case with surgeon and provide surgical guide at time of surgery
• Surgeon should obtain adequate radiographs and other diagnostic information to determine if surgical goals of treatment can be met

CT Scans are essential: It can provide valuable information.
  o HOWEVER it does not replace a diagnostic cast and wax-up
    • Use to identify anatomy and treatment plan.
    • Used to generate surgical templates.
    • Templates may be specific guides.
    • Surgery for immediate hybrid provisional may use guide with slot.
Tilting of dental Implants will increase length and result in better load distribution, increase anchorage and allow longer implants.
“Tilting of implants does not have a negative effect on load distribution when it is part of the prosthesis support.” (Dr. Edmond Bedrossian text)

How much increase?
√ Md 6.5mm (range 3-12mm)
√ Mx 9.3mm (range 5-15mm)
Reference: Bedrossian Text

Zimmer RevitaliZe Solutions provides 15 and 30 degree angled Tapered Abutments to accommodate the tilted implants.

Minimum torque for implant stability for immediate load 35 Ncm; Zimmer Tapered abutments are torqued to: 30 Ncm

Load Transfer in Tilted Implants with Varing Cantilever Lengths in an All-On-Four Situation
Conclusion: Study shows that increasing tilt of distal implants does not increase the stress significantly.

Bone Level Changes Around Axial and Tilted Implants in Full-Arch Fixed Restorations. Interim Results of a Prospective Study.
Conclusion: The use of tilted implants in the immediate rehabilitation of the fully edentulous jaws is safe and is not associated with a higher marginal bone loss as compared to axially placed implants. (mean follow-up time was 52.8 months in mandible and 33.8 months in maxilla)

√ Zones in the edentulous maxilla:
  Zone 1: Premaxilla
  Zone 2: Bicuspids
  Zone 3: Molars

“All-on-Four” Immediate-Function Concept for Completely Edentulous Maxilla: A Clinical Report on the Medium (3 years) and Long-Term (5 years) Outcomes
Conclusion: The high survival rate at patient and implant level indicates that immediate-function concept for completely edentulous maxillae using the present protocol is viable in medium and long-term outcomes.
A Retrospective Analysis of 800 Branemark System Implants Following the All-On-Four Technique


- The all-on-four technique has been shown to be successful for screw retained interim restorations the day of surgery.
- Alternate protocols are available that includes bone grafts and sinus augmentations and have equal success.
- Such procedures require longer healing time and often no immediate provisional plus additional cost.
- The use of tilted implants allow less surgery and immediate load and high success.

Conversion of denture to a provisional can be direct or indirect:
- Indirect conversion is done outside of the mouth.
- Direct conversion is done by picking up attachments in the mouth.

Clinical Outcomes and Peri-implant Findings of Four-Implant-Supported Distal Cantilevered Fixed Mandibular Prostheses: Five-Year Results


Results:
1. Fixed four-implant-supported distal cantilever mandibular prostheses presented with high implant and prosthodontic success rate.
2. Distal denture cantilevering within a defined range and distal implant tilting did not result in technical complications and did not negatively affect implant success and peri-implant parameters.
3. Inferior hygiene parameters in mandibular anterior regions may be a result of reduced cleansability and variations of anatomic landmarks.
4. Resin veneering of fixed dentures proved advantageous for repair and modifications but was disadvantage for discoloration and needed repeated professional cleaning.

Possible Complications:
Fractures of acrylic teeth, body acrylic, screws or substructure
* Excessive overload
* Lack of passive fit
* Parafunction
* Lab errors or porosity
* Inadequate restorative space
* Excessive VDO
Soft tissue complications:
* Tissue irritation under bar from rough surface or poor hygiene
* Tissue and prosthesis relationship change resulting in speech problems or food collecting under prosthesis
* Tissue overgrowth under prosthesis

**Maintenance:**
* Soft tooth brush and mouth wash
* Waterpik
* Superfloss
* Night guard
* No hard food such as ice or hard candy

**RECALL**
* Every 3 months 1st year
* Evaluate and remove if necessary to clean
* After 1st year recall based on patient assessment

Daniel F. Galindo, DDS, Prosthodontist, Private Practice
Caesar C. Butura, DDS, Oral & Maxillofacial Surgeon, Private Practice

**Conclusion:** Combination of axially placed and angled implants with the All-On-Four procedure can be successful in the mandible.

**Factors for Success:**
- Careful site selection.
- Preparation of osseous shelf to level ridge and provide space.
- Stable splinting of all four implants with immediate provisional.
- Careful occlusal adjustment to provide bilateral occlusion in the canine and premolar region and no occlusion in the distal of the prosthesis.
- Maximizing A-P spread

**Dental Implant Supported Hybrid Prosthesis Facts to know:**

_____ The plan is to place implants and place an immediate fixed temporary restoration. If the implants are not adequately supported by bone a removable restoration will be placed until such time the foundation is adequate for a fixed temporary restoration.

_____ With the temporary restoration only soft food should be consumed. Any food that is easy to cut with a fork is ok.

_____ The temporary restoration will be in place from 4-6 months. In some situations it may be longer. It is all acrylic (plastic) and will need frequent maintenance. Tissue may change around and under the restoration. The acrylic may fracture or teeth may separate from the acrylic. All of the problems can be easily repaired but it will require time in the office.
It is not possible to predict the minimum or maximum number of visits to the office during the healing process.

It will take some time to learn to speak and function with the new restoration. In some cases it may take 6-12 months.

When the surgeon and restorative dentist determine the healing process is complete, the final restoration will be made. This process will take several appointments.

After delivery of the final restoration an individualized maintenance program will be established and is essential for the patient to follow.

The maintenance program will consist of cleaning and any required repairs. There will be a fee for this service. Usually after the first year, maintenance appointments are 2 or 3 times a year.

There will be a future need to replace teeth and/or acrylic due to staining, wear or fracture. There will be a fee for this.

I have read, understand and initialed the above statements. Date: ____________________________

Patient (print): _______________________________________

Patient signature: ______________________________________

Provider signature: _________________________________