Risk Factors and Complications in Implant Dentistry
Recognition, Treatment and Prevention

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Disclosure

• Private practice in “Periodontics”
• Utilize multiple implant systems & designs
• Not employed by any company or University
• Not received personal grants or subsidies
• Have received sponsorship for lectures
• ODA compensation for this seminar
“Risk Factors in Implant Dentistry”
Learning Objectives:

• Rely on an “Evidence Based Approach”
• Review “Risk Factors” reported in the literature
• Reveal complications from a Private Practice setting
• Identify risk factors impacting on survival and success
• Recognize procedures that are predictably successful
• Describe techniques that can reduce complications
• Demonstrate treatments to deal with complications
Increasing Complications: Why?

- More dental implants being placed
- More inexperienced implant dentists
- Inadequate training courses taken
- Lectures relaying unrealistic simplicity
- Aggressive treatment of non-ideal sites
- Unproven materials / techniques
- Increased Peri-implantitis over time
- Longer term follow-ups up to 30 years
Answer:

Knowledge of Risk factors from Evidence Based Information is required for accurate Diagnosis & Treatment Planning and Patient Informed Consent
Diagnosis and Treatment Planning

• 1) Initial patient interview (Subjective Assessment)
  • Patient: complaints, problems, expectations, goals, limitations
  • Past & present medical & dental history, referrals? precautions?

• 2) Diagnostic Data Collection (Objective Assessment)
  • A) Clinical Exam (dental, periodontal, occlusal, esthetic analysis)
  • B) Radiographic Exam (e.g. periapicals, panoramic, CT)
  • C) Photographs / D) Study Models / E) Diagnostic Wax-ups

• 3) Diagnosis / Prognosis (risk factor assessment)

• 4) Treatment Plan (multidisciplinary, options, referrals? etc.)

• 5) Consultations (achieving patient (“Informed consent”))

• 6) Treatment- (sequential multidisciplinary approach)

• 7) Maintenance- (patient and professional responsibilities)
Evidence-Based Dentistry

5 Steps
- Question
- Find
- Appraise
- Act
- Evaluate

CLINICIAN
Skill and Judgement

PATIENT
Needs and Preferences

EVIDENCE
Best Available
Published Studies:
Applicability to Private Practice?

- All implants included?
- Only the best clinicians?
- Risky patients excluded?
- Risky procedures excluded?
- Statistical vs. Clinical significance?
- Protocols similar to private practice?
Implant “Survival” Statistics

Do not account for bone loss and other complications
Private Practice: Implant Documentation

• Data entry on "Triton-DIMS"
  • Relational data base
  • User defined attributes and queries
  • Statistical analysis & reports e.g. "Lifetables"
• Data on over 14,750 implants
• Follow-ups for up to 30 years

Dr. Murray Arlin, Private Practice
Private Practice: “Experience”

Private Practice “**Empiricism**” (“my clinical impression is..”)
- Procedures that **work** are repeated!
- Procedures that **don’t work** are abandoned!
- **Obvious** risk factors are easily recognized
- **Subtle** risk factors are very difficult to identify
  - (e.g. survival of 96% vs 98% = 50% fewer failures!)

Private Practice “**Well Controlled Study**”:
- Potential for a long-term large scale study
- **Obvious** factors are accurately quantified
- **Subtle** factors can also be identified & quantified???
# Implant Dentistry Risk Factors

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## Excessive Load
- Host Related
  - Transmucosal
  - Parafunction
  - Bruxism
- Operator Related
  - Implant: Size / # / Distribution
  - Materials / Occlusion
  - Splints / Cantilevers / Ratio
- Early vs Late Effects
- Biological Effects
- Mechanical Effects

## Surgical Techniques
- Sterile vs Aseptic
- Prophylactic Antibiotics
- Surgical Incision
  - Surgical Trauma
    - Excess Heat
    - Excess Compression
    - Inadequate Congruency
- Malpositioned Implants
  - Oro-facially
  - Mesio-distally
  - Apico-occlusally
  - Invasion of Anatomy

## Surgical Protocols
- 1 vs 2 stage
- Immediate Placement
- Early Placement
- Delayed Placement
- Failed Replacement
  - immediate / early / delayed
- Immediate Loading
- Number of Implants
- Implant Connection to Natural Teeth

## Implant Design
- Crestal Module
- Platform Shift
- Fracture Risk
  - Material Diameter Load Connection
- Short Implants
- Narrow Implants
- Wide Implants
- Tapered Implants

## Soft Tissue
- Biotype / Keratinization

## Bone
- Quality/Quantity

## Excessive Load
- Surgical/Prosthetic Techniques
- Surgical/Prosthetic Protocols

## Material Biocompatibility
- Implant Material
- Implant Surface
- Implant Design
Summary: Host Systemic Risk Factors

- **No apparent significant effect:**
  - Age / Controlled Diabetes / Many systemic conditions and meds

- **Higher implant failure and complication rates with:**
  - Males, Diabetes-uncontrolled (some studies)
  - Previous and ongoing Periodontitis
    - Strongest association with “Aggressive Periodontitis”
    - More with very rough surfaces e.g. Hydroxy-Apatite, TPS
  - Smoking (many studies but “direct” or “associated”)
    - Dose dependant? / Reduction-Cessation may reduce risk?
    - Reduced risk with “medium-rough” surfaced implants

- Genetic predisposition? Idiopathic Etiologies?
  - May be synergistic with smoking
  - A risk factor for cluster failures?
  - Contamination? / Allergy ? / Foreign Body Reaction?
Local Host Risk Factors

Bone Quality:  
- Type 4 bone
- Irradiation
- Infection

Bone Quantity:  
- Thin Bone
- Grafted Bone

Excessive Load:  
- Early motion over 50 µm
- Bruxism
- Prosthetic complications

Plaque Control:  
- Peri-implantitis (8x!)

Soft Tissue Thickness <2 mm:  
- Implant survival
- Facial bone loss

Insufficient Keratinized Mucosa:  
- Implant survival
- Inflammation
Surgical Protocol

- Flapless implant surgery?
- One or two stage procedure
- Immediate implant placement
- Early implant placement
- Immediate implant replacement
- Early implant replacement
- Delayed implant replacement
- Early / Immediate loading
- Number of supporting implants
- Connection to natural teeth
Flapless Implant Surgery

- Decreased morbidity and time
- Increased risk of malposition
- CBCT and Guides important
- Guided Surgery ideally
- Keratinized gingiva preservation
- Expertise to augment tissues
- Expertise to treat complications
Technique: Immediate Implant
(Optimizing Function and Esthetics)

- “Atraumatic” flapless or minimal reflection
- “Atraumatic” extraction (periotomes etc.)
- Preserve socket walls (especially facial)
- Drilling to avoid osseous perforations
- Optimal implant positioning (3 dimensions)
  - Priority: avoid compression of facial bone!
- Achieve good initial implant stability (30Ncm+)
- Optimal implant: 1-design, 2-size, 3-shape, 4-surface
  - Apical cutting threads, Large to extend beyond socket to stabilize in bone, Tapered?, Medium rough surface
- Provisionalization: control load, optimize esthetics
Teeth Connected to Implants

**Advantages**
- Tactile perception?
- Increased comfort?
- Increased chewing?
- Increased efficiency?
- Avoid vital structures
- Less graft requirements
- Decreased cost
- Patient acceptance

**Disadvantages**
- Intrusion of teeth
- Biomechanical issues
  - Component fracture
  - Screw loosening
  - Cement failure
  - Tooth decay / fracture
  - Crown fracture
- Perio / Endo lesions
- Peri-implantitis
Summary: Operator Related Factors

• Experience: strong evidence of a “learning curve”
• Sterile vs Aseptic: equivalent early success rates
• Surgical incision: no apparent effect on early success
• Surgical trauma:
  • Excess heat generation associated with early failure
  • Excess bone compression likely associated with increased bone loss and implant failure (lack of scientific studies)
  • Inadequate bone fit associated with:
    • Increased early and late implant failure?
    • Suggestion: Long-Term Temporization” of initially mobile implants.
Summary: Operator Related Factors

• **Implant malposition** may lead to complications with:
  • Implant failure, crestal bone loss, esthetics, prosthetics, and neurosensory disturbances (e.g. paresthesia)

• **Surgical Protocols:**
  • 1 vs 2 stage surgery yield similar success rates
  • 2 stage protocol should be considered for “at risk” cases
  • Partially submerged implants should be fully exposed
  • Replacement of Failed Implants:
    • Immediate replacement requires careful case selection, and despite risk may be of indicated, due to minimal intervention
    • Delayed replacement survival rates similar to conventional
    • Replacement survival rates may improve with rough surfaces
Summary: Operator Related Factors

• “Early/Immediate Loading”
  • Can be successful if micromotion controlled
  • May actually increase the % of bone to implant contact
  • Rough surface implants may display improved survival

• “Immediate Loading”-Clinical Guidelines
  • Single and Partially edentulous - not routine
Summary: Operator Related Factors

• **Number of Supporting Implants-Variables:**
  • 4 for full-arch fixed
  • Preferably 2 for mandibular overdentures, 4 for maxillary

• **Cantilever Length:**
  • Creates increased stress
  • Research suggests higher prosthetic complications
  • Need well-designed prostheses to support

• **Connection to natural Teeth:**
  • Increased complications (long term) most studies
Short Implants: Clinical Guidelines
(Evidence Based and Anecdotal)

• “Informed Consent” e.g. patient told that very short implants (<7mm) may have twice the failure rate
• Utilize wider rough implant surfaced implants
• Aim for splinted 1:1 “implant to tooth ratio”
• Avoid poor bone quality (e.g. posterior maxilla)
• Achieve good primary stability and avoid excess early loading e.g. submerge, no immediate loading
• Avoid prosthetic overloading:
  • Avoid cantilevers, balancing side contacts
  • Provide protected occlusion, night guards
  • Splint implants together, check occlusion regularly
Summary: Biomaterials

- **Rough Surface Implants may exhibit:**
  - Higher early survival rates vs “turned” titanium
  - Higher early survival in poor quality/quantity bone
  - Higher early failure with TPS Tapered “Replace”
  - Increased late failure e.g. “older” HA and TPS

- **Smooth Surface Implants (turned titanium) exhibited:**
  - Generally higher early failure rates vs rough surfaced implants
  - “Steady State” after 1 year, less than *1% late failure

(*Arlin, unpublished*)
Summary: **Biomaterials-Implant Shape**

- **Fracture:**
  - Narrow internal connection may be susceptible
- **Narrow diameter (3.25+):**
  - similar survival to standard diameter
- **Wide diameter:**
  - May be associated with more bone loss, failure, recession
- **Short Length:**
  - > Failures with “smooth” surfaces and poor bone quality
  - Only slightly lower survival rates with good quality bone
- **Tapered walls:**
  - May increase stability in poor quality bone
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- Smoking
- Genetic Factors

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- Soft Tissue:
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- Plaque Control
- Excessive Load

### Operator
- Experience/Expertise
- Surgical/Prosthetic Techniques
- Surgical/Prosthetic Protocols

### Biomaterial
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- Load Connection
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“4 Categories”

- 1) Host-Systemic
- 2) Host-Local
- 3) Non-Host-Operator
- 4) Non-Host-Biomaterial

Risk “Factors”

- 1) Systemic Disease/Smoking
- 2) History of Periodontitis
- 3) Hard and Soft Tissues
- 4) Esthetics/Plaque/Occlusion
- 5) Training / Experience
- 6) Protocols and Techniques
- 7) Splints/Cantilevers/Occlusion
- 8) Implant material/surface/design
- 9) Implant size: e.g. short/narrow
- 10) Prosthetics: e.g. Connection