

Dental Implants: Health and Disease

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PER 712



Objectives

- ▶ How is implant success defined; success rates
- ▶ Peri-implant disease definitions
- ▶ Prevalence of peri-implant disease
- ▶ Etiology, risk factors, pathogenesis
- ▶ Examination and assessment of implant health
- ▶ Prevention
- ▶ Treatment options for peri-implant disease



Historical: Dental Implants

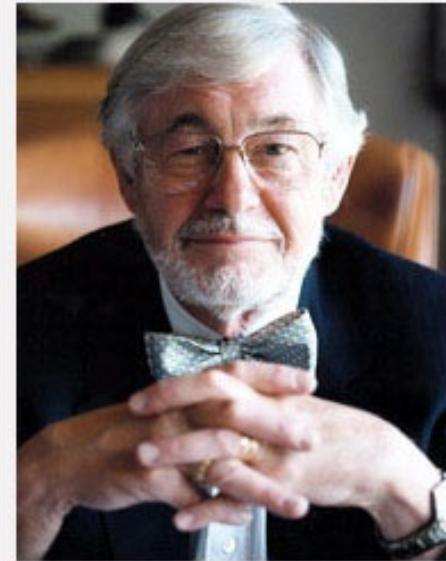
- ▶ Revolutionized treatment of fully and partially edentulous patients
- ▶ Predictability and long-term success
- ▶ Complications
 - Improper treatment planning
 - Surgical and prosthetic execution
 - Material failure
 - Lack of preventative maintenance
 - Peri-implant mucositis and peri-implantitis



Osseointegration

Toronto, 1982

- ▶ Direct structural and functional connection between bone and the surface of the load-carrying implant
- ▶ No soft connective tissue or periodontal ligament-like interface
- ▶ No mobility
- ▶ PREDICTABILITY



Per-Ingvar Branemark
1929 - 2014



Implant Success

- ▶ Absence of signs/symptoms
- ▶ Implant immobility
- ▶ No peri-implant radiolucency
- ▶ Negligible progressive bone loss (< 0.2 mm annually after the first year)
- ▶ An absence of persistent and/or irreversible signs and symptoms of pain, infections, necropathies, paresthesia
- ▶ A success rate of 85% at the end 5 years and 80% at the end of 10 years as a minimum

Albrektsson, Zarb, Worthington, and Erickson (1986)



Implant Success

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- ▶ The implant design does not preclude placement of a crown or prosthesis with an appearance that is satisfactory to the patient and dentist

Smith and Zarb (1989)



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Implant Healing and Health



Surgical Implant Placement



Implant Failure Terminology

Type of Failure	Timing
Surgical	At surgery
Osseous healing failure	Between stages I and II
Early loading	Abutment placement to first year
Intermediate	First-year loading to 5 years
Late	5 to 10 years
Long-term	>10 years

Misch, CE. Contemporary Implant Dentistry,
3rd ed. 2008



Early Failure

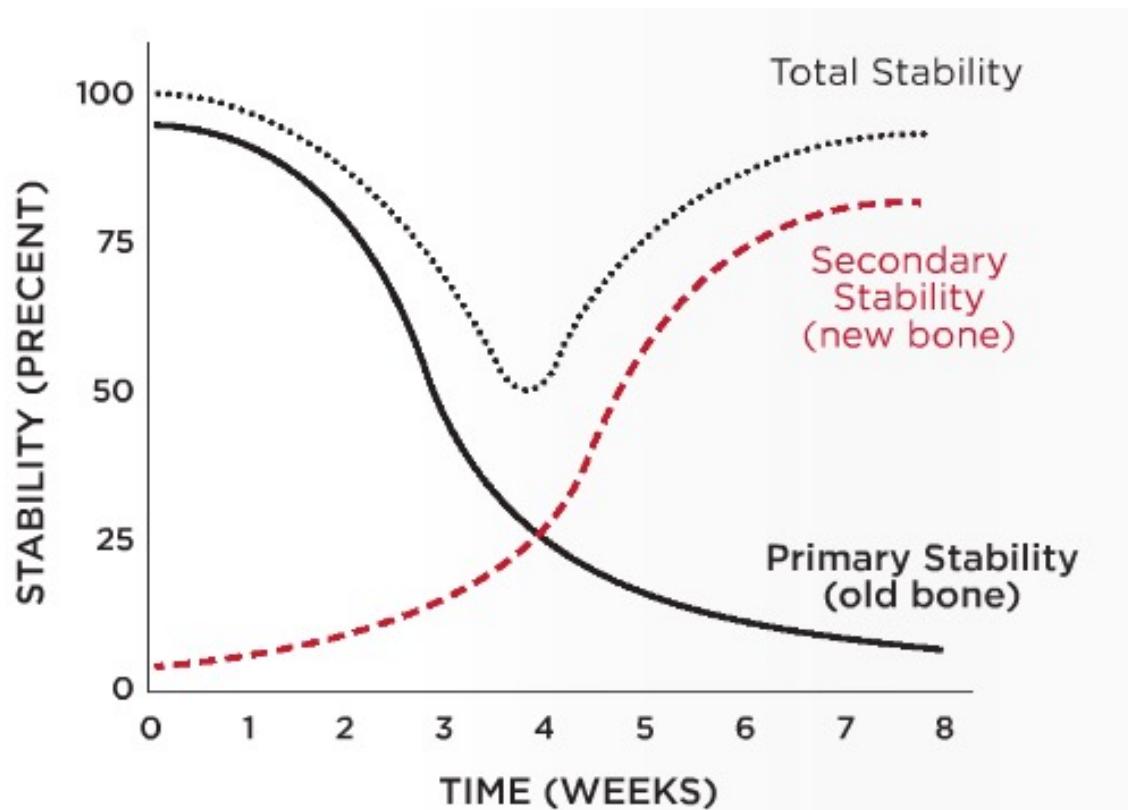
► Surgical

- Trauma
- Infection
- Occlusal overload during healing
- Poor placement: doesn't allow restoration or maintenance
- Absence of keratinized gingiva



Early Loading

Surgical: Occlusal overload during healing



Adapted from: Raghavendra S, Wood MC, Taylor TD *Int J Oral Maxillofac Implants* 2005

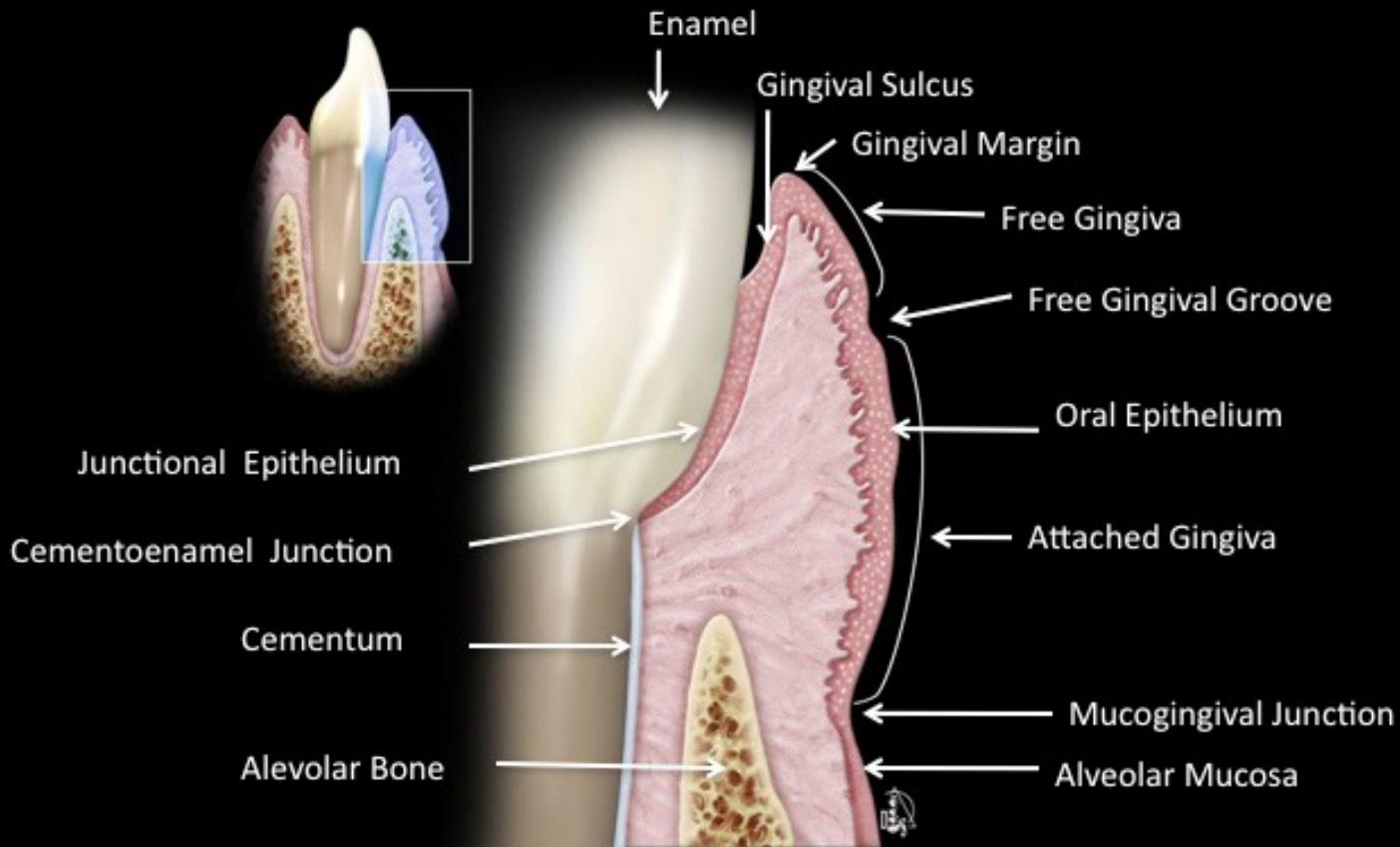


Late Failure

- ▶ Excessive occlusal forces?
 - Improper ‘engineering’ of case
 - Screw or abutment loosening
- ▶ Plaque
 - Analogous to periodontal disease
 - Plaque retentive restorative contours
 - Susceptible host



Parts of the Gingiva



Adapted from: Wilkins EM. The gingiva. In: Wilkins EM. *Clinical Practice of the Dental Hygienist*. 10th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2009:212-227.

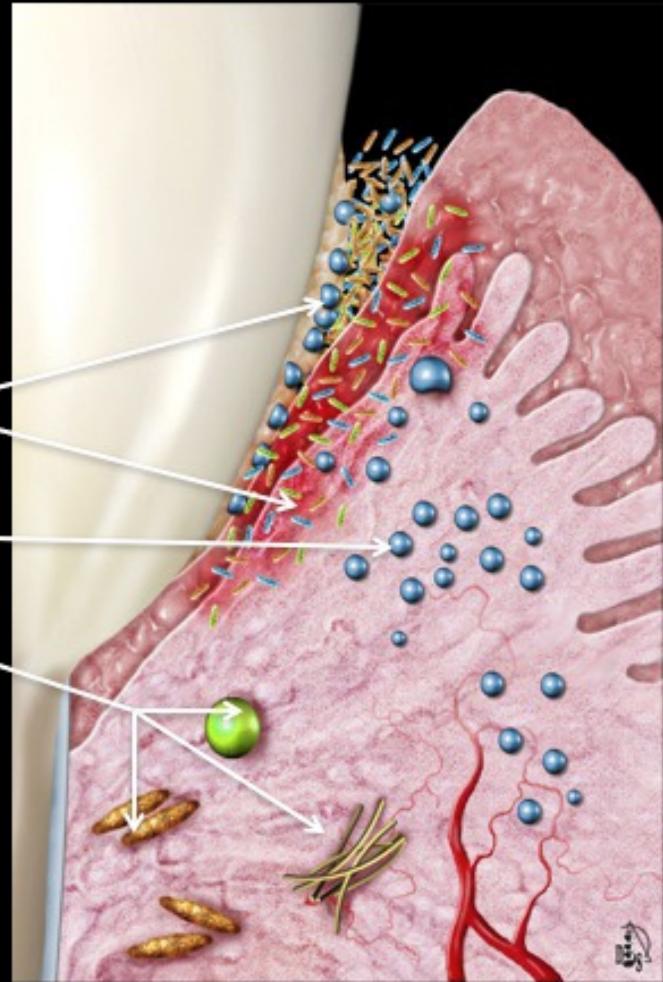




Established Gingivitis

Subgingival plaque extends and disrupts the coronal-most portion of the junctional epithelium

- PMNs continue to fight
- Lymphocytes produce antibodies
- Immune systems sends more immune cells to fight
 - Cytokines
 - PGE₂
 - MMPs
- Immune response can destroy healthy connective tissue; however, if bacterial infection is controlled, the body is able to repair the tissue



Adapted from: Nield-Gehrig JS, Willmann DE. Host immune response. In: Nield-Gehrig JS, Willmann DE. *Foundations of Periodontics for the Dental Hygienist*. Baltimore, MD: Lippincott Williams & Wilkins; 2008:85-100.



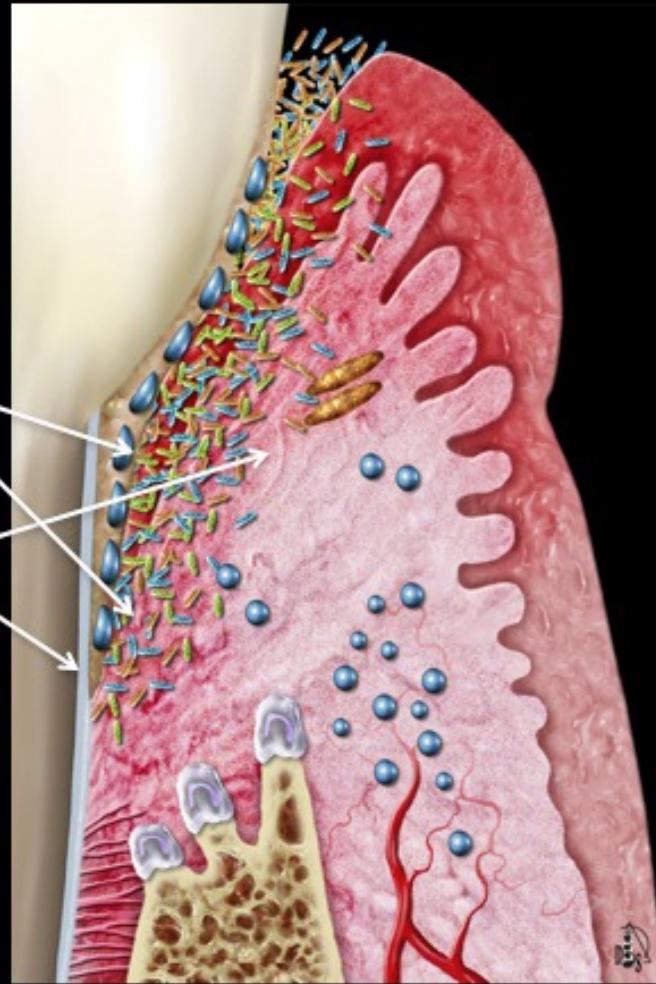


Periodontitis

The host is no longer in control and tissue destruction occurs

The plaque biofilm grows along the root surface

The junctional epithelium extends into the connective tissue and migrates along the root



Adapted from: Nield-Gehrig JS, Willmann DE. Host immune response. In: Nield-Gehrig JS, Willmann DE. *Foundations of Periodontics for the Dental Hygienist*. Baltimore, MD: Lippincott Williams & Wilkins; 2008:85-100.





Definitions

- ▶ Peri-implant mucositis
 - Reversible inflammatory process causing redness and swelling *localized to the soft tissue* around implants without signs of loss of supporting bone following initial bone remodeling during healing
- ▶ Peri-implantitis
 - An inflammatory process that includes *both soft tissue inflammation and progressive loss of supporting bone* beyond biologic bone remodeling of the functioning implant, possibly leading to implant loss

Heitz-Mayfield LJA, Salvi GE. Peri-implant mucositis. *J Periodontol* 2018;89(Suppl 1):S257-S266

Schwarz F, Derkx J, Monje A, Wang H-L. Peri-implantitis. *J Periodontol* 2018;89(Suppl 1):S267-S290

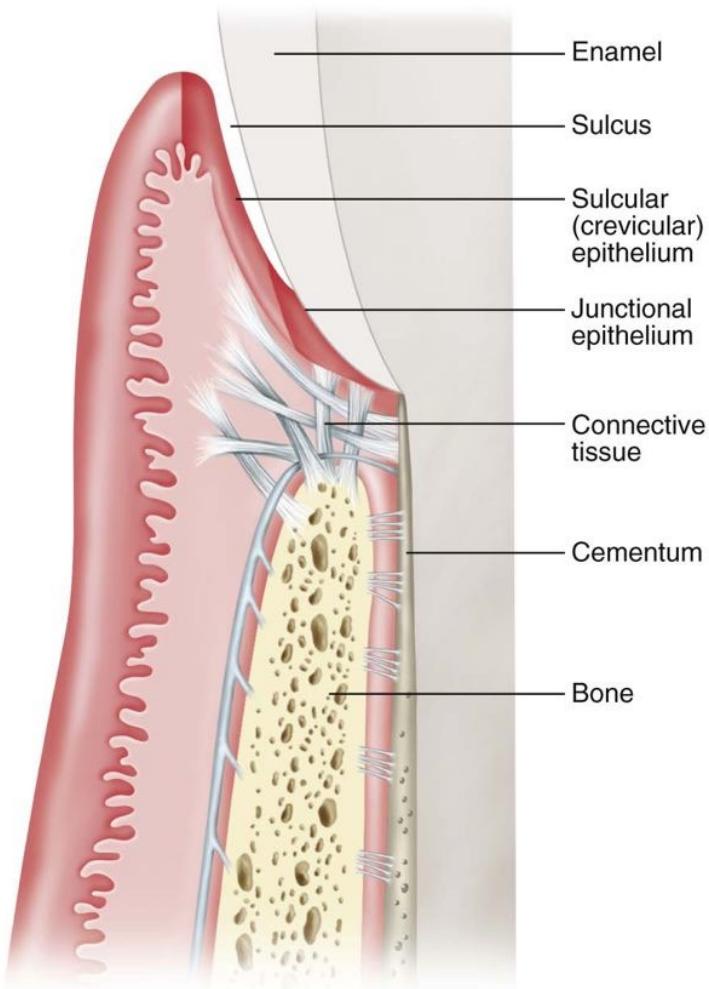


Peri-implant Mucosa

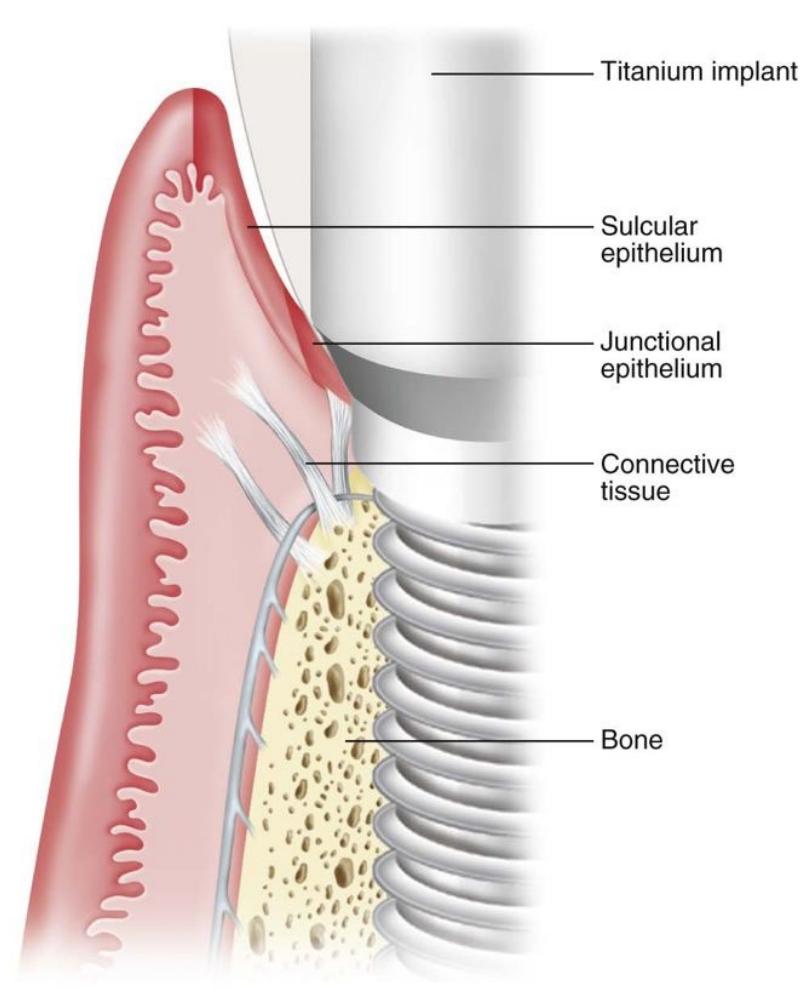
- ▶ nonkeratinized sulcular epithelium
- ▶ junctional epithelium analogous to the natural teeth
- ▶ collagen fibers run parallel to the implant surface – not perpendicular, non-attached – however some newer implant technology encourages a connective tissue attachment



A



B

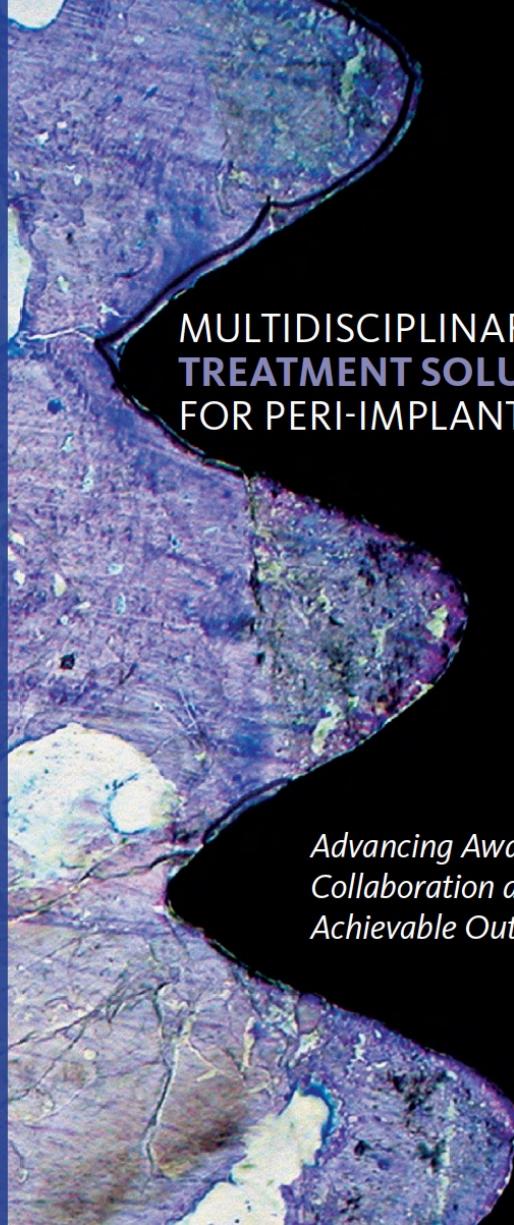


From Rose LF, Mealey BL: *Periodontics: medicine, surgery, and implants*, St. Louis, 2004, Mosby.



PROGRAM

June 9 – 11, 2017
Chicago, Illinois



MULTIDISCIPLINARY **TREATMENT SOLUTIONS** FOR PERI-IMPLANTITIS

*Advancing Awareness,
Collaboration and
Achievable Outcomes*



Peri-implant mucositis

- ▶ Bleeding on probing and/or suppuration
- ▶ Usually associated with probing depths ≥ 4 mm
- ▶ No evidence of radiographic loss of bone beyond initial remodeling
- ▶ Estimated to be present in 48% of implants followed from 9 to 14 years

Fransson C, Lekholm U, Jemt T, Berglundh T. *Clin Oral Implants Res* 2005
Roos-Jansåker AM, Lindahl C, Renvert H, Renvert S. *J Clin Periodontol* 2006



Peri-implant mucositis

- ▶ Peri-implant mucositis: analogous to gingivitis around natural teeth
- ▶ Formation of a plaque biofilm (glycoproteins plus microbial colonization) on restorations and exposed titanium surfaces
- ▶ Peri-implant mucositis does not necessarily progress to peri-implantitis
- ▶ No evidence to suggest that structural differences between implants and teeth would alter the host response to bacterial challenge



Peri-implantitis

- ▶ Bleeding on probing and/or suppuration
- ▶ Usually associated with probing depths ≥ 4 mm
- Evidence of radiographic loss bone beyond initial remodeling (Sanz and Chapple, 2012)
 - Comparison with baseline radiograph: 1–1.5 mm after remodeling from the *expected marginal bone level* following remodeling
 - If no baseline radiograph: threshold vertical distance of an additional 2 mm from the *expected marginal bone level* following remodeling



Peri-implantitis

- ▶ Analogous to periodontitis
- ▶ Bacterial insult with subsequent host immune response leading to attachment and bone loss
- ▶ Gram negative organisms similar to periodontitis
- ▶ B-lymphocytes, plasma cells, and pro-inflammatory cytokines
- ▶ May be more pronounced inflammatory response with implants and not limited by the connective tissue insertion of natural teeth
- ▶ May progress more quickly to bone loss?



Risk Factors

- ▶ Previous periodontitis
- ▶ Poor plaque control/inability to clean
- ▶ Lack of maintenance



Risk Factors

- ▶ Smoking
 - Odds ratios ranging from 3.6 to 4.6
 - Greater percentage of disease in smokers than non-smokers
 - 3.8 odds ratio for peri-implant mucositis and 31.6 for peri-implantitis*
- ▶ Diabetes
 - Systematic reviews are inconclusive
 - May be related to tissue repair and host defense mechanisms

*Rinke S, Ohl S, Ziebolz D, Lange K, Eickholz P. *Clin Oral Implants Res* 2011;22:826–833.



Risk Factors

Occlusal overload

- ▶ Definition of occlusal overload
 - Magnitude
 - Duration
 - Direction
 - Frequency
- ▶ Implants are considered less tolerant of non-axial load; may result in implant marginal bone loss



Implant Evaluation



Examination and Diagnosis of Implant Disease

- ▶ Probing
- ▶ Radiographic bone loss (interproximal versus facial/lingual bone loss)
- ▶ CBCT may be helpful
- ▶ Suppuration may or may not be meaningful

Combination: probing data over time, bleeding on *light* probing, radiographic changes over time



Probing, Bleeding, Suppuration

- ▶ Bleeding upon gentle probing – soft tissue inflammation
- ▶ Increasing probing depth and bleeding over time – radiographic evaluation
- ▶ Suppuration/exudate – pathologic change necessitating further evaluation and treatment



Radiographs

- ▶ Periapical radiographs following implant placement and final restoration provide baseline for future comparison
- ▶ Perpendicular to implant body...how?
- ▶ Validity of demarcation between the threads
 - Estimating implant angle using threads is inaccurate (Sewerin, *CO/R* 1991)



Mobility

- ▶ A mobile implant is hopeless
- ▶ Loosening of restoration and/or abutment components
 - may lead to crestal bone loss
 - may act a plaque retentive factor resulting in inflammation



Treatment



Peri-implant Mucositis and Peri-implantitis

The elimination of the plaque biofilm from the implant/restoration surface is the prime objective of treatment.



Treatment Goals

- ▶ Arrest further loss of bone support
- ▶ Reestablish a healthy peri-implant mucosal seal
- ▶ Regenerate hard and soft tissue to the implant and abutment



Treatment

- ▶ Peri-implant mucositis
 - non-surgical therapy and oral hygiene
- ▶ Peri-implantitis
 - Non-surgical therapy has not been shown to be effective
 - Surgical therapy
 - Debridement/disinfection – abrasives, chemicals, laser
 - Guided bone regeneration
 - Implant-plasty





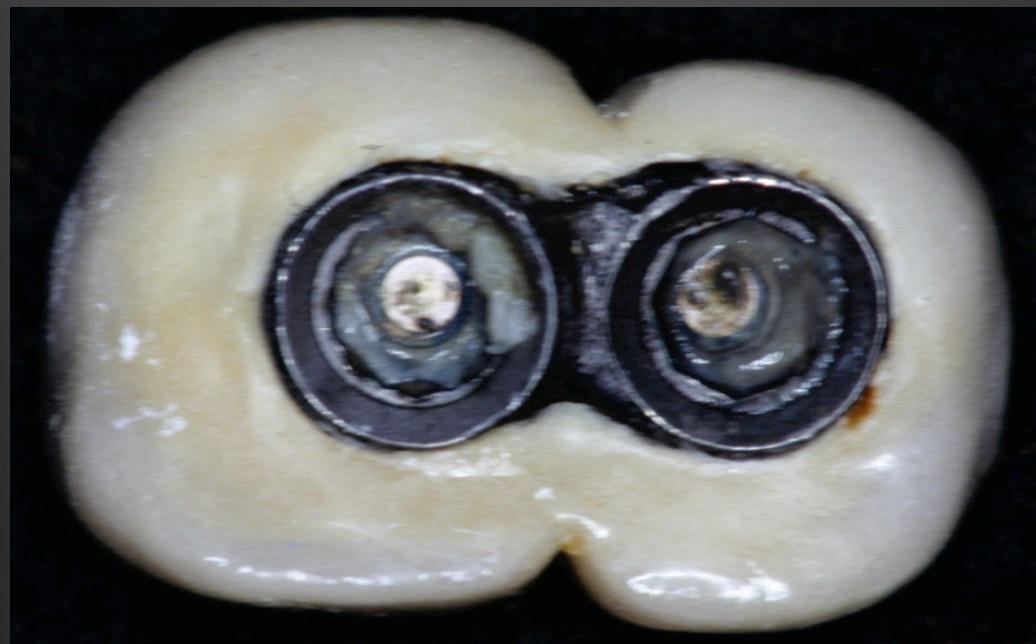
Courtesy of Dr. Joseph Califano

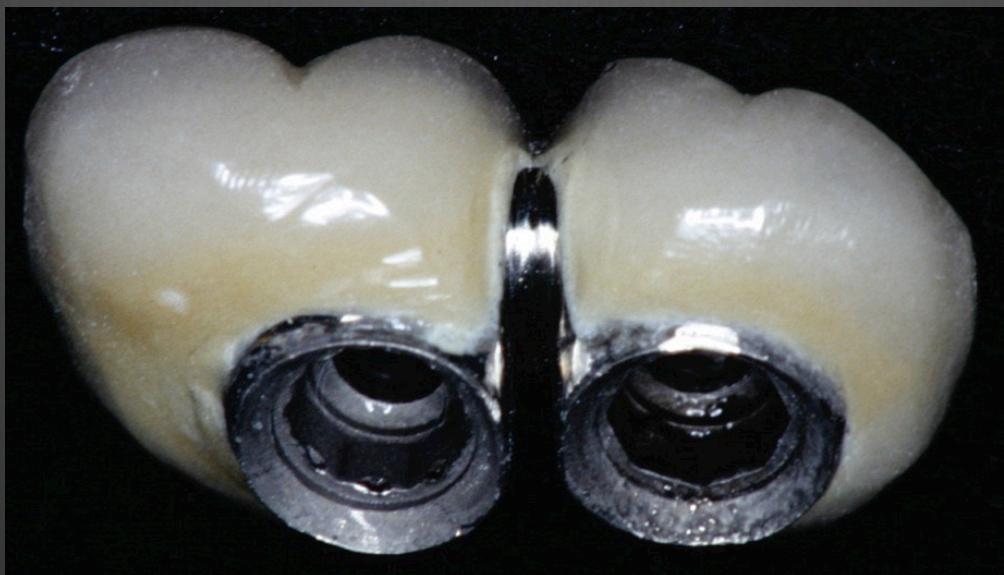


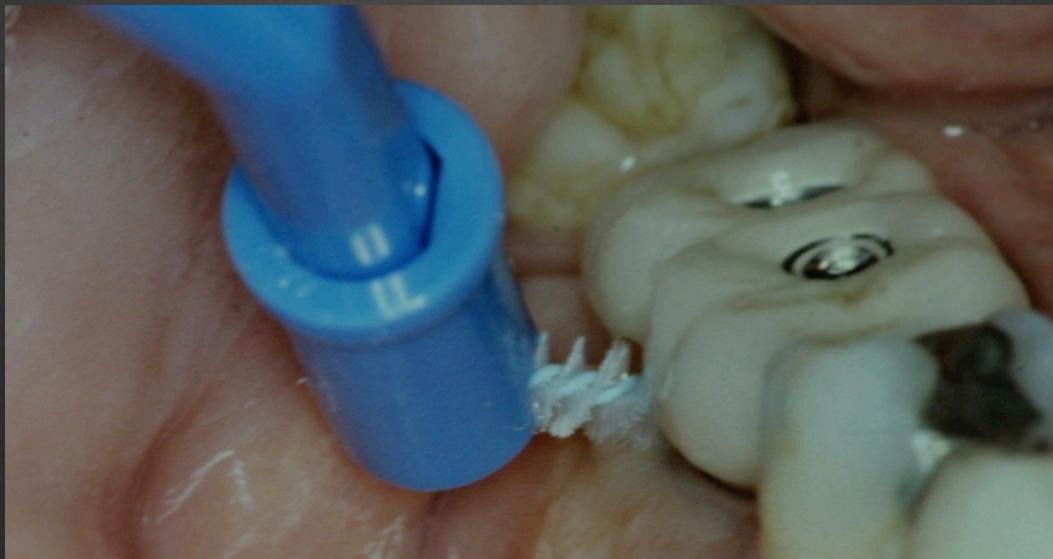


Courtesy of Dr. Joseph Califano











Nonsurgical Treatment

- ▶ Occlusal analysis and adjustment
- ▶ Evaluation of fit of prosthesis and abutment and correction as necessary
- ▶ Debridement with *appropriate* instruments (plastic, titanium, air abrasion)
- ▶ Adjunctive use of antimicrobials (chlorhexidine gluconate, Listerine®)
- ▶ Local and/or systemic antibiotics



Occlusion

- ▶ Implants don't have the 'give' of natural teeth
 - Light (no?) contact in occlusion
 - Avoid contacts on inclines and lateral excursions
 - Occlusal guards



Surgical Treatment

- ▶ Elevation of a mucoperiosteal flap and removal of granulation tissue
- ▶ Debridement and treatment of surface (mechanical, chemical, photodynamic)
 - Titanium or plastic curettes
 - Ultrasonic scalers
 - Air-polishing devices with sodium bicarbonate or glycine powder
 - Saline wash, peroxide, acid treatment
 - Irradiation with hard or soft tissue laser light
 - Implantoplasty



Case Selection

Prevention



Patient Selection

Relative contraindications:

- ▶ Uncontrolled diabetes
- ▶ Alcoholism
- ▶ Heavy smoking
- ▶ Post-irradiated jaws
- ▶ Poor oral hygiene



Patient Selection

- ▶ Age as a factor – too young or too old?
- ▶ Emotionally stable
- ▶ Cooperative – treatment and maintenance
- ▶ Realistic expectations – not all implants are successful



Presurgical Evaluation

- ▶ Restorative requirements
- ▶ Inter-arch space and jaw relationships
- ▶ Location of edentulous areas
- ▶ Quantity and quality of available bone



Presurgical Evaluation

- ▶ Radiographs
 - Panoramic
 - Lateral
 - Occlusal
 - CT scan
- ▶ Proximity of complicating structures
 - Maxillary sinuses
 - Foramina
 - Mandibular canal
 - Adjacent teeth or roots

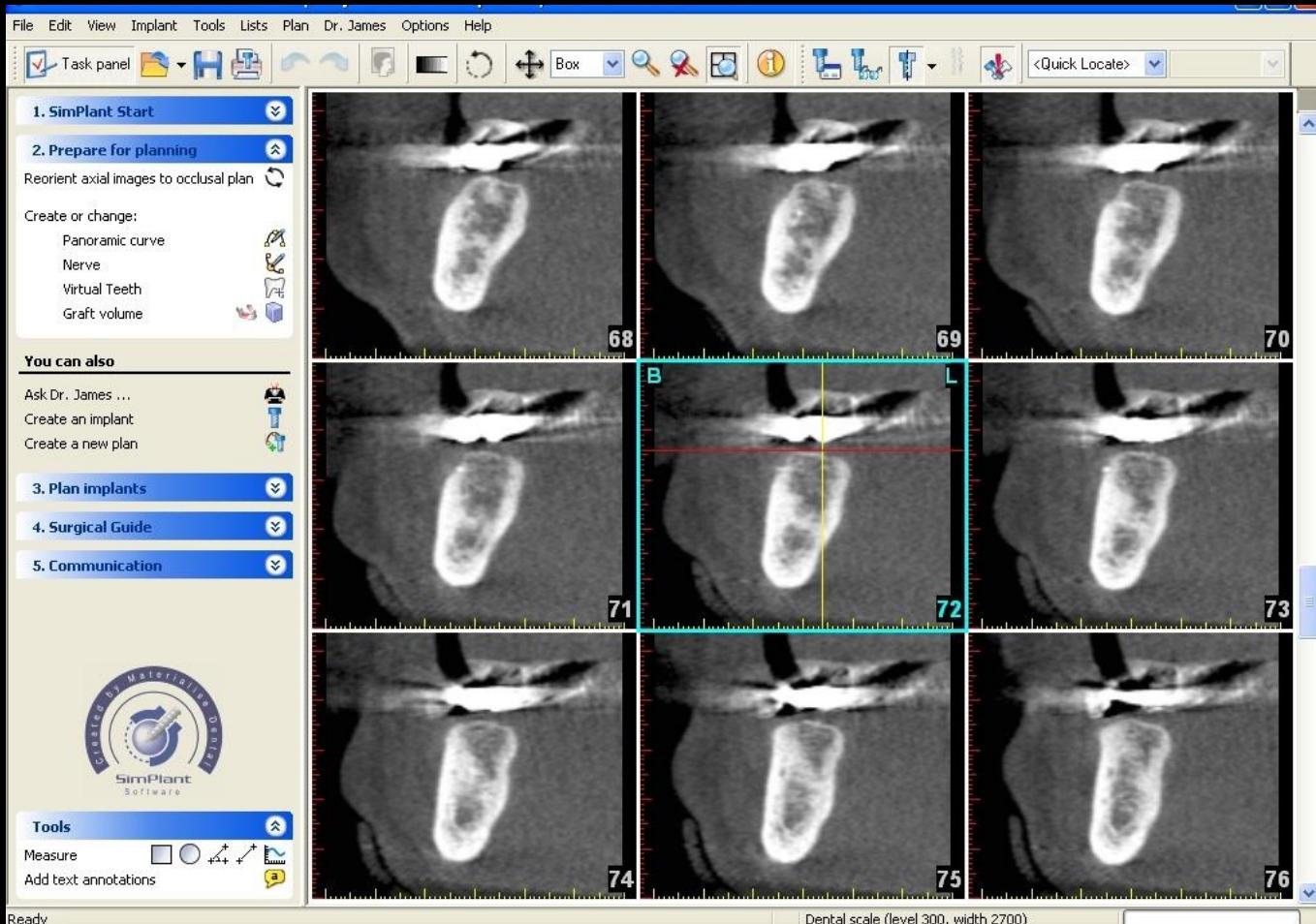


Avoiding problems/ treatment planning

Adequate bone AND soft tissue to support
the final restoration

- ▶ Develop the site for predictability
- ▶ Consider implant planning software





Case Discussion





Courtesy Dr. Vincent Iacono





