In the era of implants, when do we save teeth?

Flavia Pirih, DDS, PhD
Associate Professor
Pre-doctoral Program Director in Periodontics

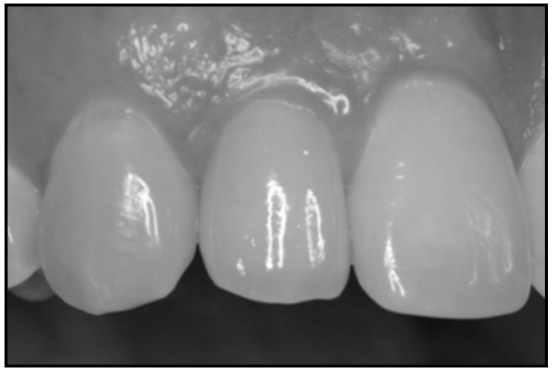
Outline

- Introduction
- Implants
- Challenges
  - Biological complications
  - Peri-implant mucositits
  - Peri-implantitis
- Alternatives to implant placement
  - Periodontal treatment
  - Endodontic treatment
  - Fixed partial denture
  - Crown lengthening
- Conclusion

Dental Implants

- 500,000 dental implants placed in the United States per year every year
- Cost of approximately $2 billion
- Five million dental implants are placed in the United States every year
- $3.7 billion dollar industry
- Prevalence of dental implants:
  - 1999-2000: 0.7%
  - 2015-16: 5.7%
  - 2026: estimated to be up to 23%
- Result in significant enhancements in function, esthetics, phonetics

(Elani et al, J Dent Res, 2019)



Implanting hope

Winner of the European Inventor Award 2011 in the category Lifetime achievement

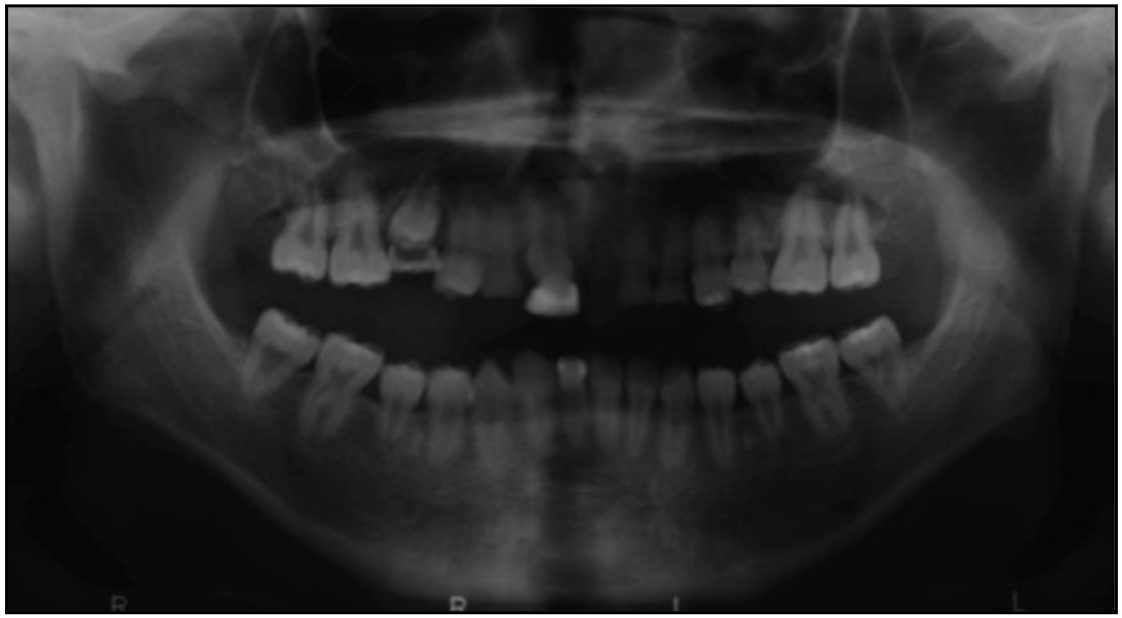
The human body naturally rejects foreign objects, even restorative inserts such as implants and prostheses. When Swedish orthopaedic surgeon Per-Ingvar Brånemark discovered an exception to this rule, he virtually revolutionised the field of implant technology.

Inventor: Per-Ingvar Brånemark, Sweden

Invention: Titanium fixture and anchoring device for implants

Sector: Dentistry

Barbro Brånemark accepted the award on behalf of her husband, who was unable to attend the ceremony



(Pirih et al, 2019)

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Dental Procedures

- There has been a:
- ↓in the number of restorative procedures (direct and indirect restorations)
- ↓in the number of prosthetic treatments
- ↓in the number of endodontic treatments
- ↓in the number of extractions (slight)
- ↑in the number of implant placements

(Eklund et al, J Am Dent Assoc, 2010 and Millenium Res, 2009, Marcus et al, J Dent Res, 1996)

Trend in Clinical Practice

- Reduced emphasis in saving compromised teeth
- Not unusual to recommend tooth extraction with modest tooth-associated ailments such as:
  - Caries
  - Need for endodontic therapy or
  - Periodontally involved teeth

(Lang-Hua et al, Clin Oral Impl Res 2014)

In many instances, patients are being advised to get rid of the compromised tooth to get the “newer, better” implant

Given the long-term track record of successful therapies for tooth preservation, it has been recently advocated to retain more teeth

(Giannobile and Lang, J Dent Res, 2016,
Lindhe and Pacey, J Br. Dent J, 2014)

“Individuals with more training in periodontology and implant dentistry more frequently promote tooth retention”

(Lang-Hua et al, Clin Oral Impl Res 2014)

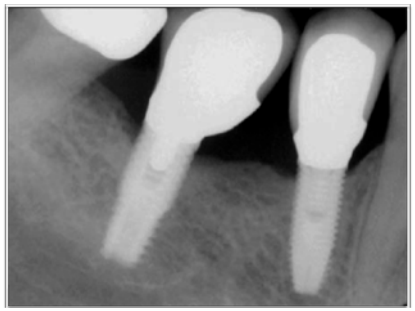
How often are implant complications observed?

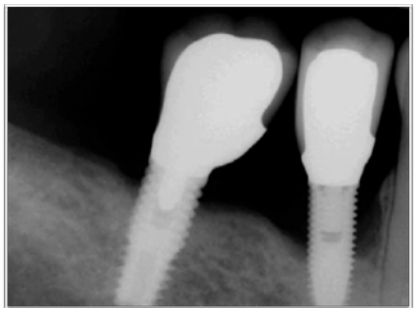
48% implants will have complications after 10-16 years

(Berglundh et al, J Clin Periodontol, 2002)

Problems

- Improper treatment planning
- Surgical and prosthetic execution
- Technical complications:
  - Related to implant components, connections (screw loosening/fracture)
  - Suprastructure fracture or deformation
- Biological complications:
  - Peri-implant mucositis
  - Peri-implantitis





Classification of Periodontal and Peri-Implant Diseases and Conditions

Proceedings of the World Workshop Jointly Held by the American Academy of Periodontology and European Federation of Periodontology

Co-edited by Kenneth S. Kornman and Maurizio S. Tonetti

JOURNAL OF Periodontology

Official Journal of the American Academy of Periodontology Since 1930

perio.org

Journal of Clinical Periodontology

EFP European Federation of Periodontology

Official scientific Journal of the European Federation of Periodontology and its member National Societies

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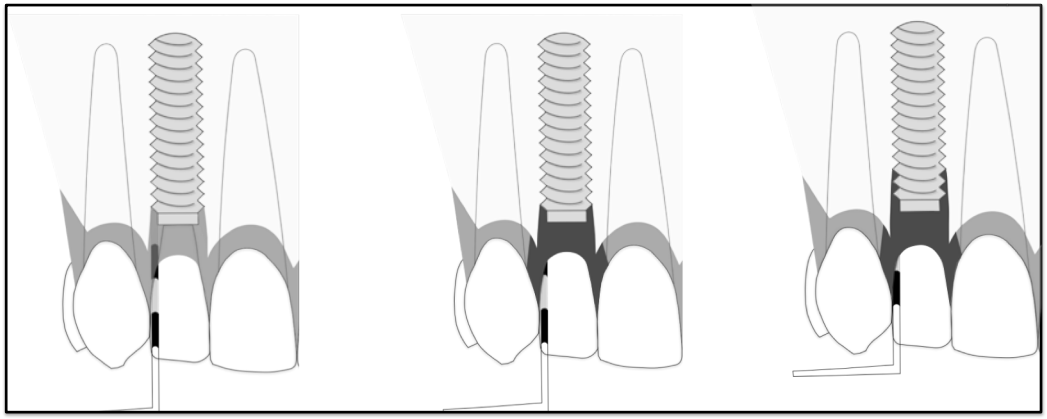
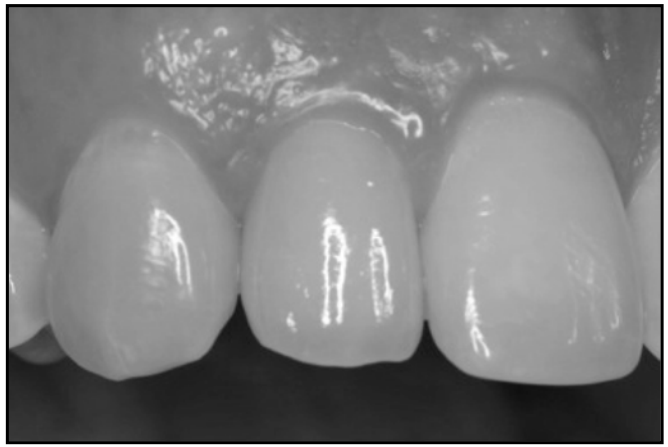
Released June 20th, 2018

Peri-implant health Peri-implant mucositis Peri-implantitis



Peri-Implant Health

- Absence of soft tissue inflammation
  - Redness
  - Swelling
  - Profuse bleeding on probing
- Probing depth should be ≤ 5mm (in general)



Peri-Implant Health

- Absence of soft tissue inflammation
  - Redness
  - Swelling
  - Profuse bleeding on probing
- Probing depth should be ≤ 5mm (in general)
- Absence of additional bone loss following initial healing
  - Implant health can exist with different levels of bone support

Prevalence

Table 3. Prevalence of Peri-implant Health and Diseases at the 9-y Examination: Subjects/Implants with Baseline Radiographs.

	Patient Level (n = 427)		Implant Level (n = 1,578)	
	% (n)	PPD ≥6 mm, %	% (n)	PPD ≥6 mm, %
Healthy[a]	23.0 (98)	9.4	39.3 (620)	3.3
Peri-implant mucositis[b]	32.0 (137)	26.3	35.1 (554)	16.3
Peri-implantitis: bone loss, mm[c]				
>0.5	45.0 (192)	43.2	24.9 (393)	34.4
>1	26.9 (115)	53.0	14.7 (232)	42.4
>2	14.5 (62)	71.0	8.0 (126)	58.7
>3	10.1 (43)	81.4	4.3 (68)	69.1
>4	5.9 (25)	92.0	2.3 (36)	80.6
Not accessible for probing	0 (0)		0.7 (11)	

(Derks et al, J Dent Res, 2016)

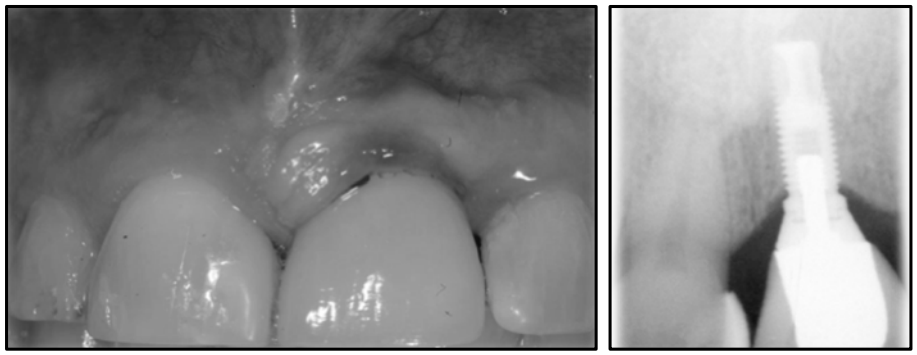
Peri-Implant Mucositis: Clinical Findings

- Presence of soft tissue inflammation
  - Redness
  - Swelling
  - Shininess
  - Bleeding
    - Line or drop bleeding within 30 seconds of probing
  - Suppuration
    - During application of light pressure to the tissues or following probing
  - PD ≤5mm
  - Soreness is a common complaint

(Classification of Peri-Implant Conditions, AAP, EFP, Renvert et al, 2018)

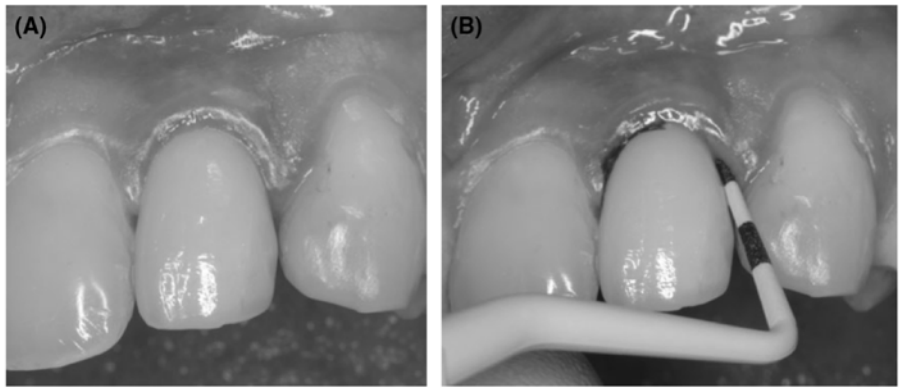
Peri-Implant Mucositis: Radiographic Findings

- No evidence of radiographic bone loss
  - –Apart from bone remodeling
    - No more than 2mm
  - –Baseline radiograph for comparison
    - If the initial radiograph is not available, then a radiograph with less than 2mm BL is not considered PI



(Classification of Peri-Implant Conditions, AAP, EAP, Renvert et al, 2018)

Peri-Implant Mucositis



(Renvert et al, Periodontology 2000, 2015)

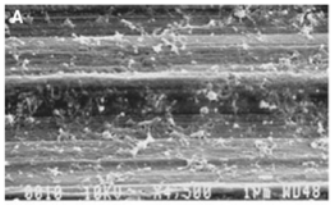
- Presence of soft tissue inflammation
  - –Redness
  - –Swelling
  - –Shininess
  - –Bleeding
    - Line or drop bleeding within 30 seconds of probing
  - –Increase in PD

(Classification of Peri-Implant Conditions, AAP, EAP, Renvert et al, 2018)

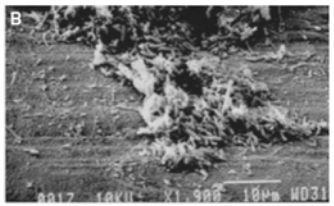
Peri-Implant Mucositis: Etiology

Bacterial biofilm around the implant

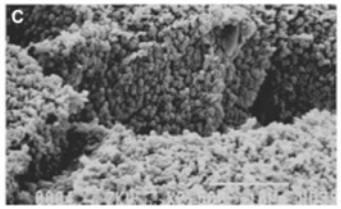
2 hours



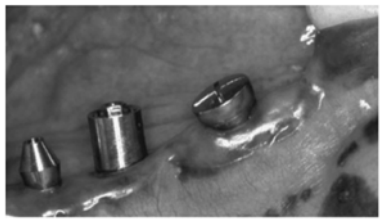
1 week



2 weeks



5 months



Shortly after the implant is placed:

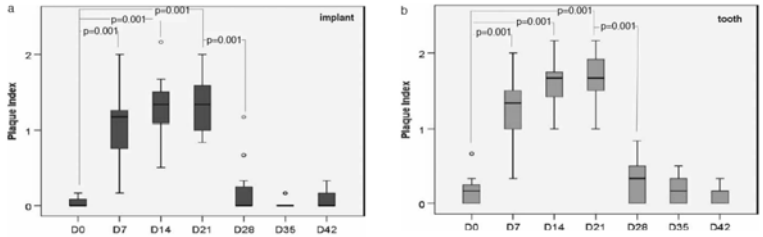
- Glycoproteins adhere to the exposed titanium surfaces
- Formation of the biofilm

(Dr. S. Abati in Dental Implant Complications and Leonhardt et al, 1992, Heitz-Mayfield and Salvi, 2018)

Peri-Implant Mucositis: Development and Resolution

- 15 subjects
- Prophylaxis ➔3 weeks without OH ➔Prophylaxis and OHI (3 weeks)
- Evaluated:
  - Plaque index
  - Gingival index
  - Microbial samples
  - MMP-8

Plaque Index



Implant Tooth

Bacterial Counts

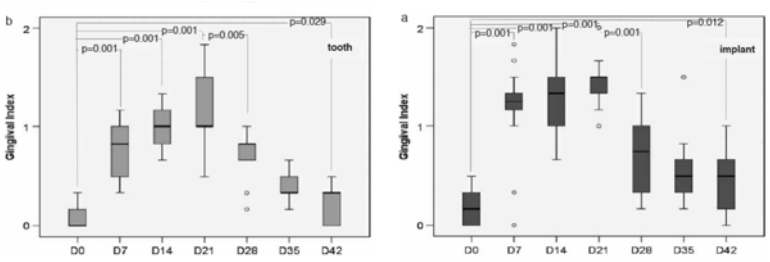
Table 3. Number subjects with $\geq 10^5$ bacteria of the red complex (e.g. *Porphyromonas gingivalis, Tannerella forsythia* and *Treponema denticola*) during 21 days of experimental gingivitis/mucositis and 21 days of reinstituted oral hygiene practices

	D0 ($n = 15$)	D7 ($n = 15$)	D14 ($n = 15$)	D21 ($n = 15$)	D28 ($n = 14$)	D35 ($n = 15$)	D42 ($n = 15$)
Implant							
P. gingivalis	0	1	0	0	0	0	1
T. forsythia	5	5	5	5	5	7	5
T. denticola	3	7	6	5	6	7	4
Tooth							
P. gingivalis	0	0	0	1	0	0	0
T. forsythia	3	6	4	6	6	4	5
T. denticola	3	6	4	4	6	5	5

(Salvi et al, 2012)

Peri-Implant Mucositis: Development and Resolution

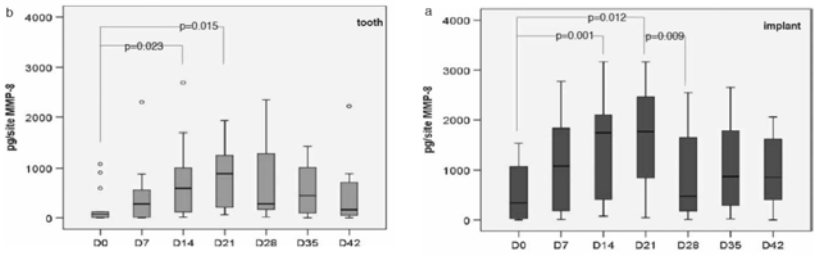
Gingival Index



Tooth Implant

MMP-8

Collagenase, degrades matrix marker for neutrophils



Tooth Implant

Soft tissues around implants develop a stronger response to plaque accumulation

Peri-implant mucositis is reversible

(Salvi et al, 2012)

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(Derks et al, J Dent Res, 2016)

Peri-Implant Mucositis: Treatment

- Mechanical debridement
- Evaluation of the prosthetic suprasctructure
- Oral hygiene instructions

(Jepsen et at, 2015; Tawse-Smith et al, 2002; Scilia et al, 2002; Porras et al, 1994; Shcenck G et al 1997; Felo et al, 1997 and review by Renvert and Polyzois, 2015)

Peri-Implant Mucositis: Professional Treatment

- Mechanical debridement: lead to a reduction in inflammation
  - Hand, powered and/or polishing tools
  - Additional use of:
    - Local and systemic antibiotics had no advantage
    - Professional irrigation (chlorhexidine) had no advantage

(Jepsen et at, 2015; Tawse-Smith et al, 2002; Scilia et al, 2002; Porras et al, 1994; Shcenck G et al 1997; Felo et al, 1997 and review by Renvert and Polyzois, 2015)

Is resolution of peri-implant mucositis possible?

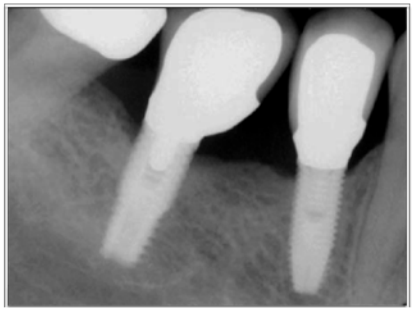
Peri-implant mucositis can be significantly reversed by professionally administered plaque removal and oral hygiene

Resolution of BOP is not achieved in all patients

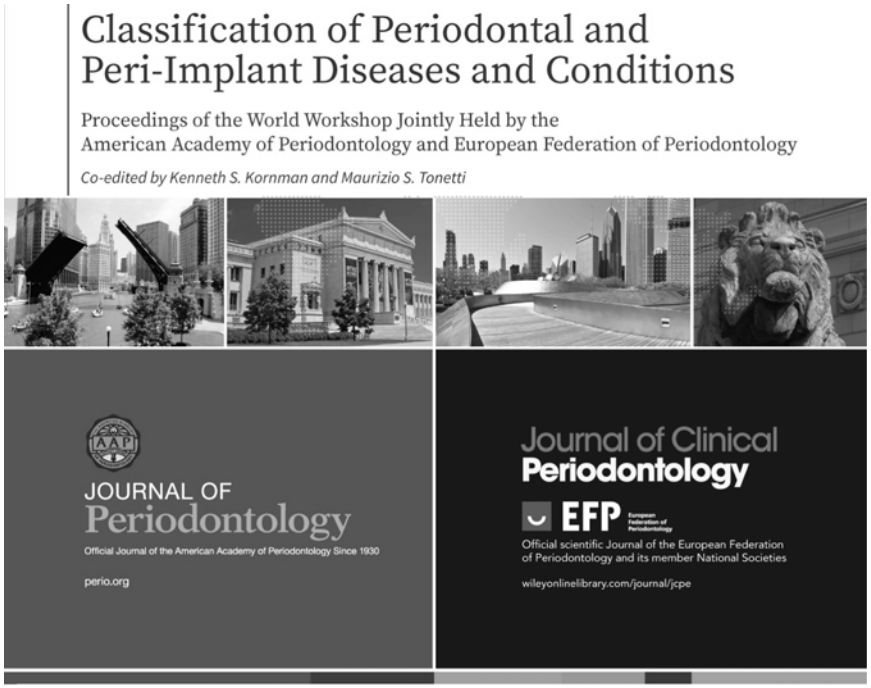
(Jepsen et al, 2015, Salvi et al, 2012)

Peri-implant Mucositis

- Is a precursor to peri-implantitis
- Over the course of 5 years, the risk of peri-implantitis:
  - With maintenance: 18%
  - Without maintenance: 43.9%



(*This study excluded all smokers, Costa et al, 2012)



- Peri-Implant Health
- Peri-Implant Mucositis
- **Peri-Implantitis**

Released June 20th, 2018

Peri-Implantitis: Definition: Clinical Findings

- Presence of soft tissue inflammation
  - Redness
  - Swelling
  - Shininess
  - Bleeding and/or suppuration
    - Line or drop bleeding
  - Increase in PD overtime
- Soreness

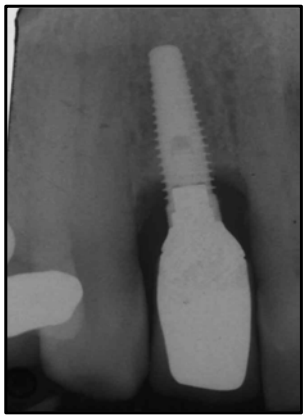
Bleeding on probing

Suppuration

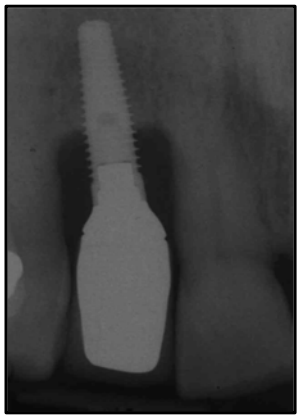
(Classification of Peri-Implant Conditions, AAP, EFP Renvert et al, 2018)

Peri-Implantitis: Radiographic Finding

- Radiographic bone loss (needs to be evident)
  - Apart from initial bone remodeling



1 year post rest

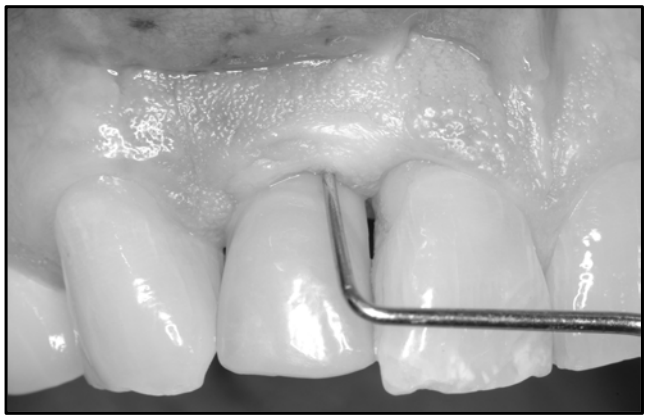


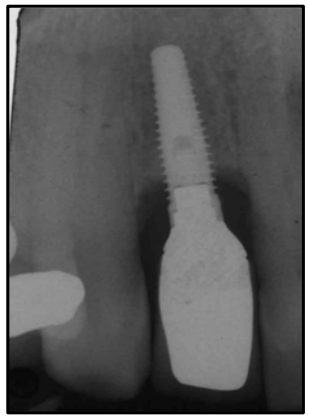
2 years post-rest

(Classification of Peri-Implant Conditions, AAP, EFP, Renvert et al, 2018)

Peri-Implantitis

- Clinical signs of inflammation
- PD ≥ 6mm
- Bone loss after initial remodeling





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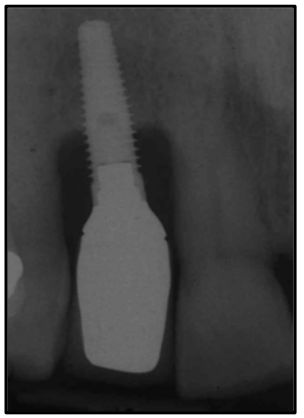
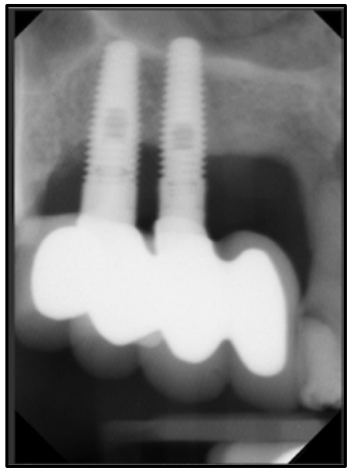


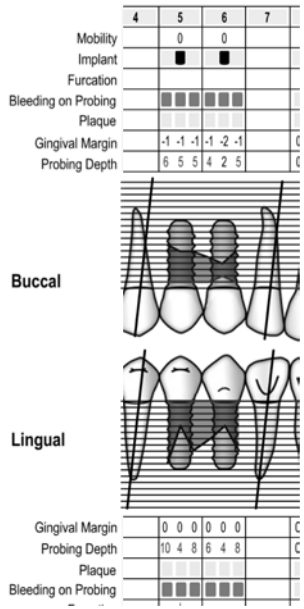
2 years post-rest

(Classification of Peri-Implant Conditions, AAP, EFP, Renvert et al, 2018)

What if you don’t have a previous radiograph?

- Clinical signs of inflammation
- PD ≥ 6mm
- Bone loss of ≥ 3mm is considered PI





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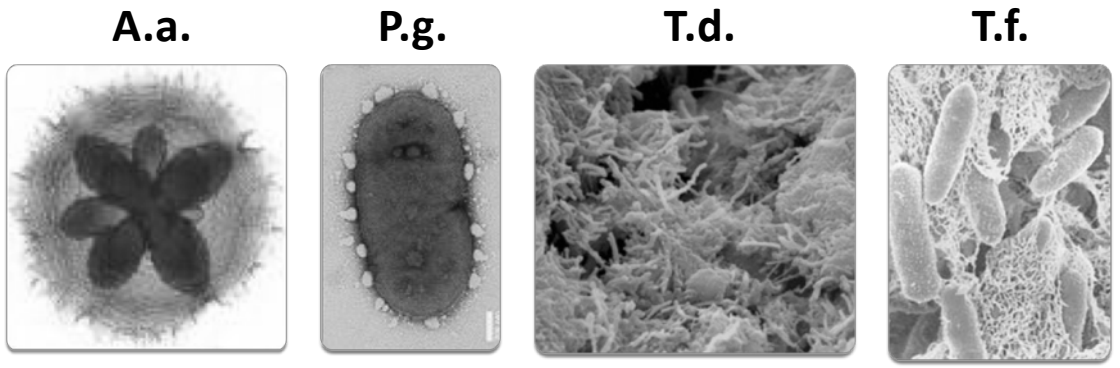
Not accessible for probing	0 (0)		0.7 (11)	

Moderate/severe peri-implantitis

(Derks et al, J Dent Res, 2016)

Peri-implantitis: Etiology

- Bacterial insult and subsequent host response
- Bacterial species are similar to those found in periodontitis
- Gram negative
- Linked with opportunistic pathogens:
  - S. aureus
  - P. aeruginosa

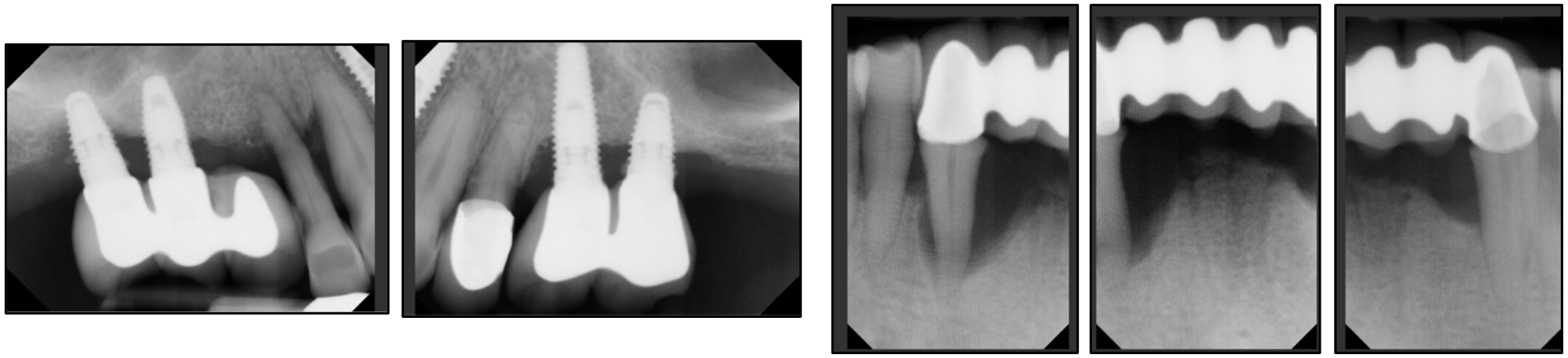


(Quirynen et al, 2006, Furst et al, 2007, Salvi et al 2008)

Peri-Implantitis: Potential Risk Factors

- Chronic periodontitis
- Poor plaque control
- Lack of periodontal maintenance
- Cement
- Smoking
- Diabetes
- Titanium
- Occlusal load

Peri-Implantitis: Risk Factors/Chronic Periodontitis



Peri-Implantitis: Risk Factors/Chronic Periodontitis

Author	Number of Subjects	Follow-up Time (Years)	Odds Ratio of Ds of Development
Derks et al, 2016	588	9	4.1
Roos-Jasanker et al, 2006	216	9-14	5
Kodsland OC et al, 2010, 11	109	1-16 (mean 8.6)	6
Daubert et al, 2015	192	9-15 (mean 10.9)	7.3

Strong evidence that chronic periodontitis is a risk factor for peri-implantitis development

(Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Peri-Implantitis: Risk Factor/Poor Plaque Control

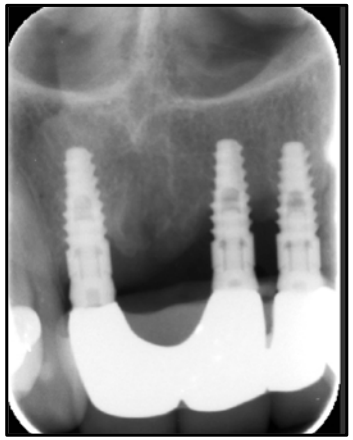
- 4 studies showed that poor plaque control was the strongest statistical predictor for PI
- Factor to consider:
  - Reduced keratinized mucosa had higher plaque scores (<2mm)

(Schwarz et al, 2017; Ferreira et al, 2006; Rokn et al, 2017, Aguirre-Zorzano et al, 2015, Souza et al, 2016)

Peri-Implantitis: Risk Factor/Poor Plaque Control

- Access to OH
  - –Cleansable sites: 18% PI
  - –Non-cleansable sites: 65% PI

(Serino and Strom, 2009)



Peri-Implantitis: Risk Factor/Poor Plaque Control

Author	Number of Subjects	Follow-up Time (Years)	Odds Ratio of Ds of Development
Ferreira et al, 2006	212	0.5-5 (mean 3.5)	3.8
Rokn et al, 2017	134	1-11 (mean 4.4)	5.4
Aguirre et al, 2015	239	9-15 (mean 10.9)	5.4
Schwarz et al, 2017	238	1 month-6 yrs (mean 2.2)	9.3

Strong evidence that poor plaque control is a risk factor for peri-implantitis development

(Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Peri-Implantitis: Risk Factor/Maintenance Therapy

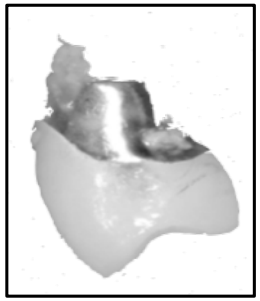
- Costa et al, 2012 (5 yr-study):
  - With maintenance therapy risk of PI: 18%
  - Without maintenance therapy risk of PI: : 44%
- Rozucco et al, 2010, 2012 (10 yr study)
  - With maintenance therapy risk of PI: 27%
  - Without maintenance therapy risk of PI: 41%

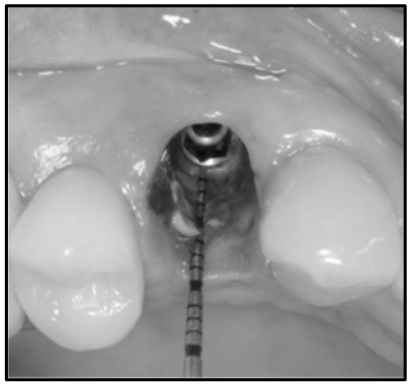
Strong evidence that lack of maintenance therapy is a risk factor for peri-implantitis development (Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Peri-Implantitis: Risk Factor/Cement

- There is a correlation between excess cement and the prevalence of peri-implant diseases
- Proportion of diseased implants varied from 9-81%
  - differences in case definition

*Several implants with excess cement had no signs of disease





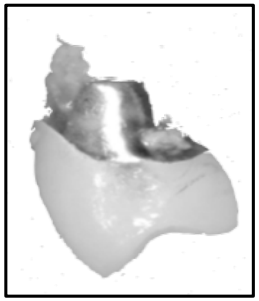
(korsch et al, 2017 a, b; Wilson et al, 2009, Linkevicius et al, 2013, images from Dr. Maria Galvan)

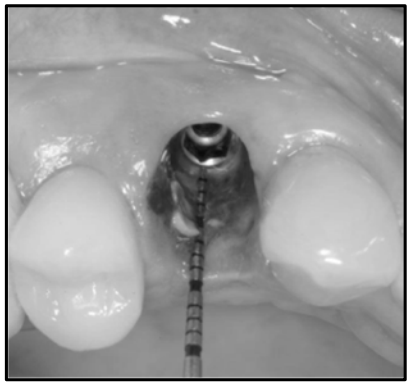
Excess cement has been suggested as a risk factor for peri-implantitis development

(Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Peri-Implantitis: Risk Factor/Cement

- Suprastructure design may hamper the ability to access the subgingival space
- Implant surface topography may provide a positive environment for bacterial attachment





Peri-Implantitis: Risk Factor/Smoking

- Smokers have more crestal bone loss compared to non-smokers
- 18% of all implants develop PI in smokers, while only 6% non-smokers
- Cross-sectional studies:
  - Odds ratio: 3 (Jepsen et al, 2015)
  - Odds ratio: 5 (Roos-Jansaker et al 2006)
  - Odds ratio: 32 (Rinke et al, 1996)

(Lindquist et al, 1996; Karoussis et al, 2003 ; Jepsen t al, 2015; Roos-Jansaker et al, 2006; Rinke et al, 1996))

Peri-Implantitis: Risk Factor/Smoking

- Majority of the studies fail to identify smoking as a risk factor
  - –Smoking may be confounded by hx of periodontitis
  - –Categorization of smokers and non-smokers
  - –Patient self-reported information

(Koldsland et al, 2011; Casado et al, 2013; Dalago et al, 2017; Daubert et al, 2015; Marrone et al, 2013)

Data identifying smoking as a risk factor for peri-implantitis are inconclusive

(Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Peri-Implantitis: Risk Factor/Diabetes

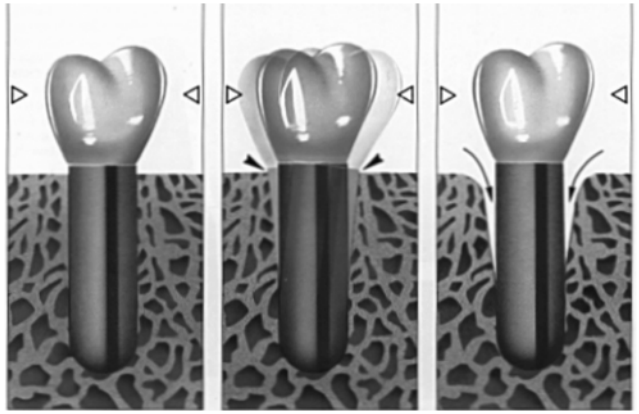
- Conflicting data
- Ferreira et al, OR is 1.9
- Tawil et al, 2008
  - 1-12 years, assessed HbA1c regularly
  - HbA1c level ≥7 %: 4.3% of the implants had PI
  - HbA1c levels was ≥9%: 9.1% of the implants had peri-implantitis
- Many cross-sectional studies failed to demonstrate a relationship
  - Most studies did not evaluate HbA1c levels (self-reported)

Data identifying diabetes as a risk factor for peri-implantitis are inconclusive

(Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Peri-Implantitis: Risk Factor/Occlusal Load

- Occlusal and lateral overload did not lead to peri-implantitis
  - –Animal studies

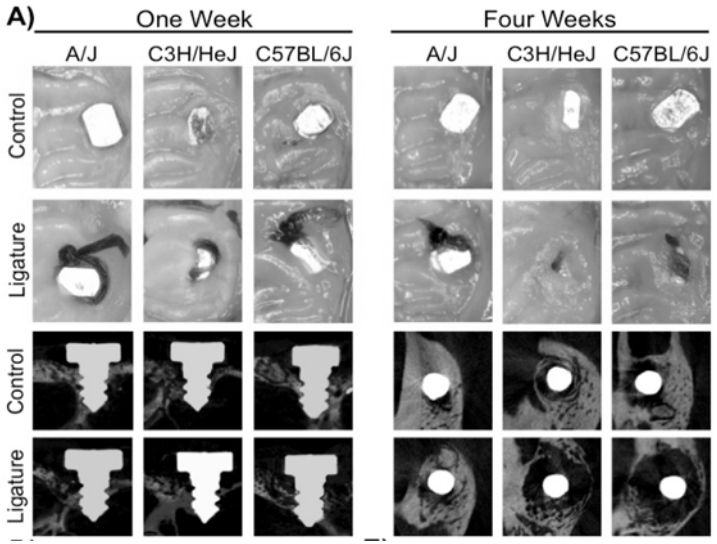


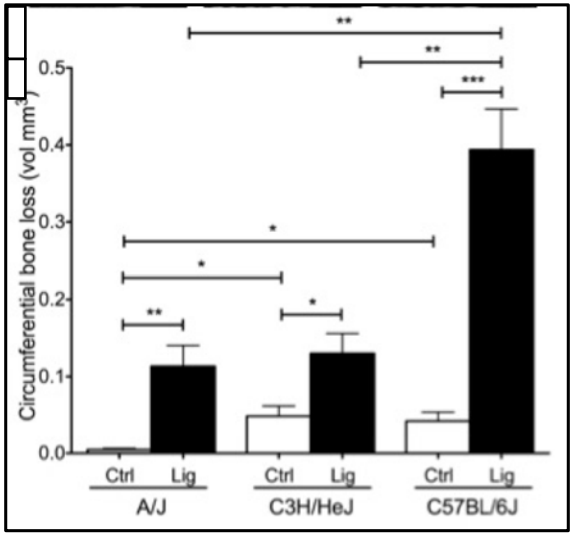
(Gotsfred et al, 2002; Heitz-Mayfield et al, 2004 and Kozlovsky et al, 2007, Canulo et a2016)

Currently there is no evidence that occlusal overload is a risk factor for peri-implantitis

(Classification of Peri-Implant Conditions, AAP, EFP, Schwarz et al, 2018)

Genetics???

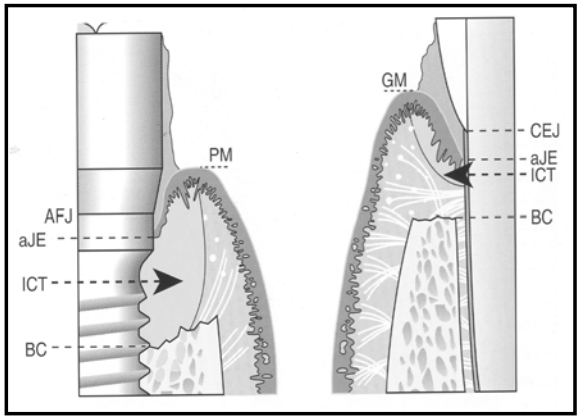




Suggests the role of genetics in peri-implantitis development

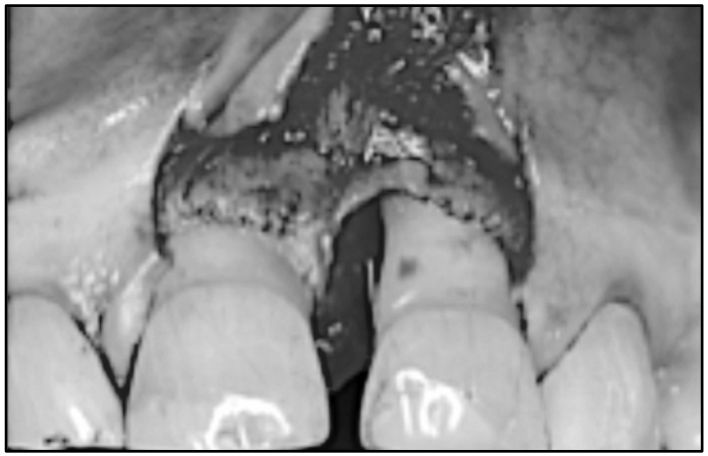
(Hiyari et al, 2018)

Comparison Between:
Peri-implantitis and Periodontitis



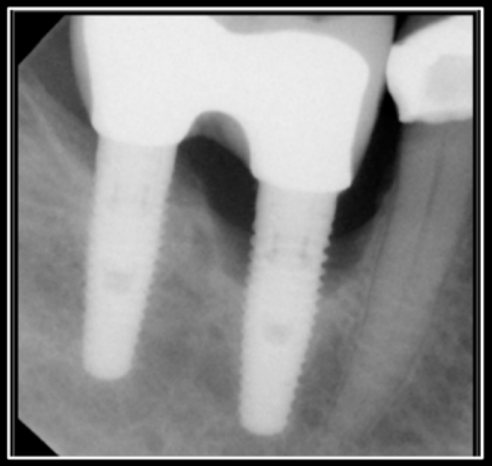
Peri-implantitis vs. Periodontitis: Clinically

Usually 360° around fixture



Most commonly surface specific

Peri-implantitis vs. Periodontitis: Radiographically

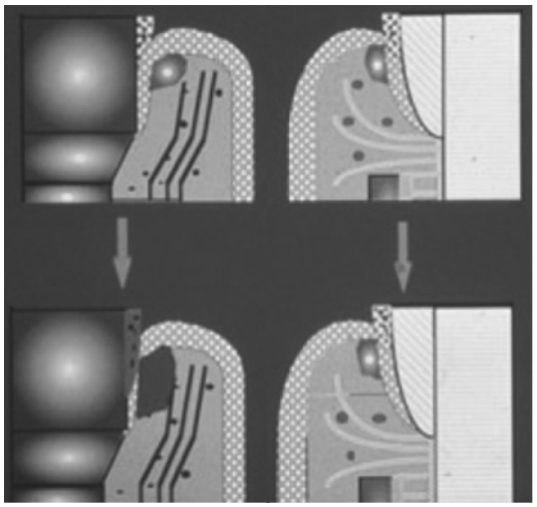


Implant: saucer shaped lesion

Peri-implantitis vs. Periodontitis: Host Response

3 weeks

3 months

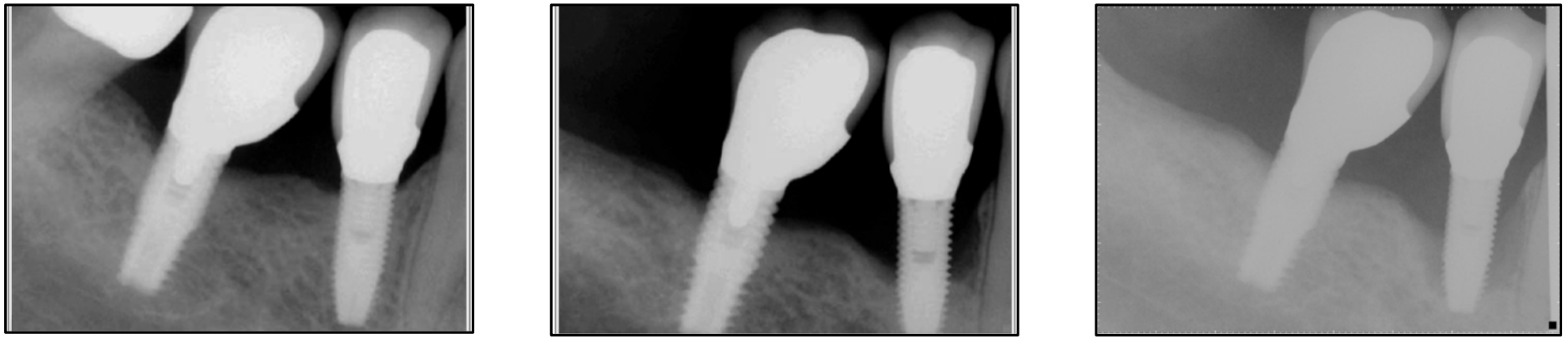


The inflammatory infiltrate around the implant is almost 3-fold greater than around the tooth**

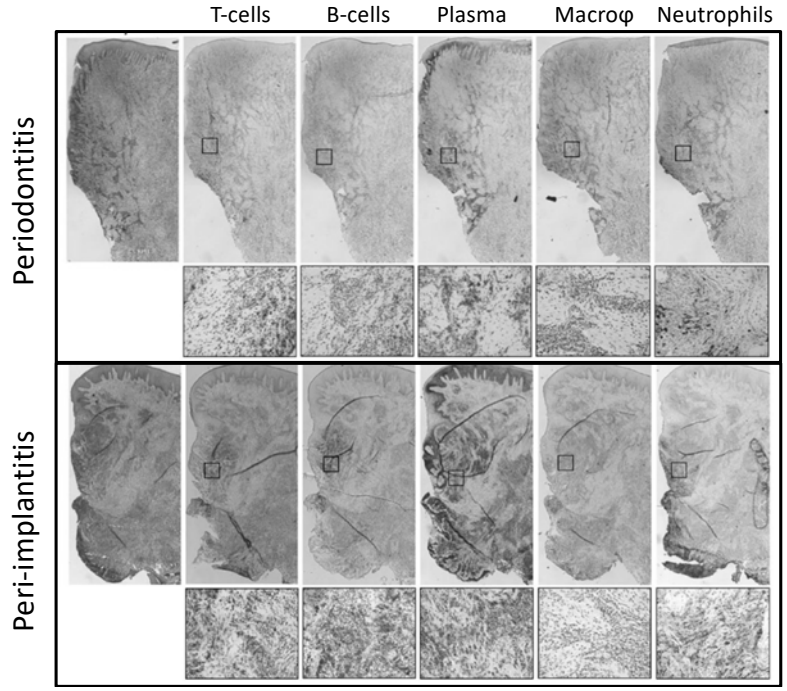
** beagle dogs

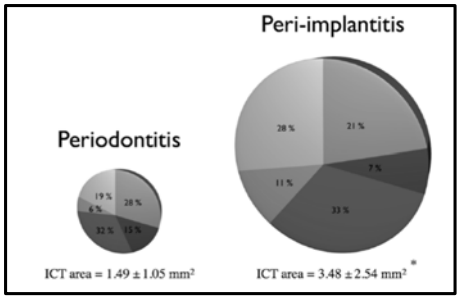
(Berglundh et al, Clin Oral Impl Res, 1992;
Ericsson et al, Clin Oral Impl Res, 1992)

Peri-implantitis: Disease Progression



Radiograph taken 6 months apart





Size of the circle
represents area of the infiltrate

Blue=T-cells, Purple=B-cells
Red= plasma cells, Brown=macrophages
Green=leukocytes

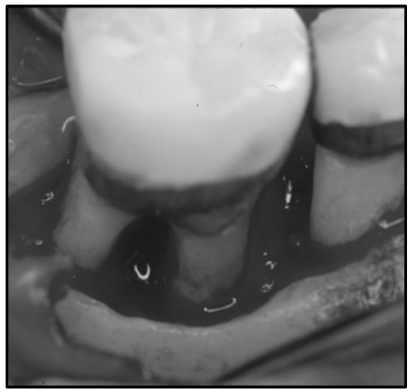
*40 human biopsy samples from 40 patients with periodontitis and
40 human biopsy samples from 40 patients with peri-implantitis

This study suggests that there are histopathological differences between periodontitis and peri-implantitis

(Carcuac and Berglundh, J Dent Res, 2014)

Periodontitis and Peri-implantitis Treatment

- Peri-implantitis:
  - Not predictably arrestable and treatable
- Periodontitis:
  - Arrestable/treatable



Treatment Options

Non-surgical therapy

** limited evidence of effectiveness compared to surgical

- Debridement
  - With or without surface decontamination
    - locally delivered antibiotics, laser
  - With or without antibiotics

Surgical therapy

*more effective that non-surgical

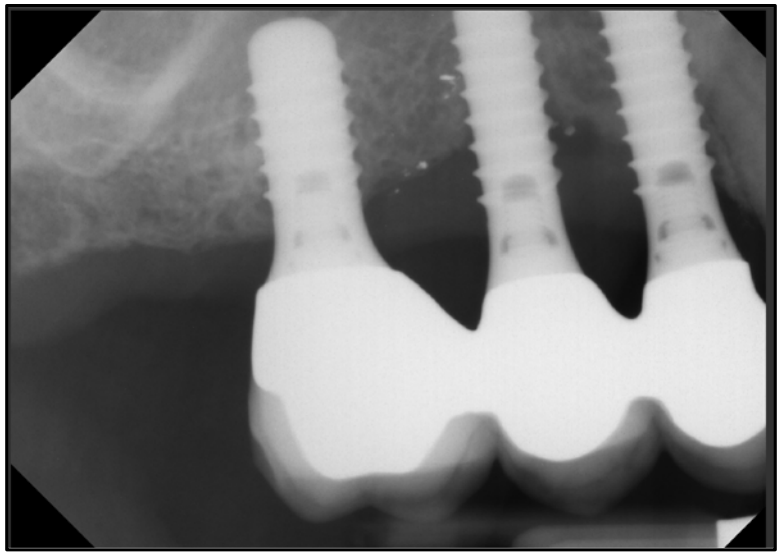
- Open flap debridement
- Ressective Surgery
- Regenerative procedures (bone graft +- membrane)
  - * Does not address disease resolution

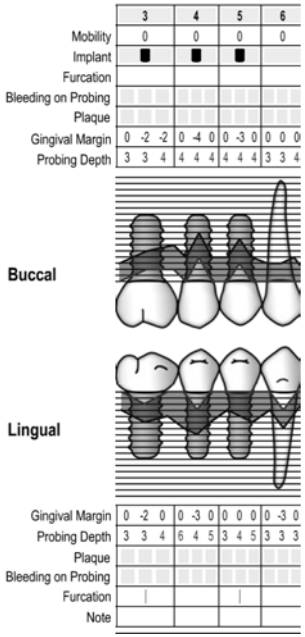
- Implant removal
  - Implant replacement (whenever possible)

(Lindhe et al, 2008)

Peri-Implantitis: Resective or Regenerative Treatment

- Choice of surgical treatment is highly empirical, mostly based on:
  - Defect morphology
  - Location of the peri-implantitis
    - Esthetic or non-esthetic area

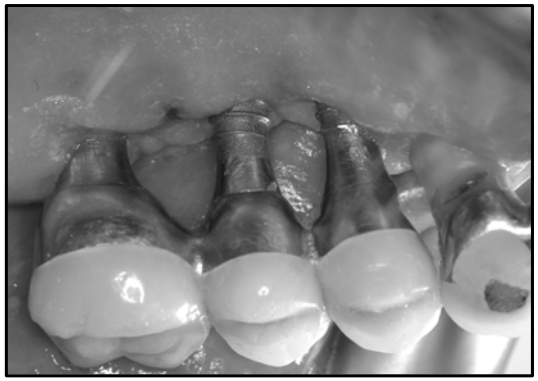


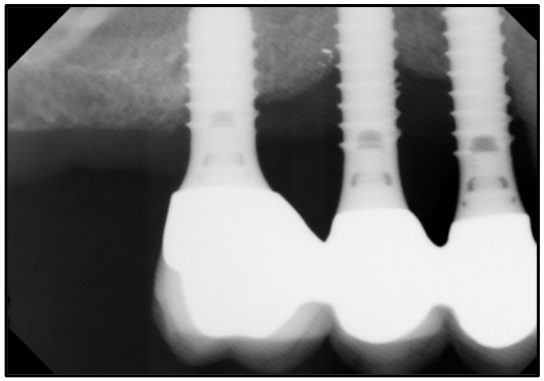


Resective Treatment

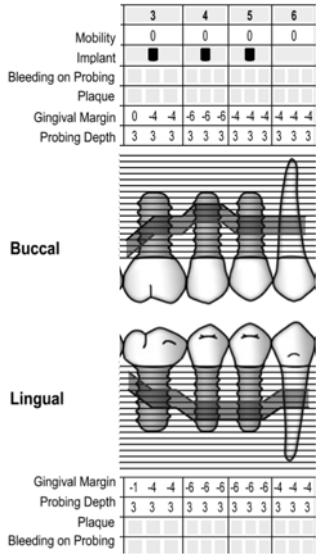
(Dr. Paulo M. Camargo)

Peri-Implantitis: Resective Treatment





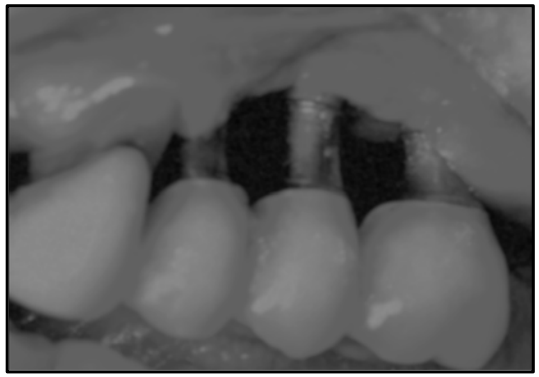
1 and ½ years after the resective surgery



(Dr. Paulo M. Camargo)

Peri-Implantitis: Resective Treatment

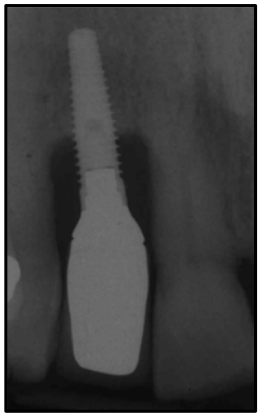
- Resective surgery:
  - 58% periodontitis resolution
    - Despite treatment, progression continued in 4 implants
    - 7/26 implants were lost in 5 years
    - 4/26 continued to lose bone despite treatment
- Resective and removal of threads:
  - 50% of the implants had no signs of disease



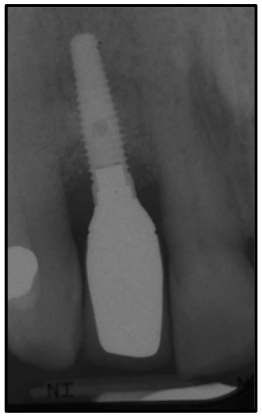
(Leonhart et al, 2003; Schwarz et al, 2010)

Peri-implantitis Treatment: Regeneration

- Main goal is access to decontaminate the implant
  - The regenerative procedure does not address disease resolution
- Appears to be defect dependent
- Bone graft/substitute with/without membrane
- Can lead to some bone fill
- Warn the patient about the possibility of recession



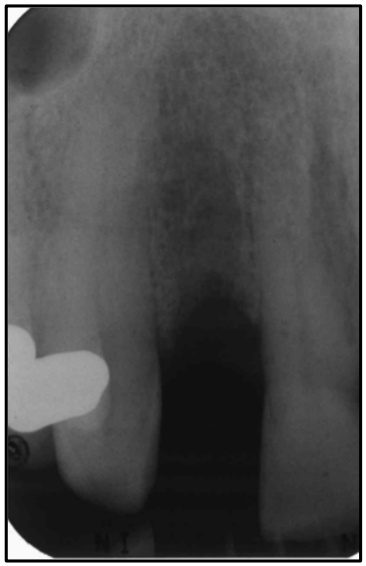
Prior to sx



6 mos. after sx

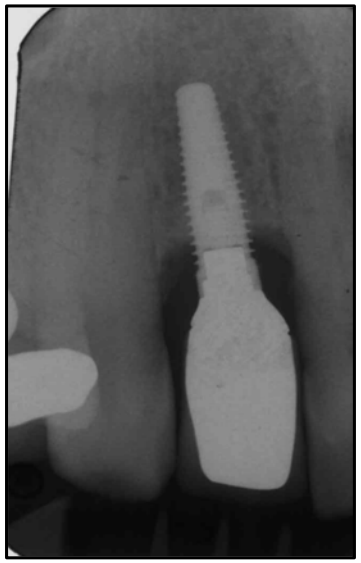
(Renvert and Polyzois, 2015)

Baseline: Root Fracture



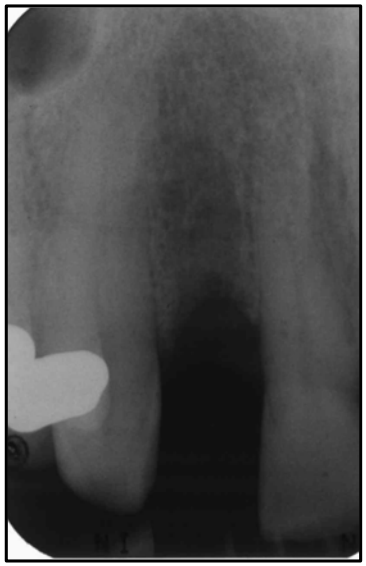
6 months post-extraction

4 months post-insertion

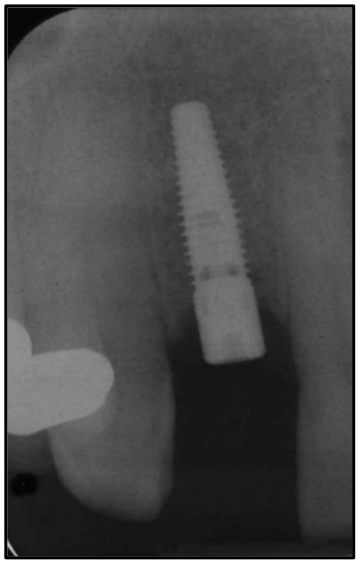


1 year post-restoration

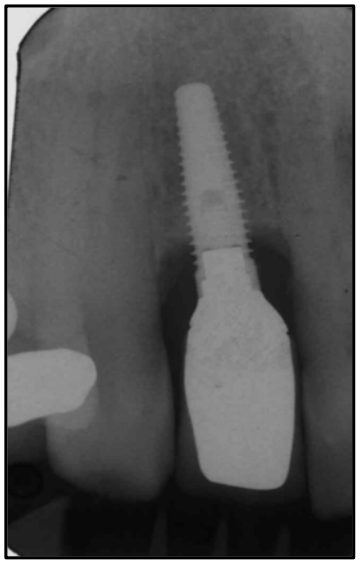
Baseline: Root Fracture



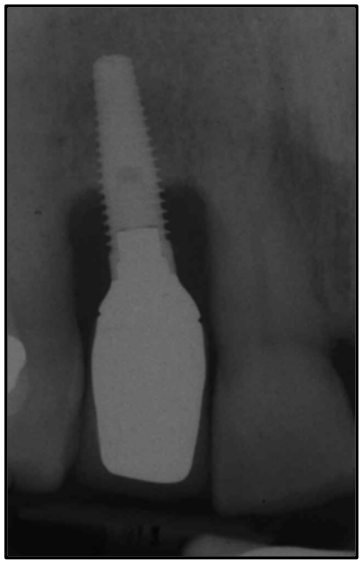
6 months post-extraction



4 months post-insertion

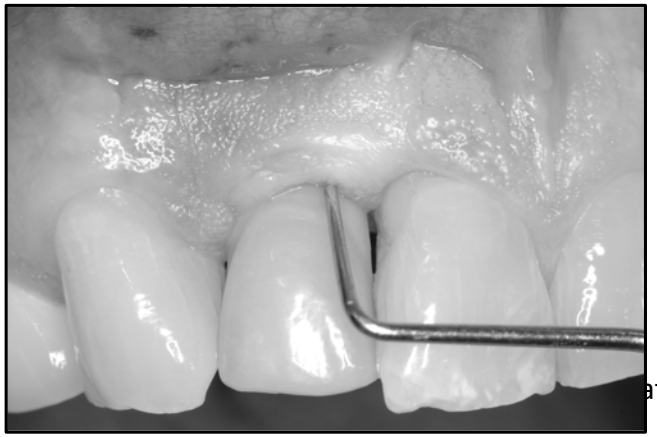


1 year post-restoration



2 years post-restoration

2 years later



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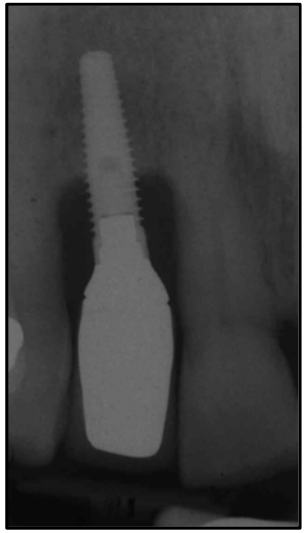
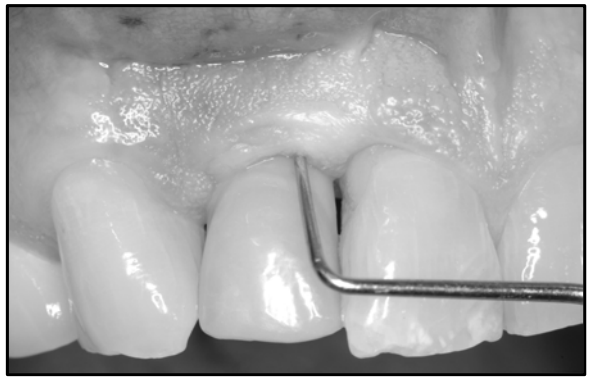
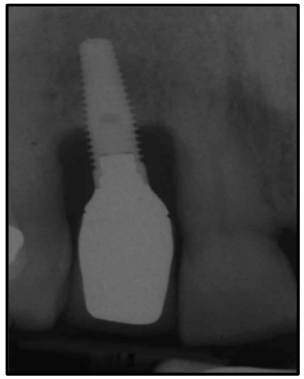


Possible Explanations

- Patient is asymptomatic
- Excess cement
- Implant fixture
- Loose abutment screw
- Peri-implantitis





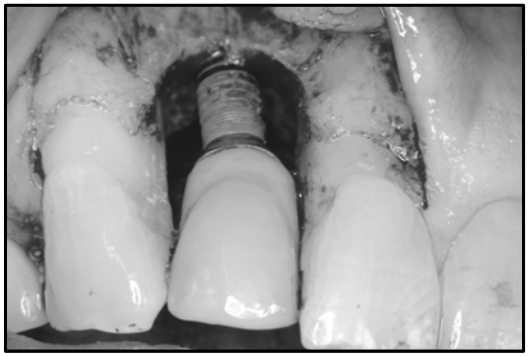
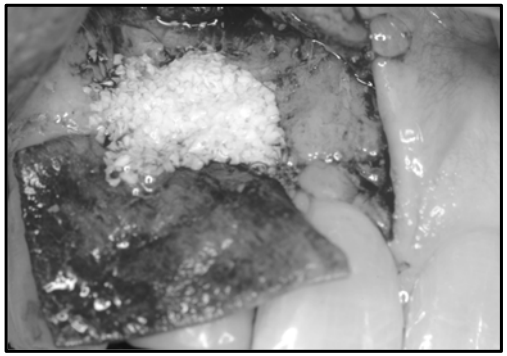
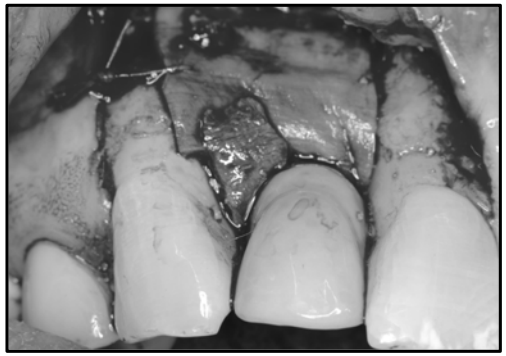
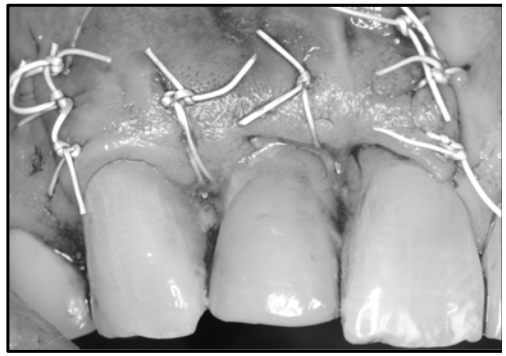
Considerations

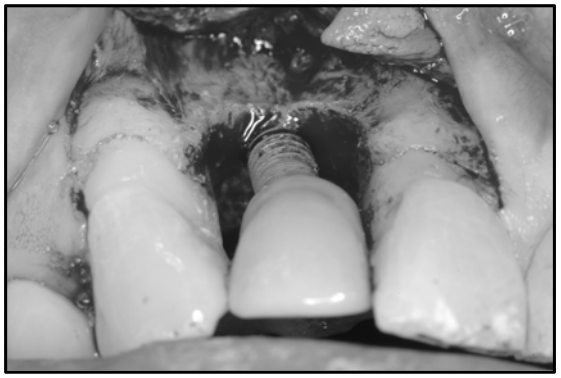
If treating existing implant

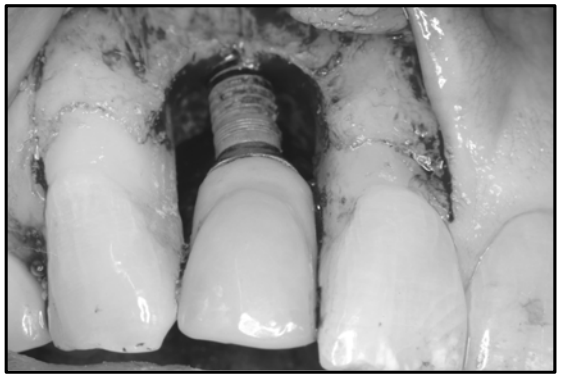
- Remove vs. maintain restoration
- Choice of bone graft, barrier, biological agent
- Healing period
- Parameters to determine success
- Exposed fixture and re-integration
- What to do differently to prevent recurrence
  - Maintenance
  - Restoration design

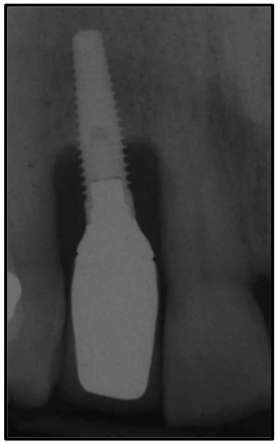
If not treating existing implant

- FPD
- Replace with another implant
  - Rebuild alveolar ridge
  - Given that adequate bone rebuilding is successful
    - Implant fixture to be used
    - Restoration design

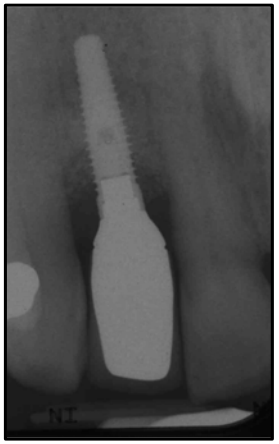











Prior to sx



6 mos. after sx

Peri-Implantitis: Disease Progression

	Baseline (N = 26)	1 Year (N = 25)	5 Years (N = 19)
Percent sites with plaque	100	8	11
Percent sites with gingival bleeding	100	36	5
Bone loss ≥1 thread	0*	12	4
No change		12	9
Bone gain ≥1 thread		1	6

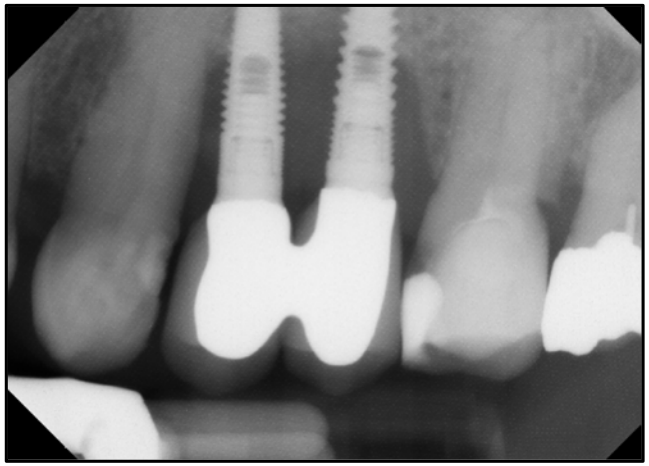
* All implants included in the study had bone loss of ≥3 threads at baseline.

- 26 implants were treated non-surgically and then surgically
- 7/26 implants were lost in 5 years
- 4/26 continued to lose bone despite treatment

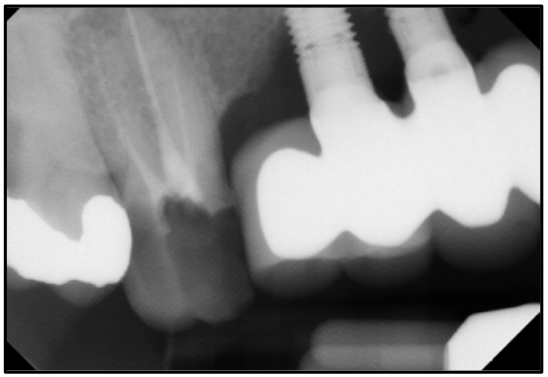
(Leonhardt et al, 2003)

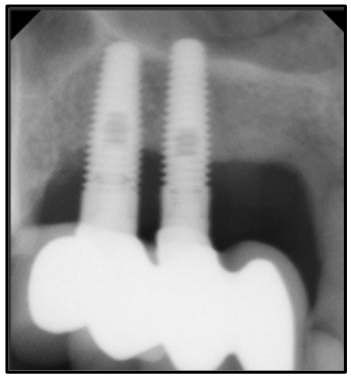
Implant Removal: When

- Implant is loose
- Bone loss around the implant has exceeded 2/3's of the implant

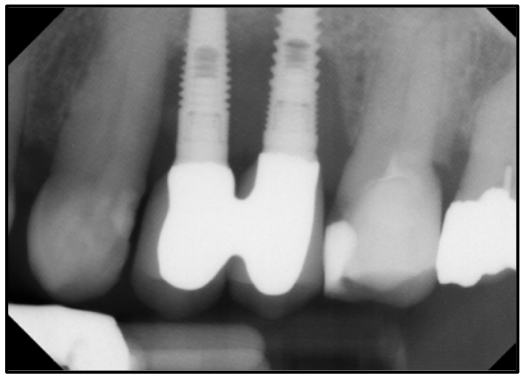


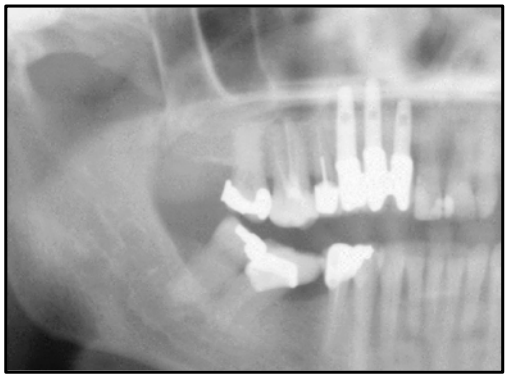
Patient Presented to the Practice to Restore Tooth #3

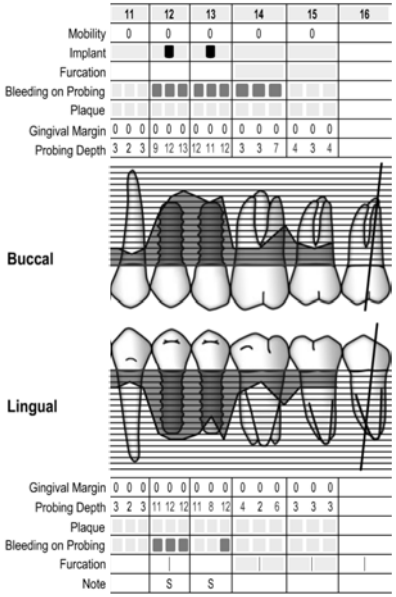


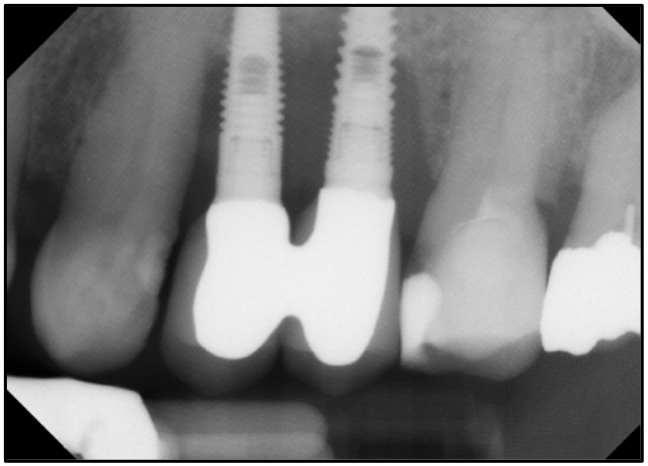


Implant on #7 was removed 2 yrs. after placement





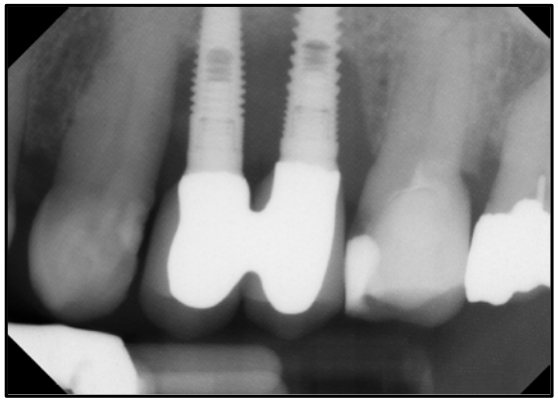




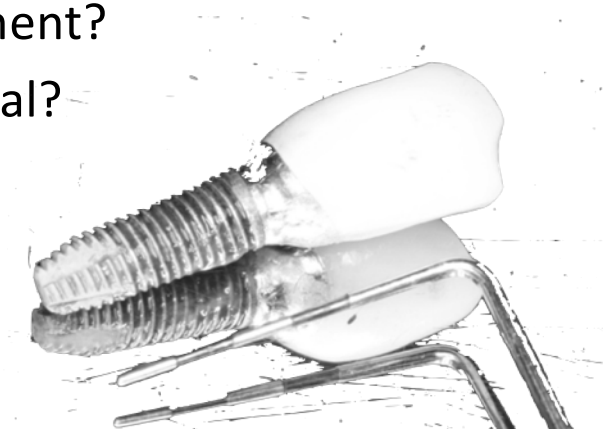
Implant Removal

- Implants placed 4 years prior to coming in to the office
- One implant had peri-implantitis within the first two years and it was removed
- Sporadic supportive therapy

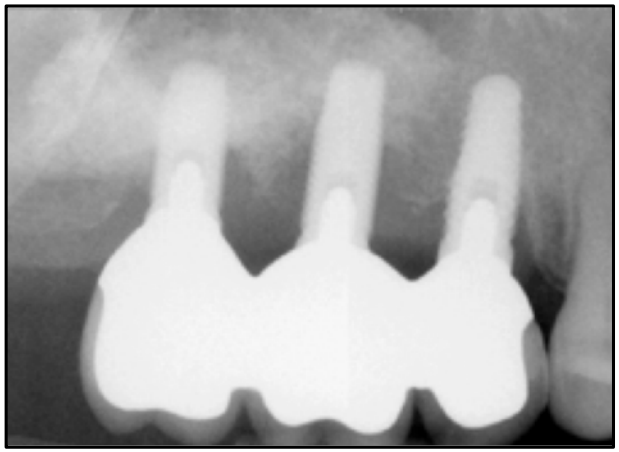
What Are the Options for Implants #12 and 13?



- Non-surgical treatment?
- Surgical treatment?
- Implant removal?



Peri-Implantitis: Implant Removal



(Dr. Maria Galvan)

Peri-Implantitis: Consequences of Implant Removal

- What are the treatment options after implant removal?
- How is this area going to be restored?
- Do we want to place a new implant?
- What are the chances that we will be able to re-graft and place a new implant?

Treatment of Peri-Implantitis

Very difficult and unpredictable

Surgical therapies seem to have better results than non-surgical

No ideal treatment option

(Khoskham et al, J Dent Res, 2013)

Clinical Implications

- Identify risk factors associated with developing peri-implant diseases
- Establish radiographic baseline at the time of implant placement
- Establish clinical and radiographic baseline at the final prosthesis insertion
- Monitor implant health
- Early diagnosis and intervention

(AAP consensus report, J Periodontol, 2013)

Analogy/Math

- Based on Derks study, 25% of the implants placed will have PI in 9 years (45% patients)
- If you place 100 implants/year= 1000 implants in 10 years
- If 12.5% have moderate to severe PI (Derks) = 125 implants
- Approximately 50% of the peri-implantitis cases can be treated

62-63 of the implants cannot be successfully treated

Do we tell our patients that once implants are placed, there are risks and consequences associated with them?

HOME » NEWS » FEATURES

Peri-implantitis: The 'time bomb' in dental implants

A little-known disease is emerging in which bacterial infection causes the loss of the bone supporting the implant

1K 0 127 1K Email

Catherine Gunnell's dentist diagnosed her with peri-implantitis Photo: Jay Williams

(telegraph.co.uk)

- What are the challenges in placing an implant?
  - Do we have enough bone where it need needs to be?

Periodontal Treatment

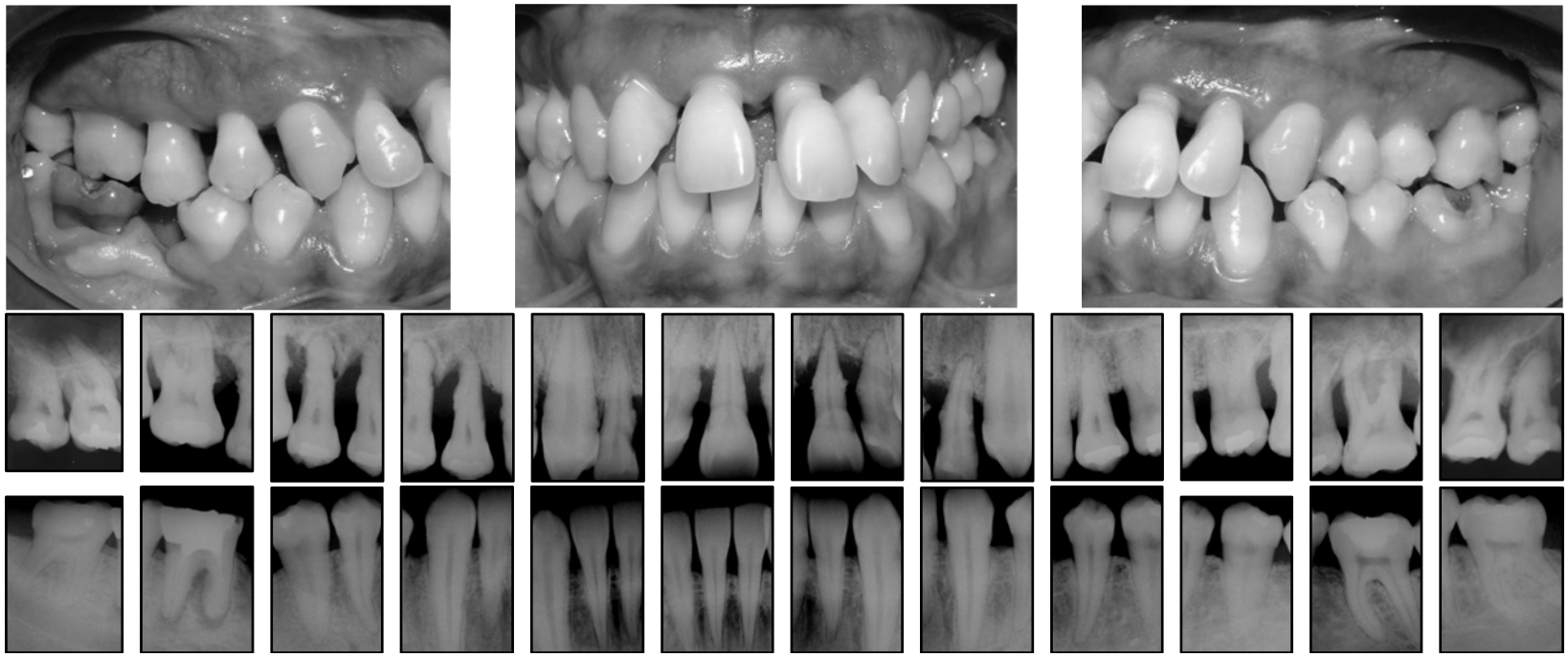
Case

- 38-year-old male
- Good general health
- No diabetes
- Non-smoking

CC: my upper teeth have moved out of place for the past 5 years and I don’t like how it looks

(Carnio et at, J Am Dent Assoc, 2015)

Initial Presentation



Initial Presentation

	1			2			3			4			5			6			7			8			9			10			11			12			13			14			15			16		
B	3	2	3	3	2	5	7	2	9	7	1	7	10	5	10	5	2	2	2	2	7	8	2	7	7	2	7	8	1	5	4	2	2	2	2	3	3	2	3	10	5	7	3	1	3	4	5	6
P	3	3	3	3	2	3	6	1	9	6	5	9	10	6	10	5	4	5	5	5	6	6	6	5	6	8	9	7	6	5	3	2	2	3	2	3	4	2	4	10	3	6	3	2	3	4	3	3

Diagnosis

Severe Chronic Periodontitis

Positive Characteristics:

- Limited tooth mobility
- No smoking history
- Highly motivated patient
- Excellent oral hygiene
- Non-contributory medical history

Treatment Options

- Extractions of all/most max teeth with full or partial removable denture
- Extractions of all max teeth and implants with fixed or removable support
- Attempt to save max teeth with non-surgical and surgical therapy

Severe chronic periodontitis

- Treatment:
  - Scaling and root planing (4 sessions, 1 week intervals)
  - Re-evaluation 8 weeks after scaling and root planing
  - All teeth with PD ≥4mm were re-treated with SRP
  - 3-month periodontal maintenance

1 year after non-surgical treatment

VARIABLE	BASELINE	1 YEAR
Pocket Depth, Sites (%)		
1-4 mm	55.6	85.6
5-6 mm	23.3	8.9
≥ 7 mm	21.1	5.6
Bleeding on Probing		
Sites (no.)	31	4
Sites (%)	34.44	4.44
* mm: Millimeters.		

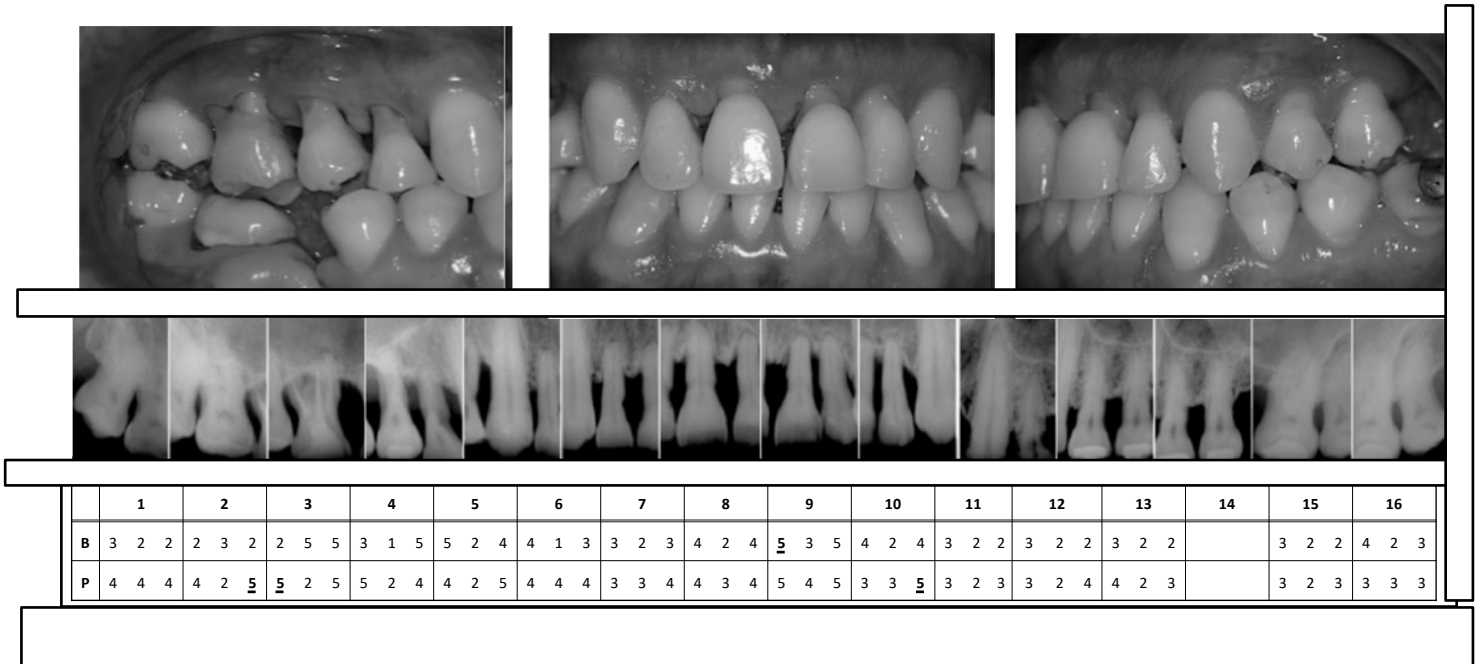
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
B	3 2 2	3 2 3	8 **7** 6	5 1 **5**	5 2 6	2 2 2	2 2 3	3 1 3	4 2 3	4 2 2	2 2 2	2 2 3	3 1 2	8 **7** 8	3 2 2	2 2 3
P	4 5 3	4 3 4	7 2 **9**	4 2 3	4 2 9	3 2 2	2 2 2	3 2 3	3 2 4	3 2 3	3 2 2	4 2 4	4 2 2	7 2 8	2 2 2	3 **5** 5

6 years after initial treatment immediately after orthodontic tx

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	3 2 2	2 2 2	3 6 6	5 1 4	5 2 4	4 2 2	2 2 2	5 3 4	5 3 5	3 2 3	2 2 3	3 2 3	3 2 2		3 2 2	3 3 4
P	4 4 3	2 2 4	8 2 6	5 3 5	4 2 6	3 3 3	3 3 4	5 3 4	4 3 2	2 3 7	3 3 3	3 3 5	3 3 3		4 2 2	3 3 5

VARIABLE	BASELINE	1 YEAR	6 YEARS
Pocket Depth, Sites (%)			
1-4 mm	55.6	85.6	82.2
5-6 mm	23.3	8.9	15.6
≥ 7 mm	21.1	5.6	2.2
Bleeding on Probing			
Sites (no.)	31	4	4
Sites (%)	34.44	4.44	4.44

12 years after
initial treatment



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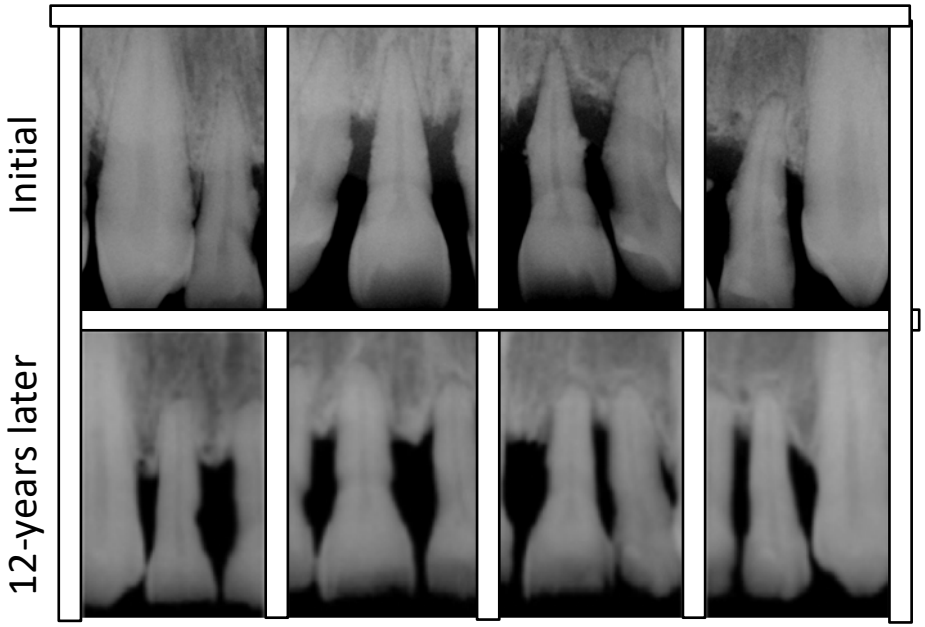
P	4 4 4	4 2 5	5 2 5	5 2 4	4 2 5	4 4 4	3 3 4	4 3 4	5 4 5	3 3 5	3 2 3	3 2 4	4 2 3		3 2 3	3 3 3

Initial

12-years later



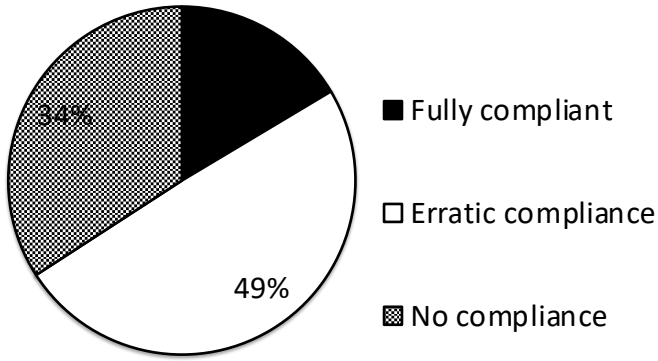
Maxillary pocket depth (number and relative proportion of sites) and bleeding on probing at various time points.

VARIABLE	BASELINE	1 YEAR	6 YEARS	12 YEARS
5-6 mm	23.3	8.9	15.6	15.6
≥ 7 mm	21.1	5.6	2.2	0.0
Bleeding on Probing				
Sites (no.)	31	4	4	4
Sites (%)	34.44	4.44	4.44	4.44

* mm: Millimeters.

Possible explanations for the success of this case

- Meticulous oral hygiene
- Skill of the practitioners
- Compliance with periodontal maintenance
  - Patient only missed 2 appointments in 12 years



(Modified from Wilson, J Periodontol, 1984)

Periodontal Maintenance

- 3 month periodontal maintenance is adequate for most patients
  - Over treatment (maybe)
  - Under treatment: 20-25% of patients present with attachment loss over 14 years
  - Even with periodontal maintenance some individuals may still have periodontal breakdown

(Knowles, 1973; Ramfjord et al., 1982, Lindhe and Nyman, 1984; Hirschfeld and Wasserman, J Peridontol, 1978; McFall, J Perio 1982; Meador and Love, J Perio 1985

- No periodontal maintenance
  - 55 % of the sites had 2-5 mm of attachment loss
- Consistent maintenance
  - 1% of the sites had 2-5 mm of attachment loss

(Axelsson and Lindhe, 1981)

Chronic Periodontitis-Tooth Loss

	Hirschfeld and Wasserman, 1978	McFall, 1982
Disease severity	600 patients (15 years) • 76.5% severe • 16.5% moderate • 7% mild	100 patients (10 years) • 36% severe • 53% moderate • 11% mild
Well-maintained (0-3 teeth)	**83.2%**	**77%**
Downhill (4-9 teeth)	**12.6%**	**15%**
Extreme downhill (10-23 teeth)	**4.2%**	**8%**

- 48-year-old female
- CC: “Periodontal therapy doesn’t work for me”
- Past periodontal history: Phase I and II (UL and LL)
- Patient had excellent oral hygiene
- Periodontal abscesses 2-3 times per year

Initial

PD #2M: 6M
PD#3: 7-8 B and D

(Dr. Susan Haake’s case)

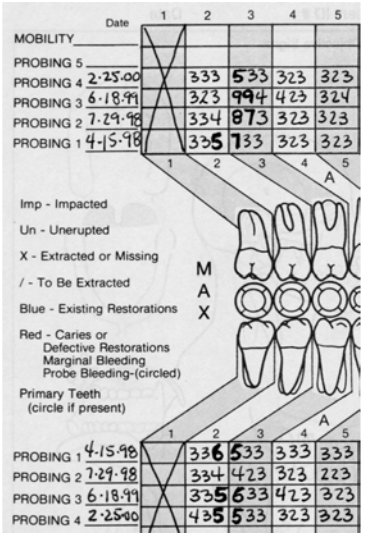
- Initial Diagnosis:
  - Localized severe chronic periodontitis
- Initial Treatment:
  - Extraction of #3
  - Or SRP and OHI
- Reevaluation:
  - Recommended extraction of #3
  - Patient declined and entered maintenance therapy

Re-eval
(same radiograph)

PD #2M: 6M
PD#3: 7-8 B and D

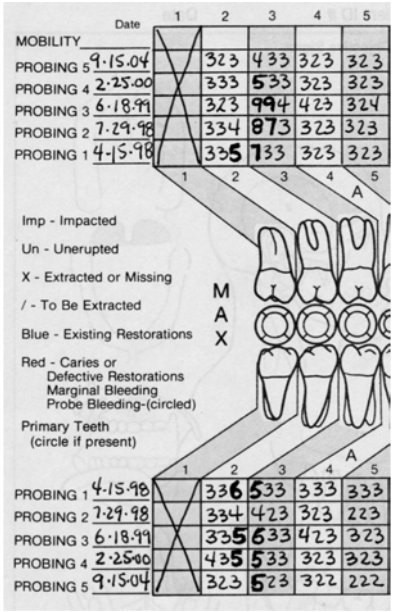
- **Periodic Exam 1 year later:**
- Patient reported no bleeding and no abscesses since initial therapy
- Increased pocket depth noted #3 (7-9mm)
- Discussed options for #3 with patient:
  - Extraction
  - SRP with locally delivered antimicrobial
- Patient Agreed to: SRP and Arestin placement #3 (5-6mm PD no BOP, no mobility)

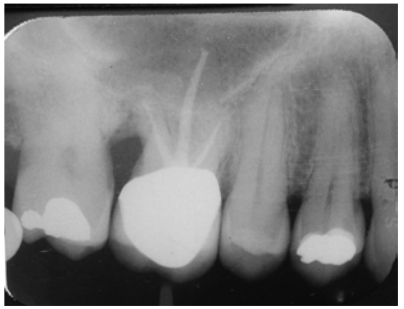
8 months later

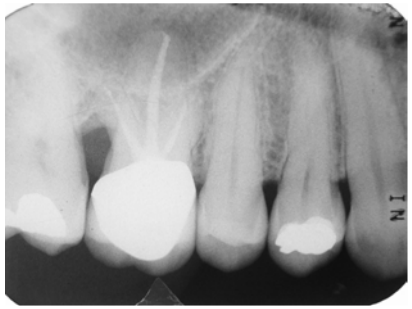


Continued recall program

- Periodic Exam 6 years later







Initial **6 years later**

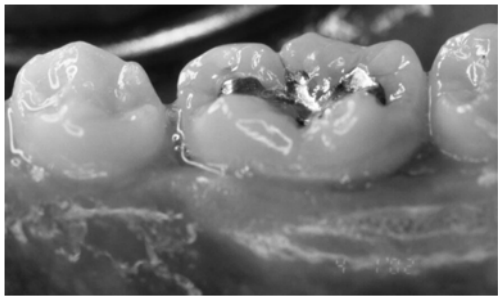
Aggressive Periodontitis/Molar Incisor/Grade C

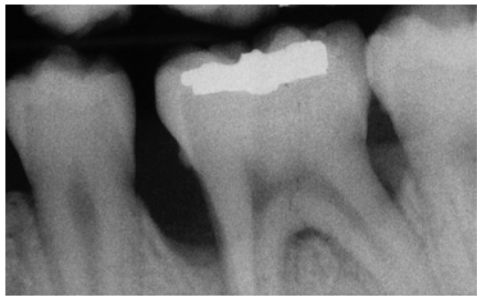
Aggressive Periodontitis

- Rapid attachment loss and bone destruction
- Rapid attachment loss and bone destruction
- The amount of microbial deposits is inconsistent with the disease severity
- Relatively rare
  - 0.53% localized aggressive periodontitis
  - 0.13% generalized aggressive periodontitis
- Even though it is not classified by age it tends to affect young individuals

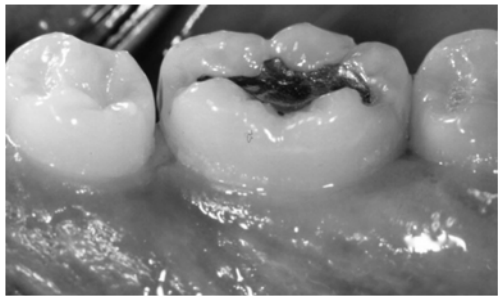
(Albandar and Tinoco, 2002, Loe and Brown, 1991)

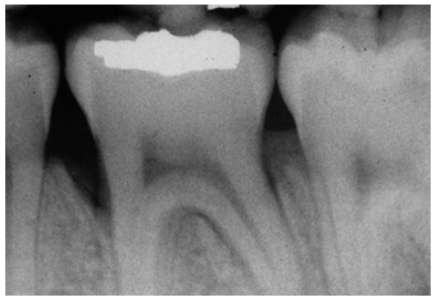
Initial Evaluation



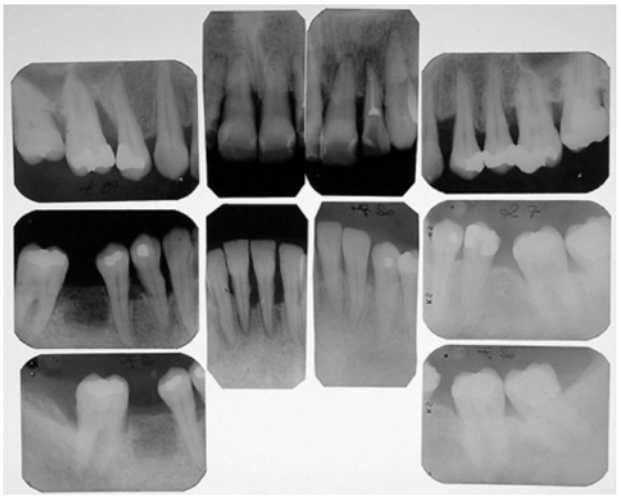


1-year after initial treatment





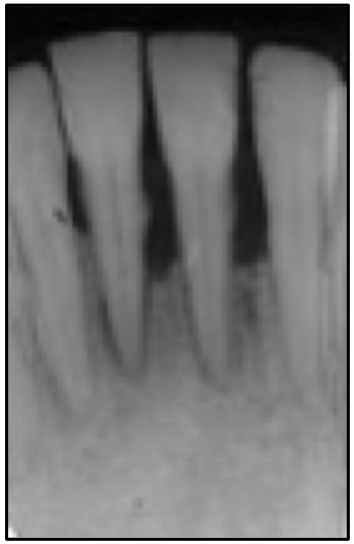
Initial



- 30-year-old patient

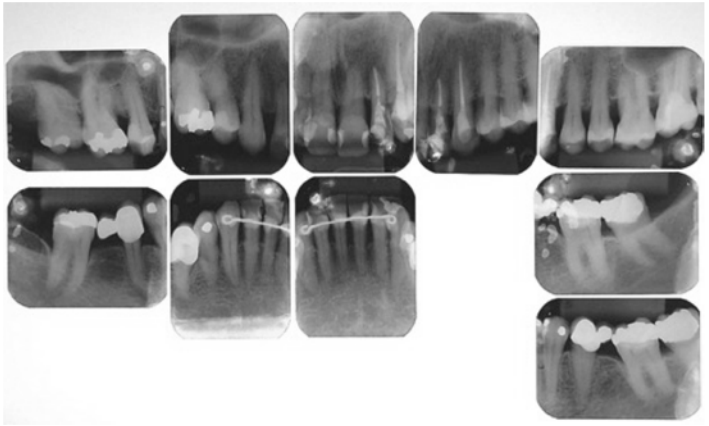
(Dr. João Carnio)

Baseline



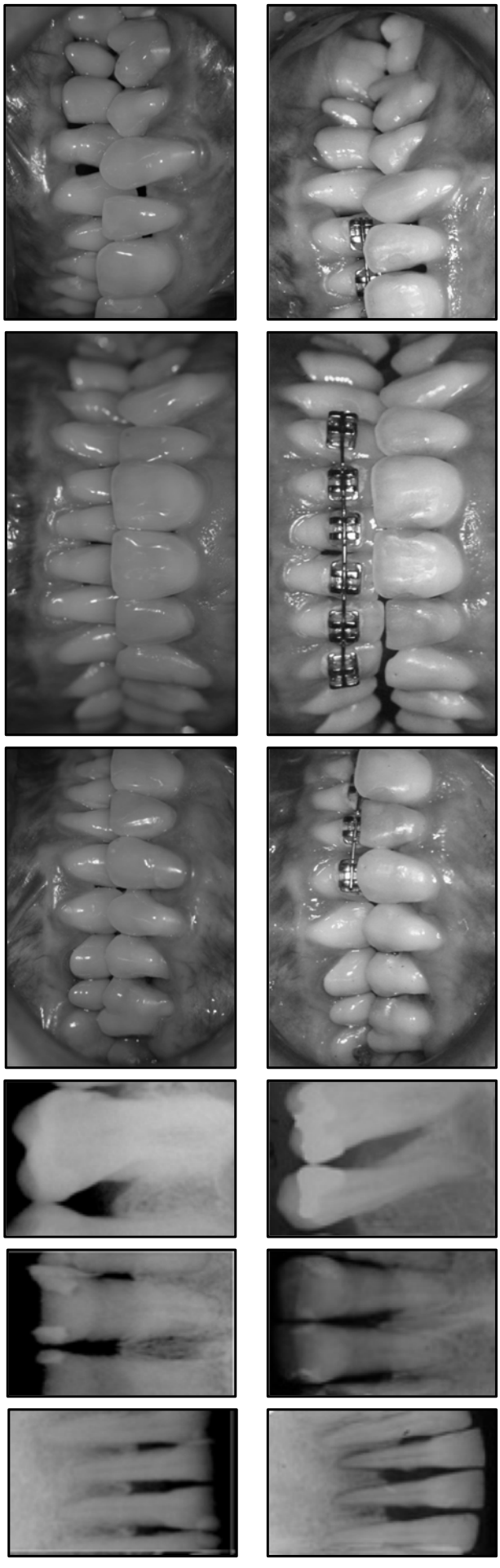
15 years later



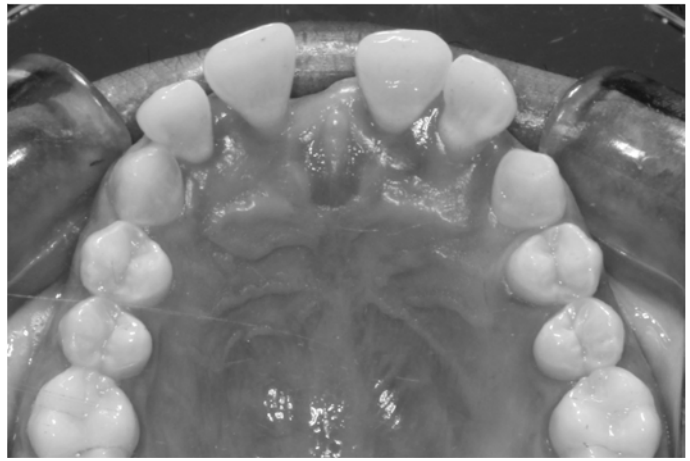



23 years later

23 years later Initial

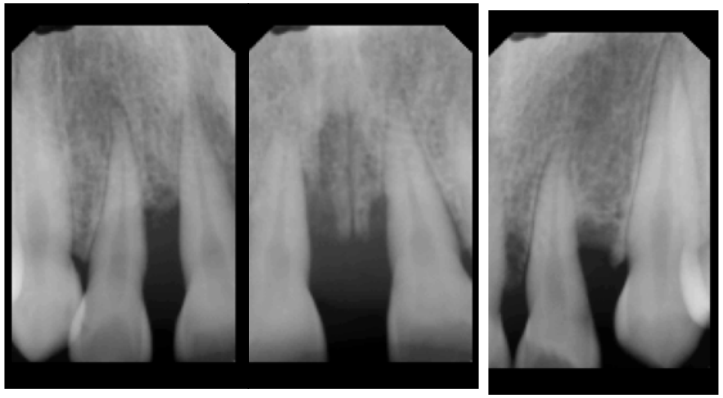







3-3-4/4-10-10 5-5-3/4-2-6


3-3-5/5-7-10 7-6-6/4-2-6

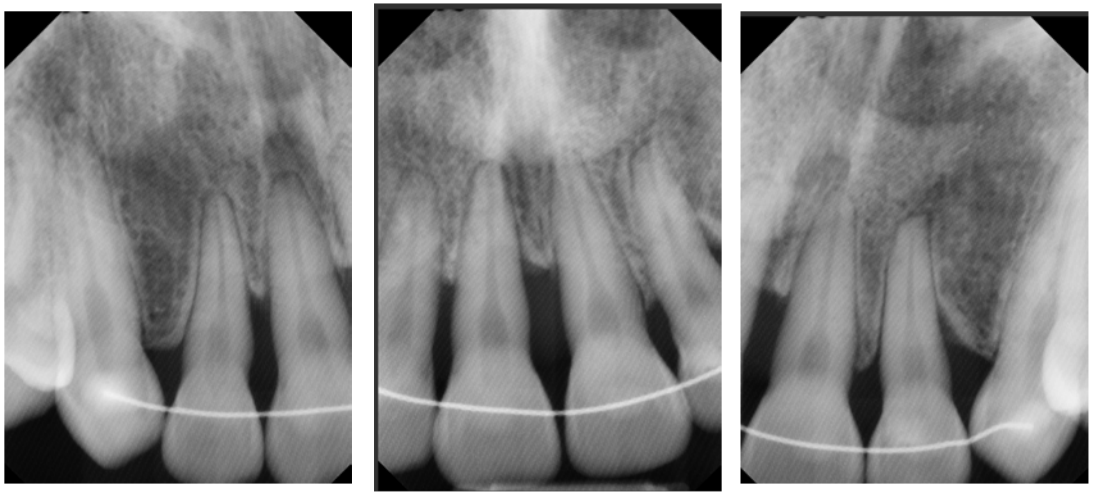


Initial Treatment Plan

- SRP
- Orthodontic treatment
- Extract 7-10 after orthodontic treatment
- Place implants on 7 and 10

2 months after perio sx

1 year after perio sx

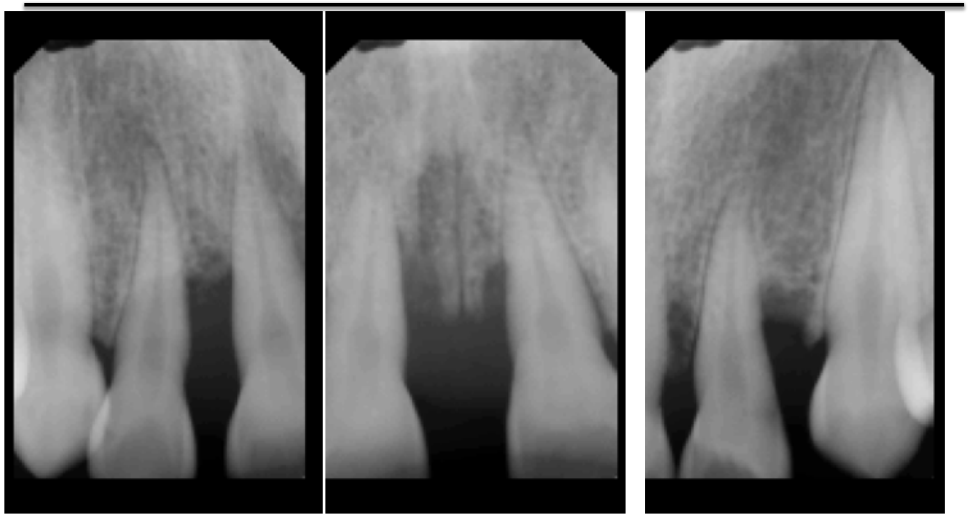


Initial

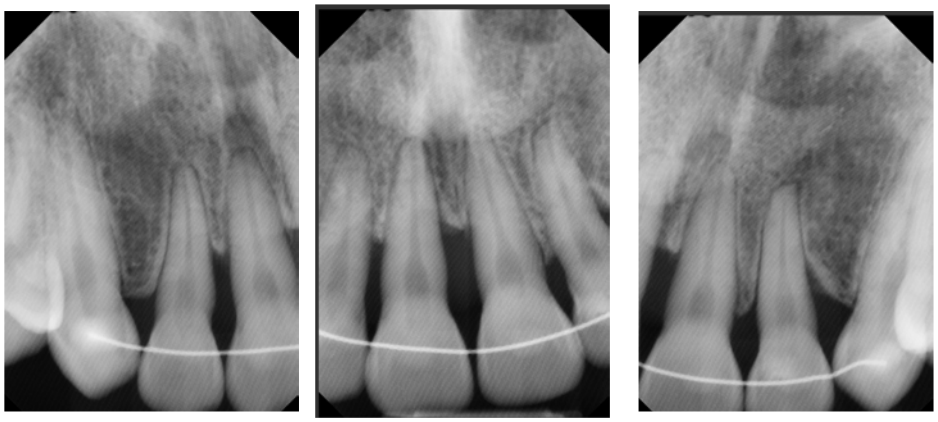
3 years after initial tx

1 year after perio sx

Initial



5 years after
2 years after perio sx



Aggressive Periodontitis Cases/Molar Incisor

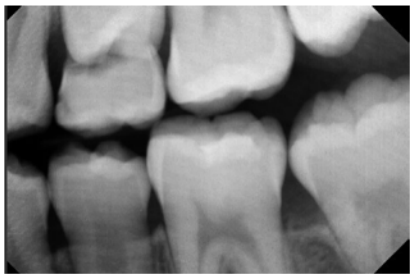
- After treatment
- 0.09 teeth per patient year
  - 0.05 localized
  - 0.14 generalized
- 46% pts lost no teeth
- 16% lost one tooth
- 66% teeth were molars

- Disease also may be self-limiting
- Tend to respond really well to treatment!!!

Prevention is still the key!!

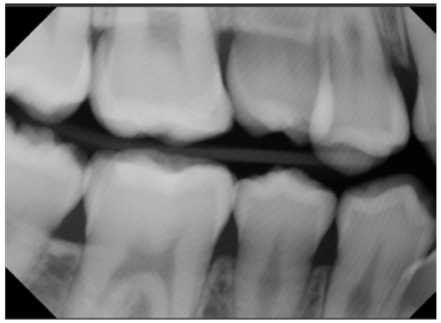
(Nibali et al, J Dent Res, 2013, Lang, Bartold et al. 1999)

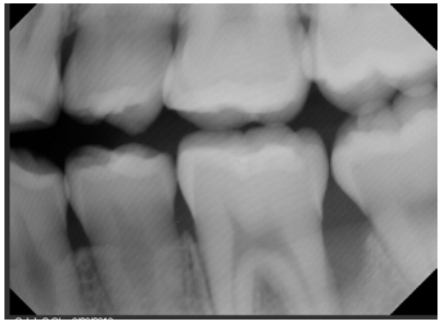
2011



2012

2013



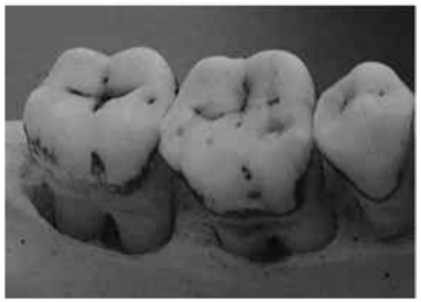


PD #19DL
- Initial: 12mm

Should we have done anything different in this case?

Could we have minimized the problem?

Does this patient have bone loss?



- Dense cortical facial and lingual plates of interdental bone obscure destruction of cancellous bone
- To see destruction of the interproximal cancellous bone radiographically:
  - the cortical bone must be involved
    - A reduction of the cortical plate (at least 0.5 to 1.0 mm)

Diagnostic Tools

Radiographs are highly specific

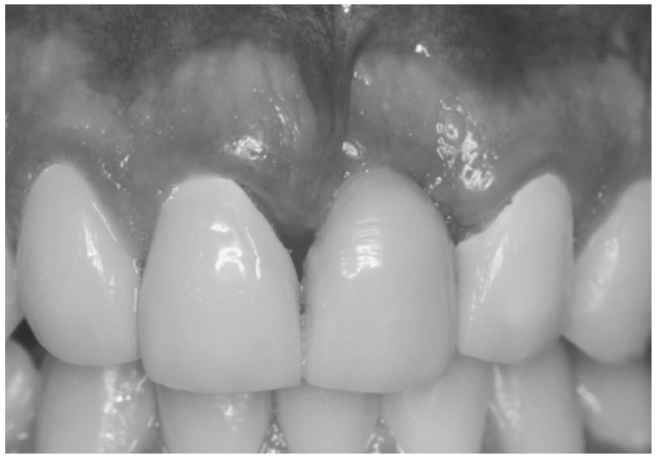
Periodontal probe is more sensitive

An initial bony lesion might not be visible on the radiograph and periodontitis may remain undetected

The New York Times

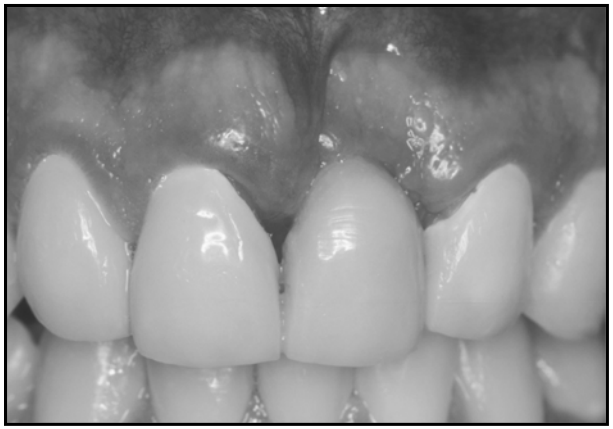
A Dental Shift: Implants Instead of Bridges

By **JANE E. BRODY** NOV. 16, 2009

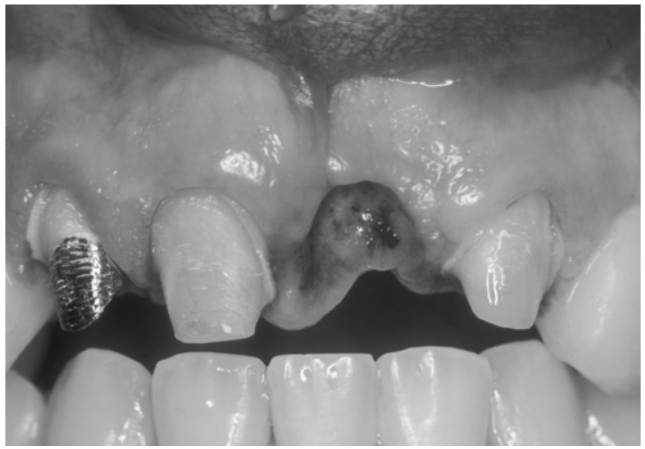
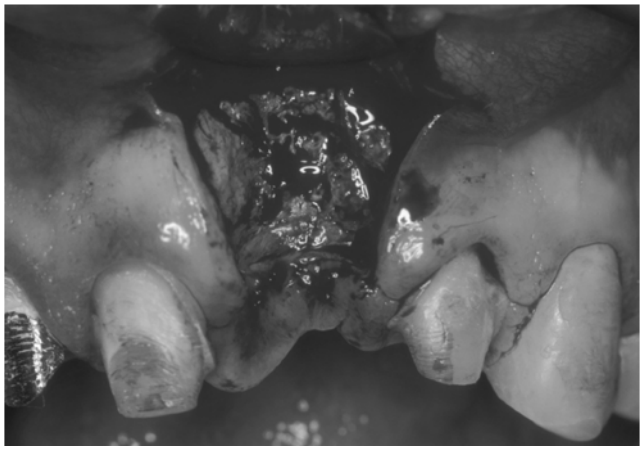
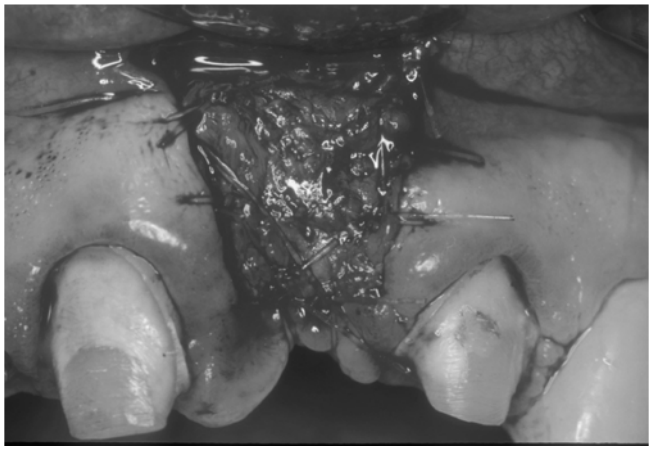

40 year-old patient who lost tooth #9 in a bicycle accident at age 25
The FPD is 15 years-old with recurrent caries along an abutment margin

(Dr. Paulo and Luciano Camargo)

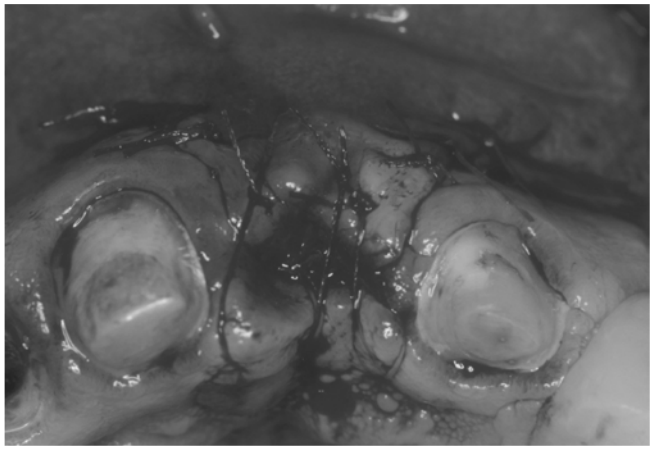
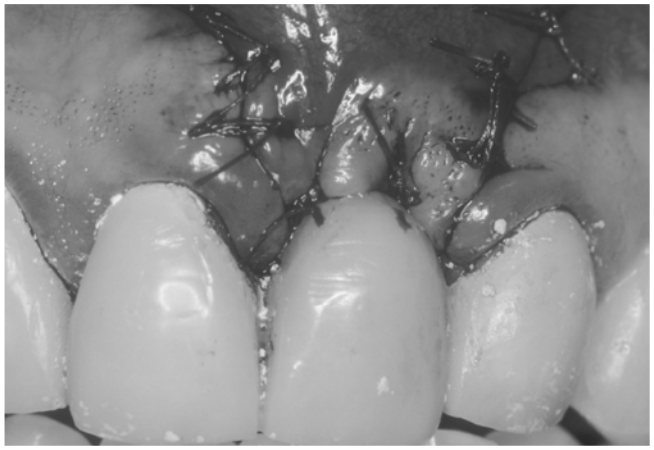


Replacement recommendation:

a. Implant and individual crowns
b. Re-make FPD
c. Remake FPD with CT graft for ridge augmentation

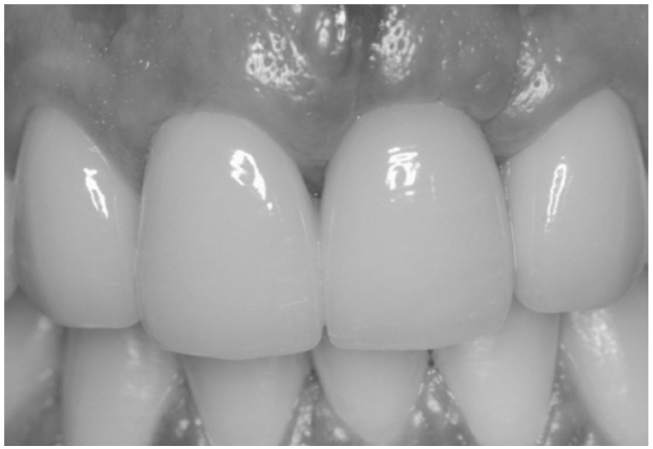
(Dr. Paulo M. Camargo)

(Dr. Paulo M. Camargo)

Baseline

10 years later



(Restorative dentistry by Luciano M. Camargo Curitiba, Brazil)

Clinical implications

- The retention of periodontally compromised teeth can have long-term value
- Conventional dentistry can be a sound alternative
- If extraction is elected, what are the replacement options?
- If implant dentistry is chosen, how do we minimize risk and increase predictability?

A systematic review on survival rates and complications of fixed dental prostheses on severely reduced periodontal tissue support

Estimated % of

- FPD survival rate:
  - 5 years: 96.4%
  - 10 years: 92.9%
- Abutments with no endodontic complication
  - 10 years: 93%
- Abutment that were caries free
  - 10 years: 98.1%

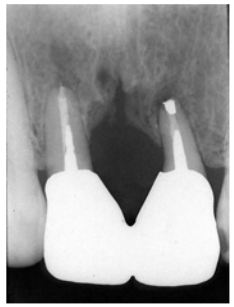
Periodontally compromised teeth successfully treated and maintained at regular intervals have high longevity

(Lulic et al, Clin Oral Impl Res, 2007)

Baseline (1983)



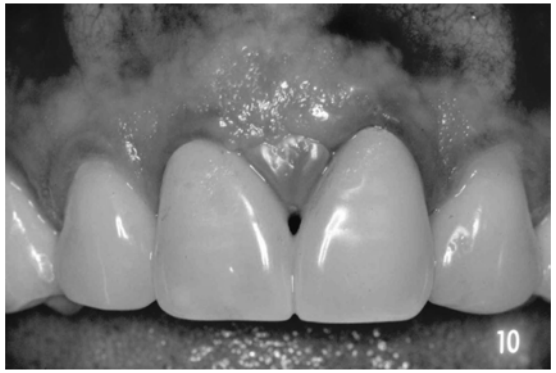
7 years later

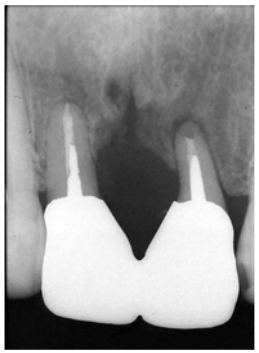



Congenitally missing central incisors

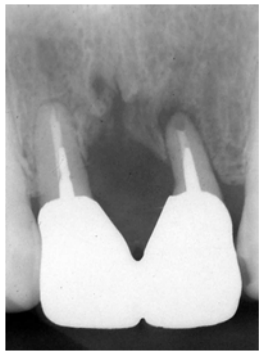
(Dr. João Carnio, 1983)

10 years later



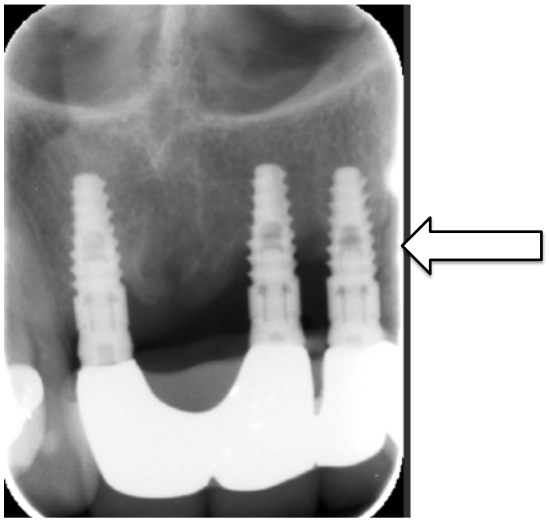


16 years later



28 years later

(Dr. João Carnio)



Crown Lengthening

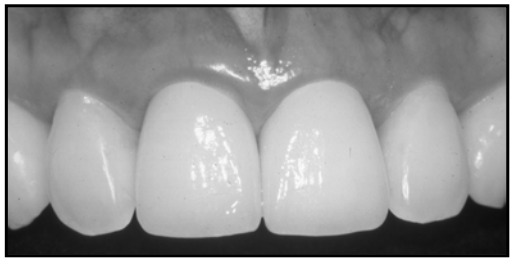
Elongation of the clinical crown in order to enhance restorative dentistry and/or to improve esthetics

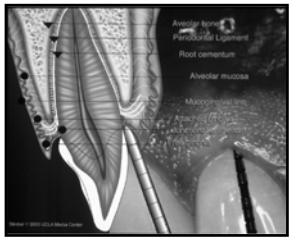
Modalities of Clinical Crown Lengthening

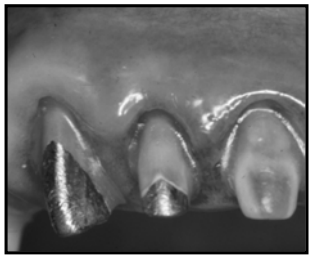
- **Surgical:** gingivectomy or apically positioned flap
- **Orthodontic:** forced tooth eruption (orthodontic extrusion)

Crown Lengthening: Clinical Considerations

- Biological considerations
  - Preservation of supra crestal attachment (SCA, biologic width)
  - Periodontal health
- Mechanical considerations
  - Retention
  - Resistance (ferrule effect)
- Esthetic considerations
  - Tooth proportions
  - Gingival architecture

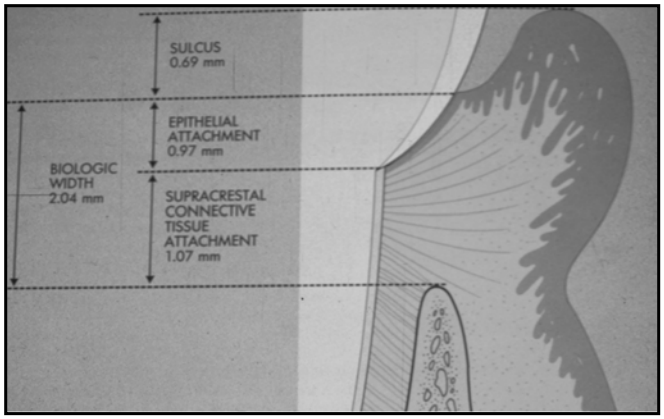






Biologic Width

- Average dento-gingival unit measurements
  Sulcus: 0.69 mm
  - Epithelial attachment: 0.97 mm
    - Range 0.08 to 3.72 mm
  - Connective tissue attachment: 1.07 mm
    - Range 0.00 to 6.52 mm
- Biologic width
  - EA + CTA: average 2.04 mm
  - EA + CTA + sulcus: average 2.73 mm



Gargiulo, Wentz & Orban, JP, 1961

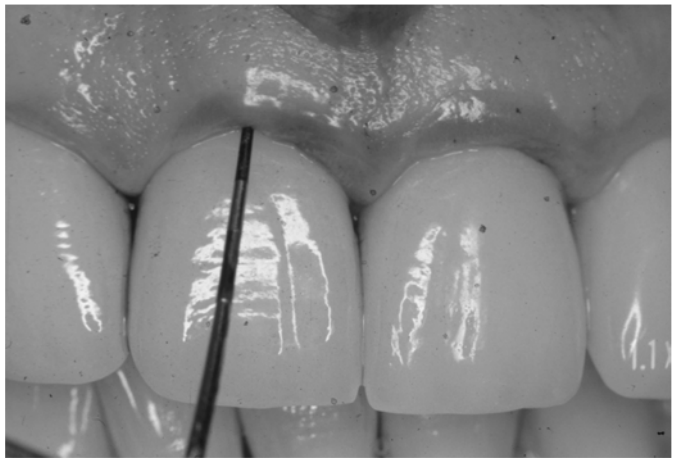
Biological Considerations: Variations in Supra Crestal Attachment

- Distance from the gingival margin to the bone crest
  - Normal bone crest
    - 3 mm - 85%
  - Low bone crest
    - > 3 mm - 13%
  - High bone crest
    - < 3 mm - 2%

(Kois, JED, 1994 & Perio *2000*, 1996)

Violation of Biologic Width

- Common violation:
  - Restorations placed too apically
- Clinically
  - Zone of chronic inflammation
  - Increase in pocket depth
  - BOP



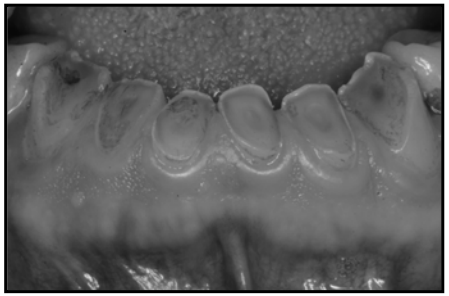
(Günay et al, IJPRD, 2000)

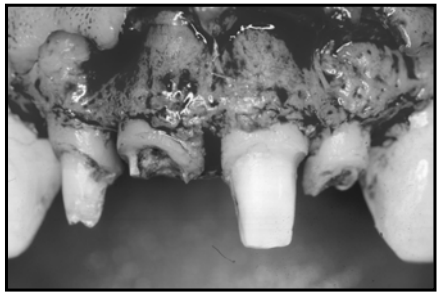
Clinical Crown Lengthening: Indications

- Subgingival caries
- *Subgingival crown fracture*
- Subgingival perforation
- Prosthetic retention
- Improve aesthetics (gummy smile)

Mechanical Considerations

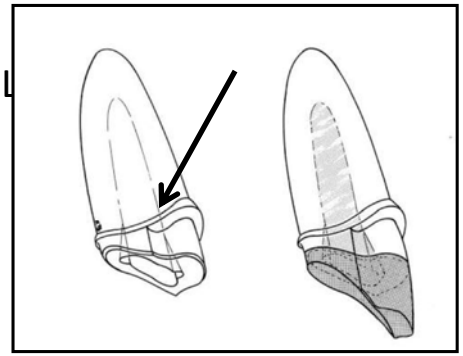
- Retention
- Resistance
  - Avoid fracture of remaining tooth structure
  - Avoid displacement of the entire restoration

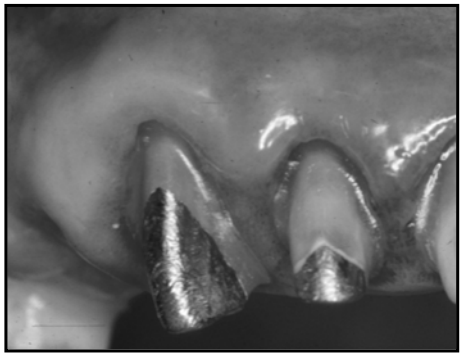


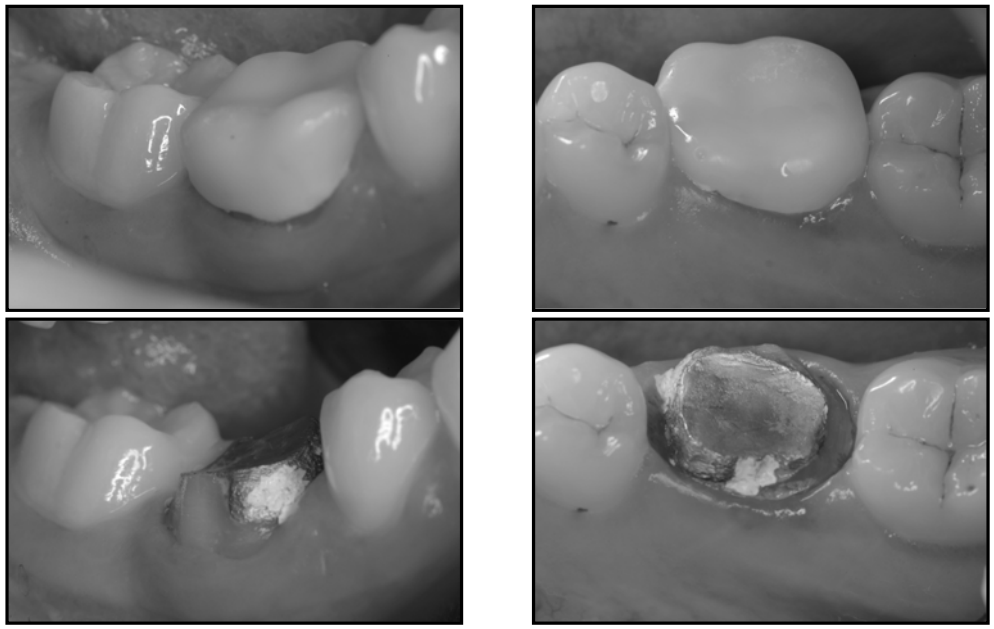


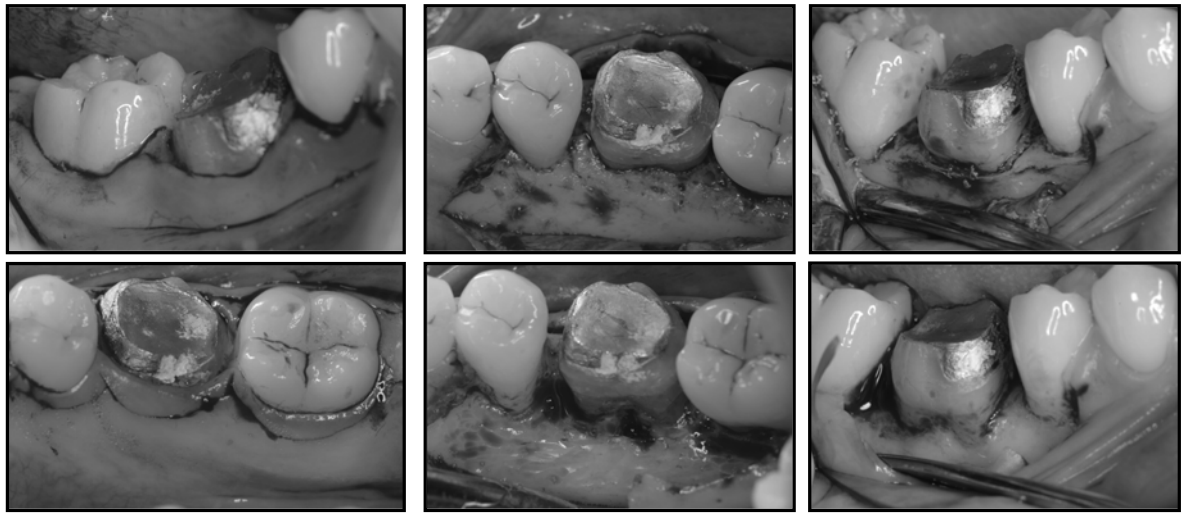
Mechanical Considerations: Resistance

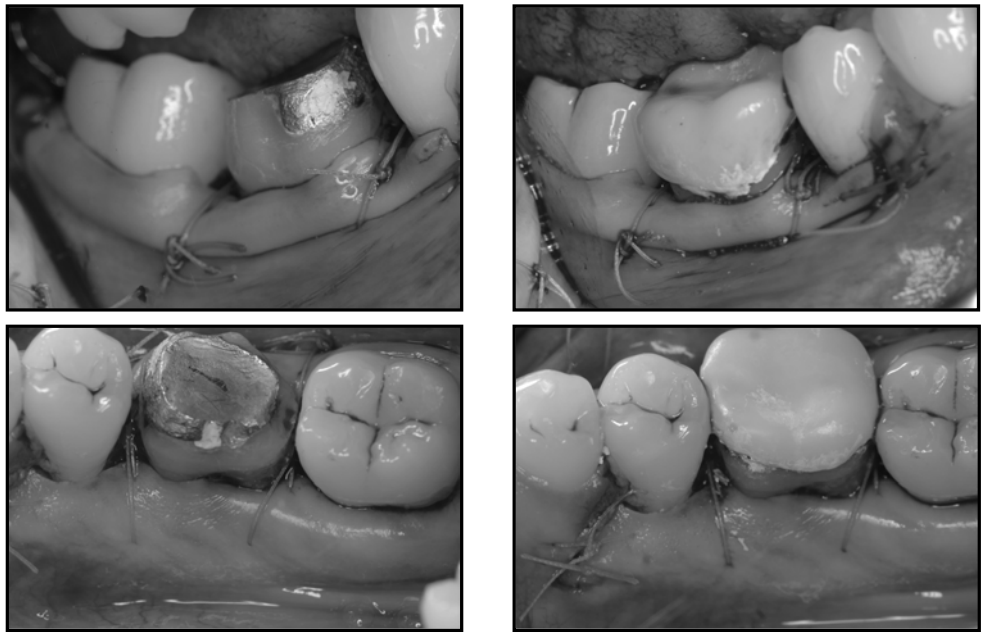
- Crown must encircle a collar of sound tooth structure
- “Ferrule Effect”
- Maintains transfer of functional forces to root/PDL
- *MINIMUM* 1.5-2 mm
  on facial and lingual

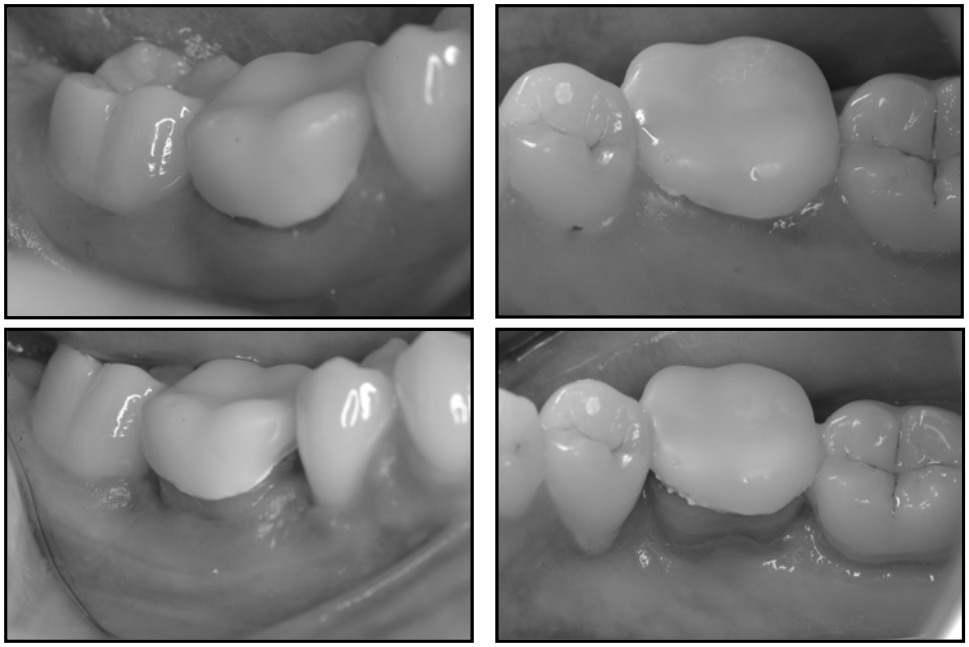




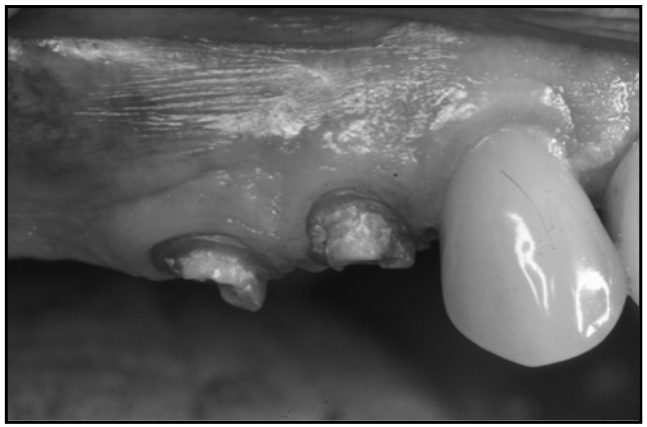


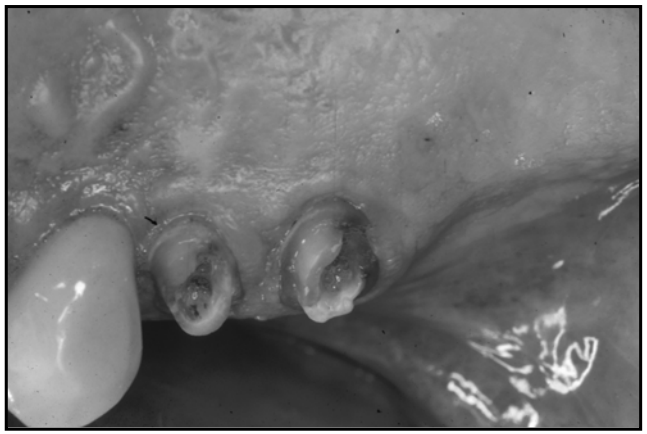


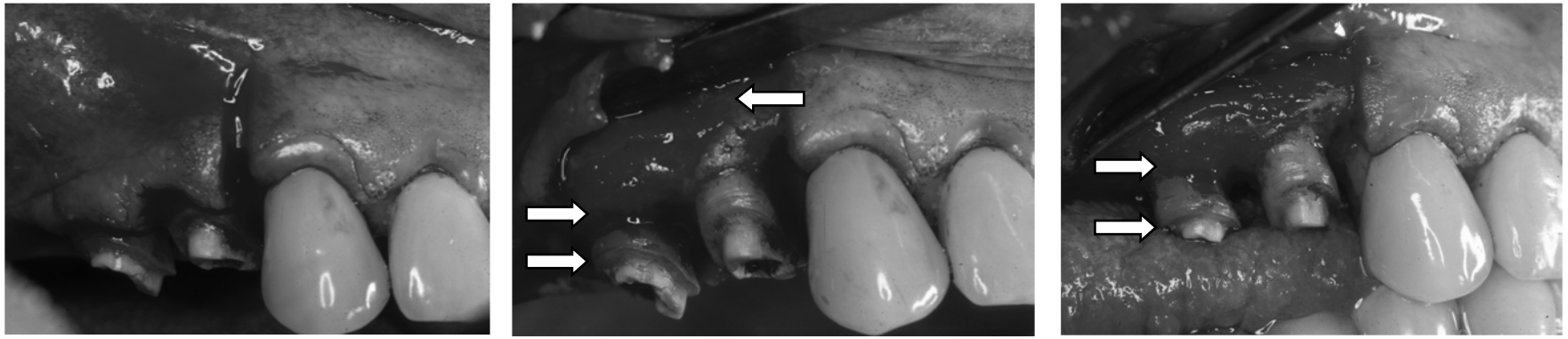


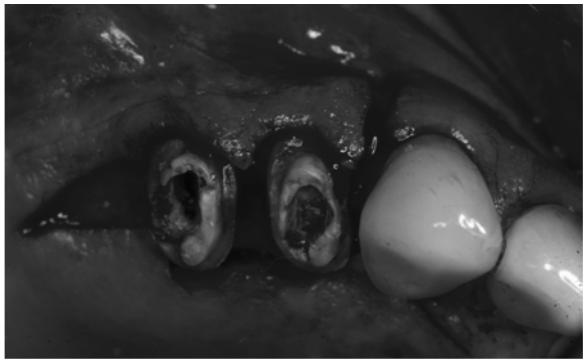
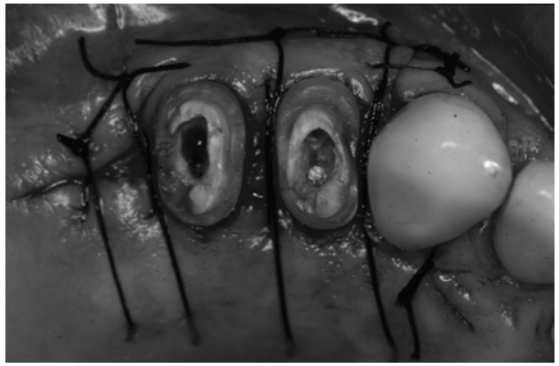


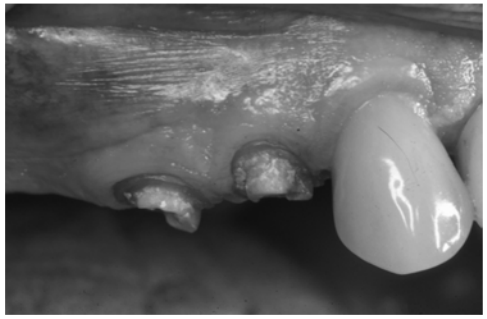
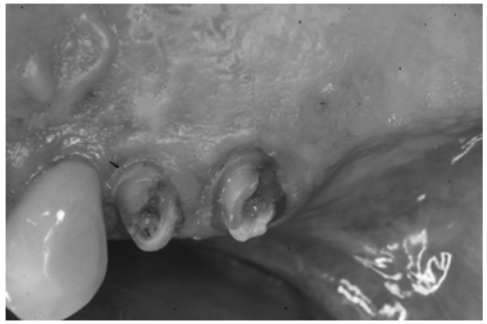
70 year-old patient with controlled high blood pressure who wishes to maintain his natural dentition for as long as possible:

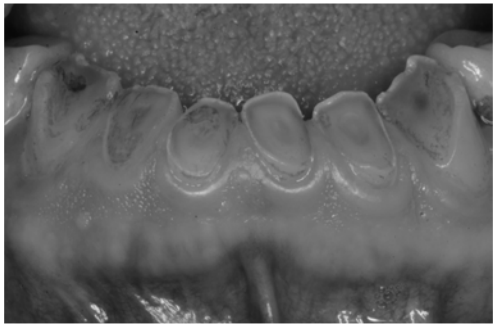
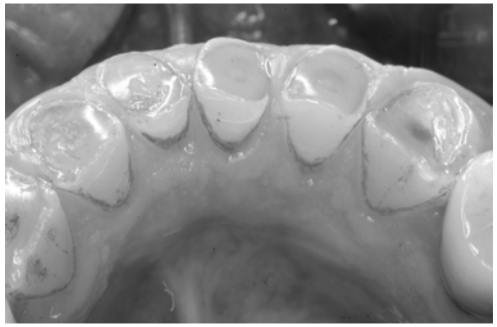
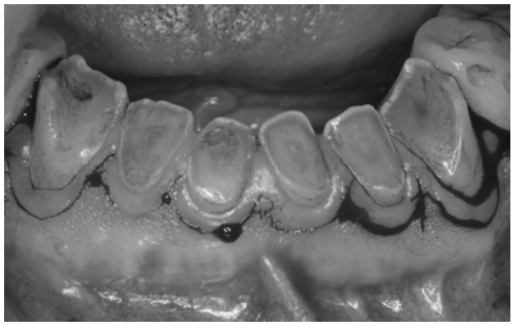


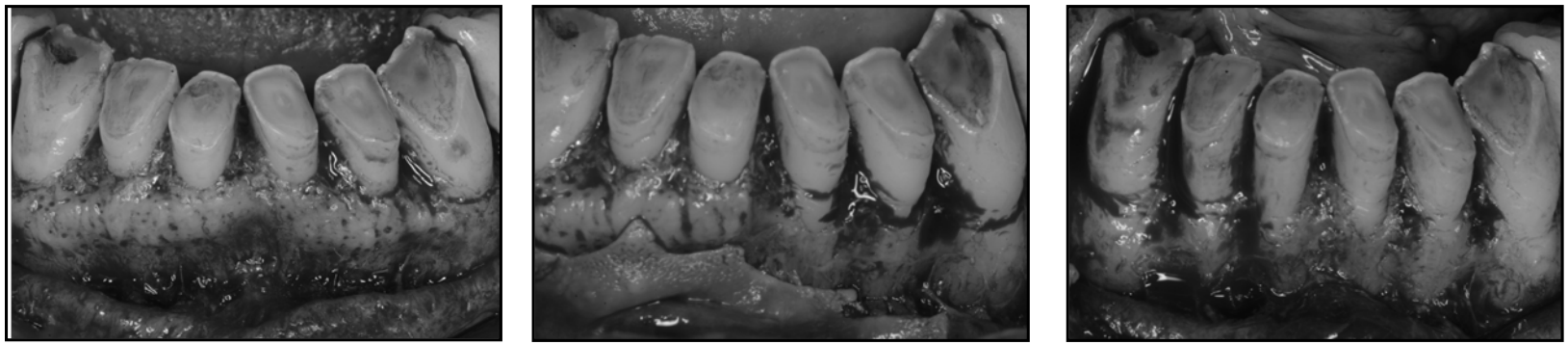


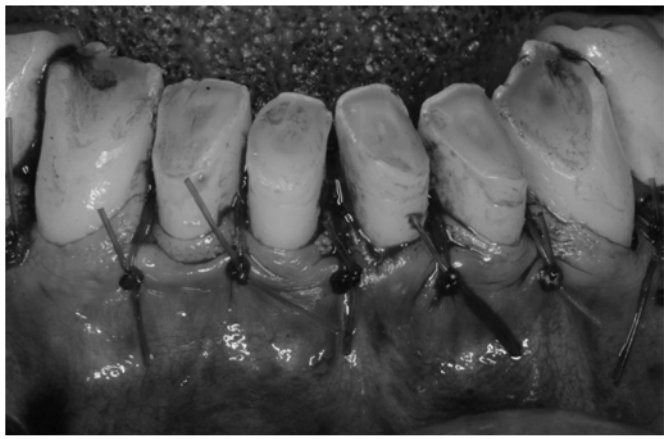
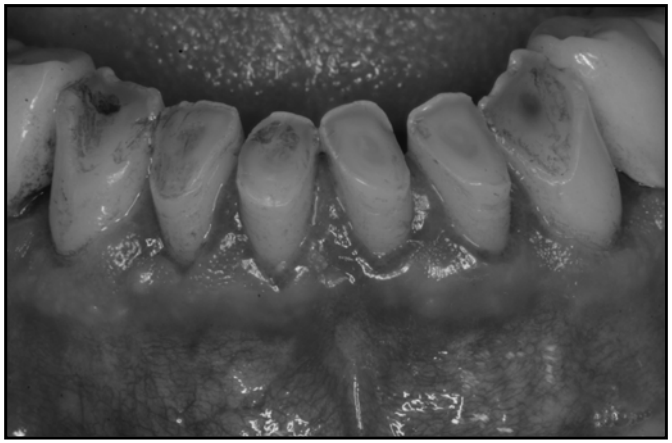


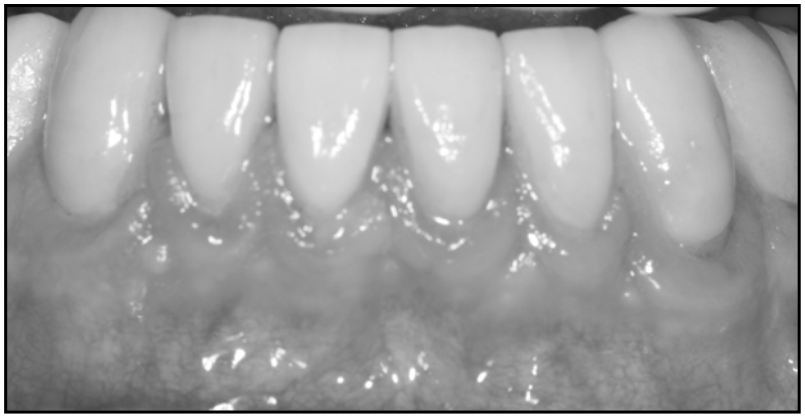




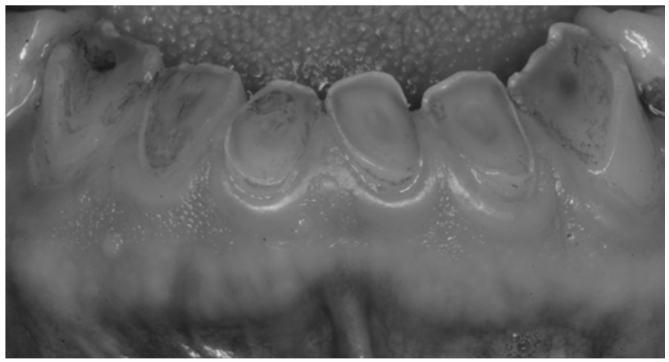



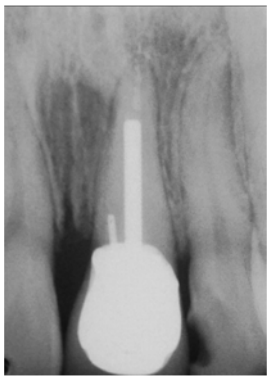





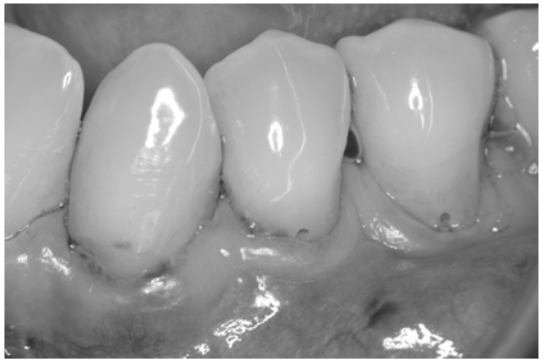
Surgical Crown-Lengthening: Contra-indications

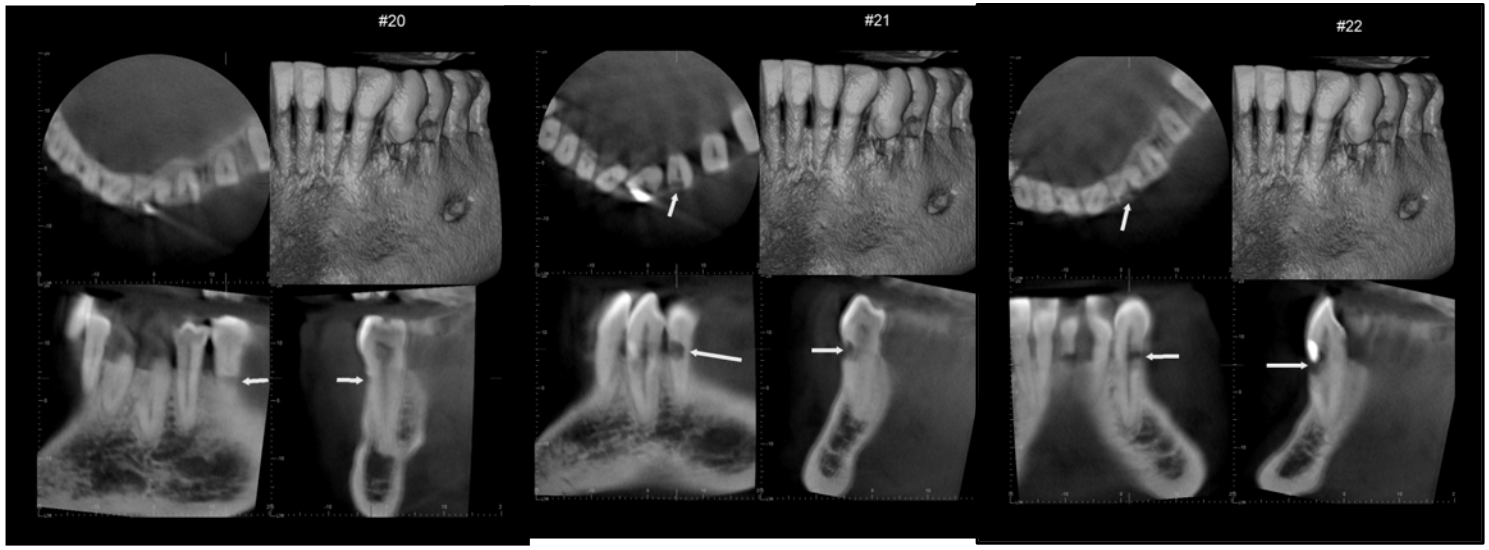
- Deep caries, external root resorption or a fracture that would require excessive bone removal on contiguous teeth
- Surgery would create an unaesthetic outcome
- The tooth has a poor prognosis



External Root Resorption

- Determining when to save or extract a tooth more challenging
- CBCT extremely helpful

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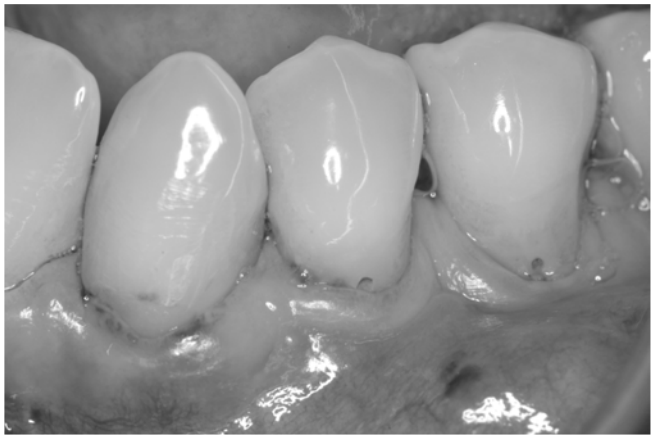
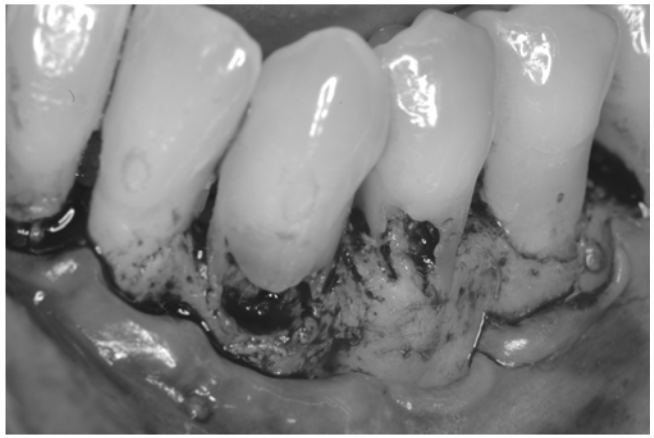
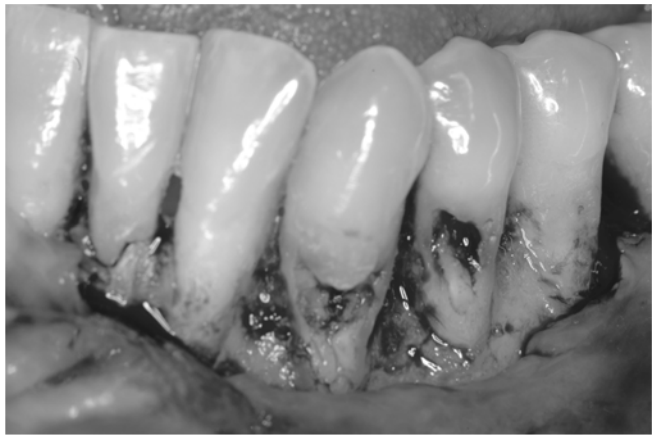
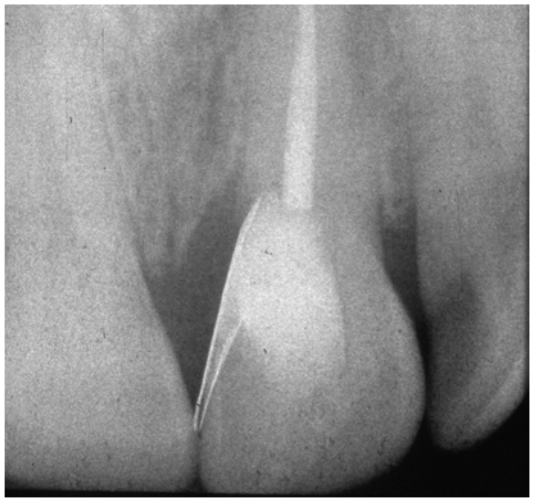
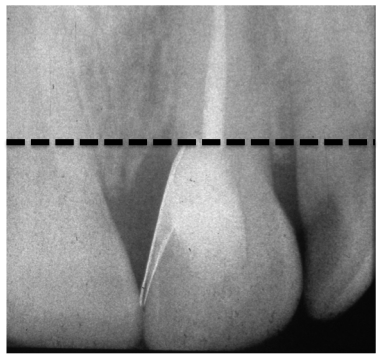




38 year-old healthy patient with a complaint of swelling on buccal of tooth #9

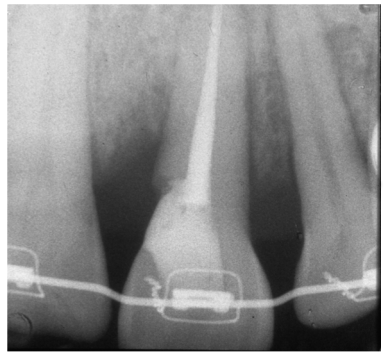


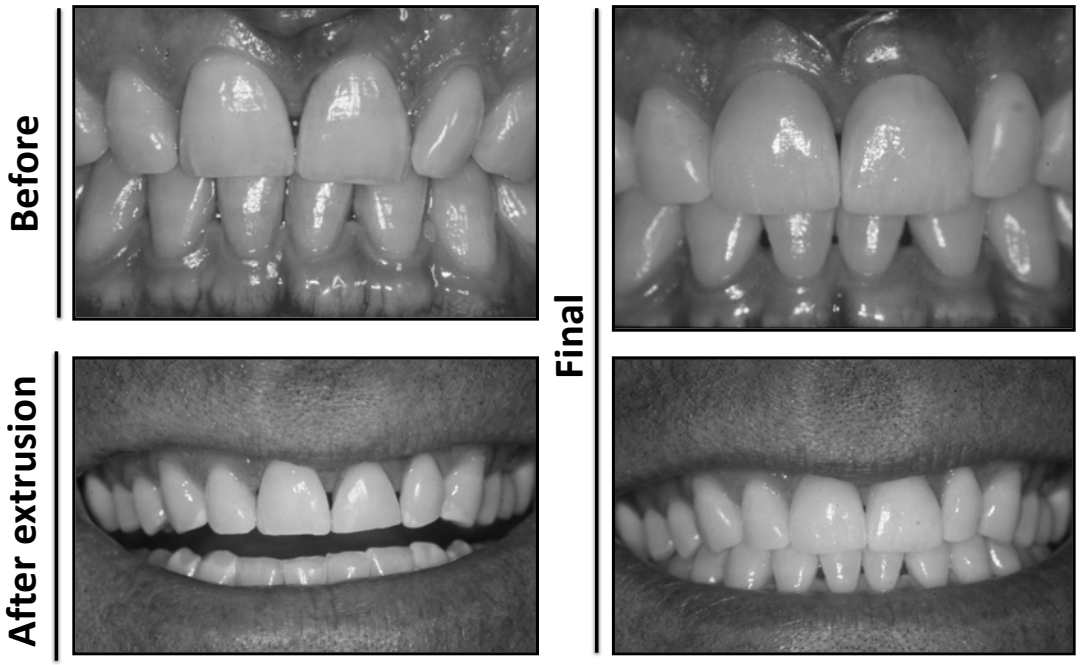
a. Crown lengthening
b. Extraction and implant
c. Orthodontic extrusion

Baseline



3 weeks





Considerations

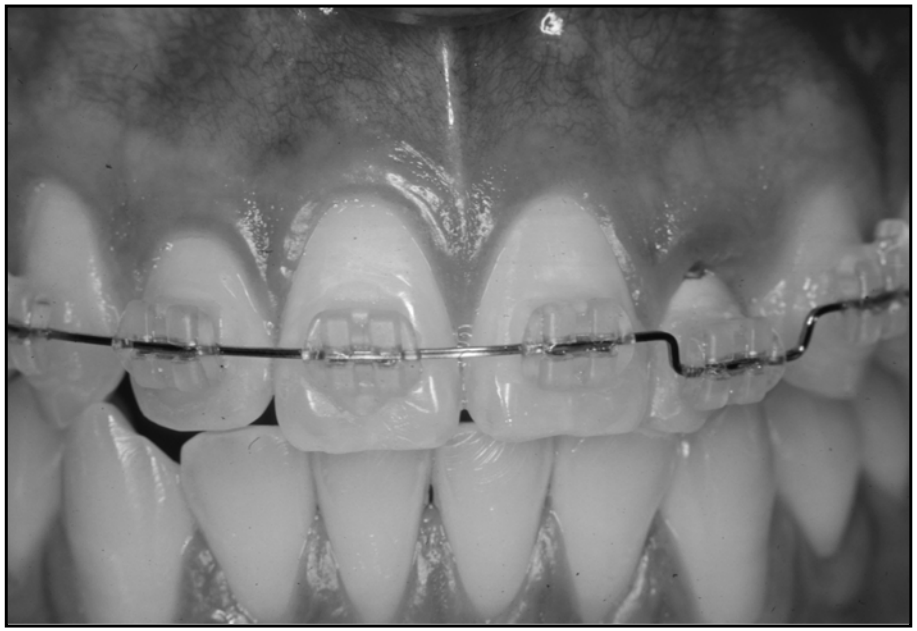
Extruded tooth has a smaller diameter at the gingival margin

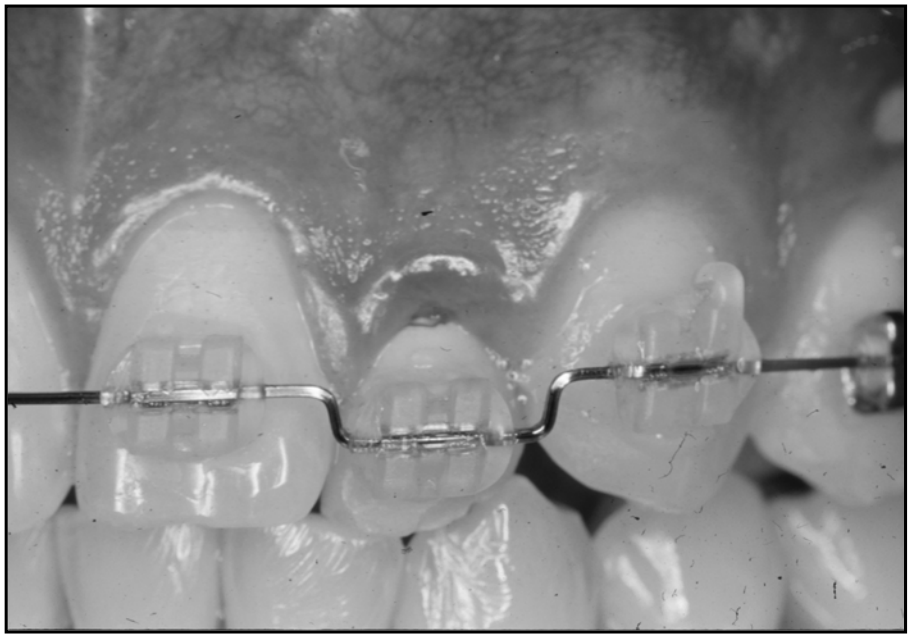
- Requires change in the emergence profile of the final restoration
- In maxillary anterior cases, it often results in in the need to restore both teeth to maximize aesthetic results

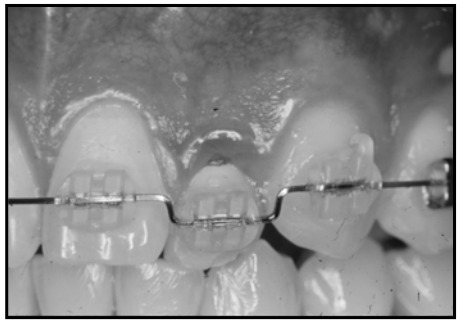
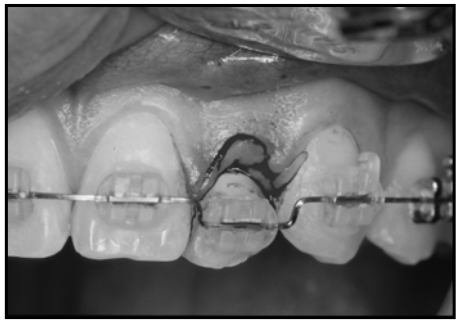
Considerations

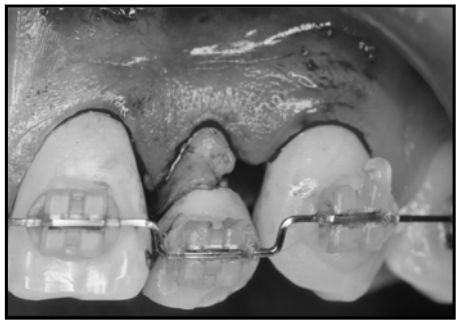
- Tooth vitality
  - Vital pulp
    - Rapid extrusion may result in pulpal necrosis
      - Slow extrusion (i.e., 2-3 mm over 4-8 mos.) will result in the need of a secondary surgical procedure
  - Endodontically treated tooth (most common)
    - No apparent problems

(Oppenheim, AJOOS, 1940, Simon et al, OS, 1980)



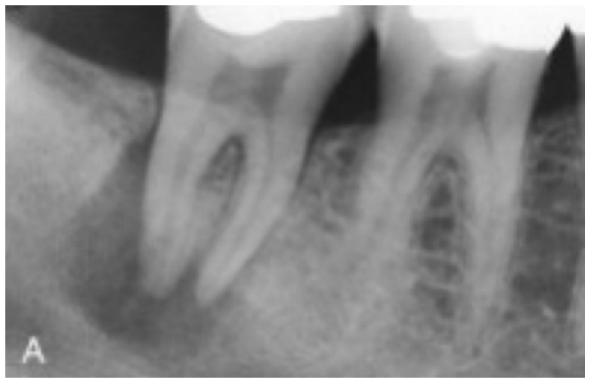


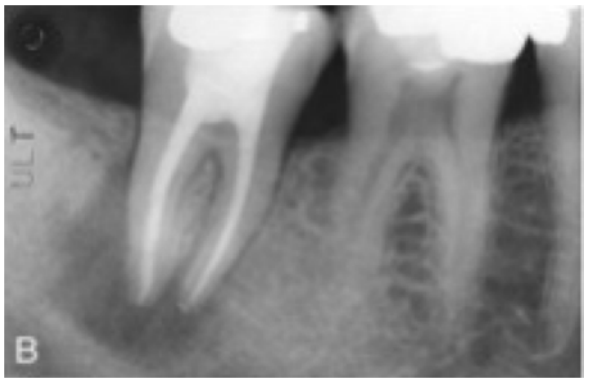






Endodontic Treatment



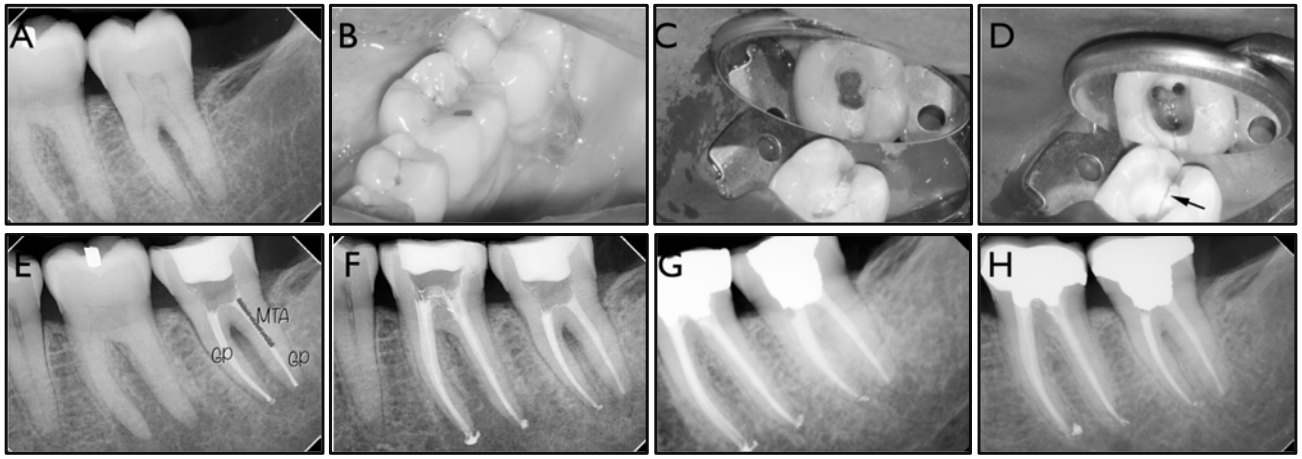
Initial presentation



6 months after endodontic treatment

(Dr. Mo Kang)

Endo-Perio Lesion



- Healthy Patient
- Spontaneous throbbing pain on the LL quadrant with pain exacerbation on pressure
- #19 pulpal necrosis with symptomatic apical periodontitis
- #18 pulpal necrosis with apical abscess

(Case from Dr. Mo Kang and W. Morgan)

Endodontic Treatment vs. Implants

- Academy of Osseointegration Workshop 2006:
- Differences in outcomes of endodontically treated teeth compared to (single tooth) implant supported restoration
- 1797 implant studies
- 430 endodontic studies
- Follow-up of up to:
  - 144 months for implants
  - 300 months for teeth

No difference in implant survival compared to non surgical root canal therapy

Both therapies are excellent treatment modalities

(Iqbal and Kim, Int J of Oral Maxillofac Implants, 2007)

The longevity of Implants and Teeth

- Systematic review to compared implant survival and natural teeth with endodontic or periodontal treatment

- Survival rate:
  - Healthy tooth: 99.5% over 50 years
  - Periodontally compromised: 92-93%
  - Endodontically treated: high
  - Survival rates of implants after 10 years: 82-94%

Natural teeth exceed the life expectancy of implants at a 10 year time point

Similar?

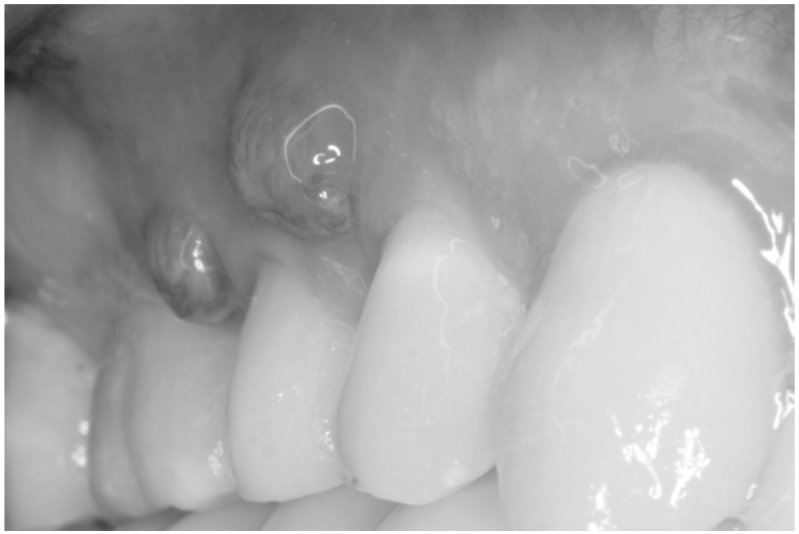
(Holm-Pedersen et al, 2007, Clin Oral Impl Res, 2007)

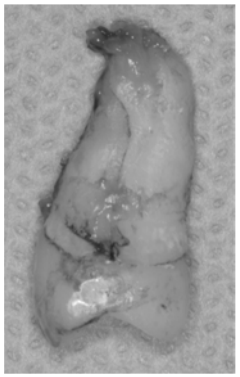
Do I always save teeth?

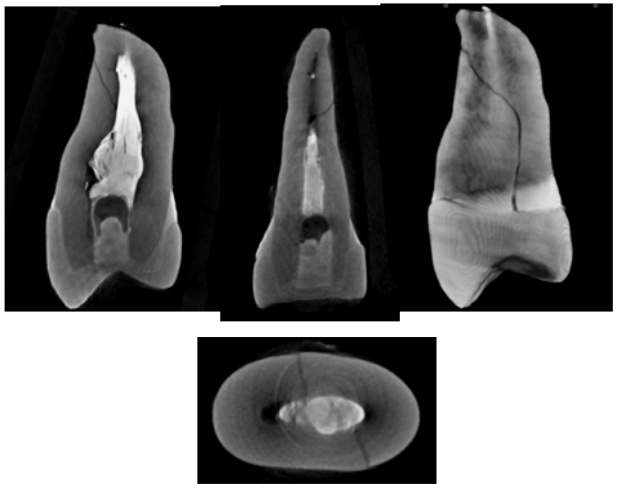
Fractured the lingual cusp
Endodontic treatment

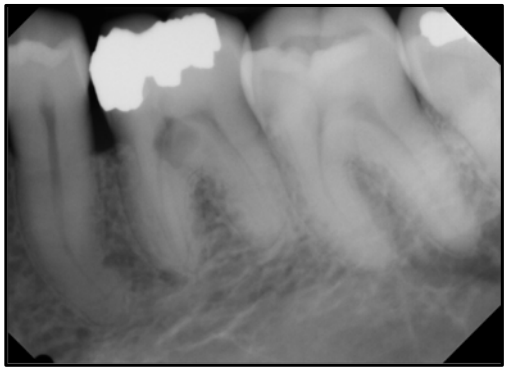
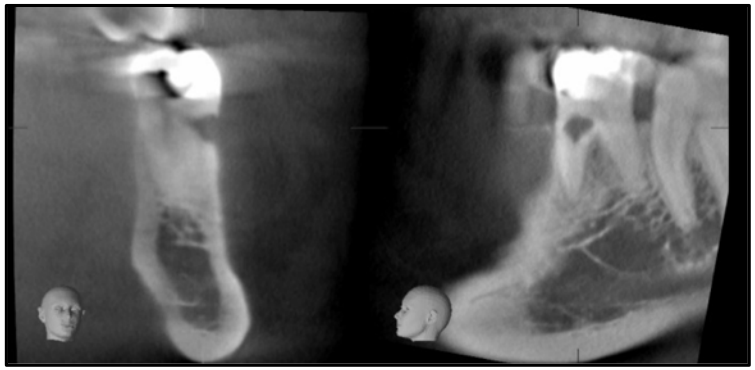
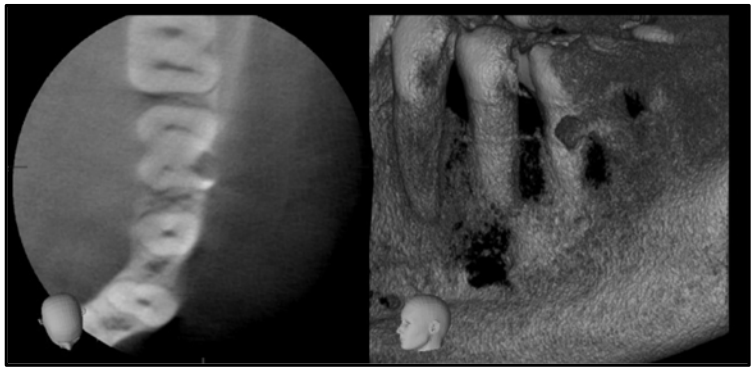
7 months later

8 months later







Decision Making on When to Keep or Extract a Tooth

- Prognosis of the teeth
- Comprehensive treatment plan
- Patient's desire
- Esthetics
- Cost
- Need for additional treatment:
  - Crown lengthening
  - Endodontic treatment

Considerations Prior to Implant Placement

- Patient
  - Expectations
- Site specific conditions
  - Gingival phenotype
  - Need for bone grafting
- Risk of peri-implant mucositis and peri-implantitis
- Importance of maintenance

Summary

The survival of implants, periodontally treated teeth and endodontically treated teeth is very similar

Thank you!

fpirih@dentistry.ucla.edu