Vejle Oktober, 2013

Implant prosthodontic complications and challenges

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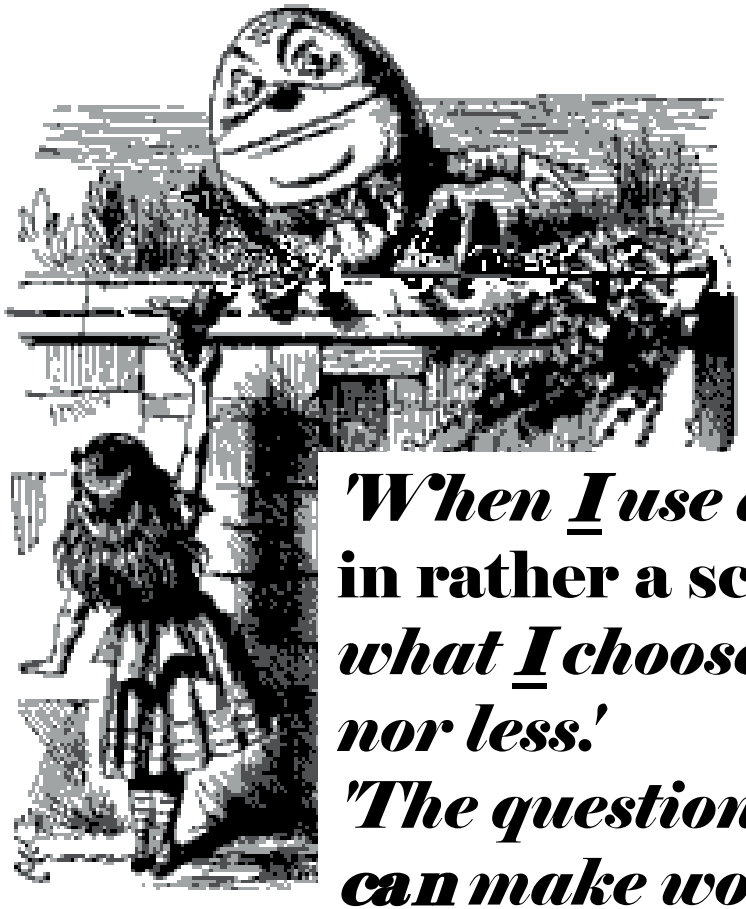


'When I use a word,' **Humpty Dumpty said, in rather a scornful tone,** ***'it means just what I choose it to mean — neither more nor less.'***

'The question is,' **said Alice,** ***'whether you can make words mean so many different things.'***

A WORD OF CAUTION FIRST – WHAT'S IN A WORD?

Complication

Per
Microsoft Thesaurus

- Barrier
- Difficulty
- Hindrance
- Hold-up
- Hurdle
- Impediment
- Obstacle
- Problem
- Setback
- Snag
- Technical hitch
- Tricky situation
- Trouble

«Complication»: the correct definition?

- **Webster's D.:** A disease or diseases, or adventitious circumstances or conditions, coexistent with and <**negatively**> modifying a primary disease, but not necessarily connected with it
- **Oxford D.**: A secondary disease or condition aggravating an already existing one
- **NCBI Pubmed MESH-terms**: Non-existent
- **Glossary of Prosthodontic Terms**: No definition

“A surgical complication” – the debate is still ongoing

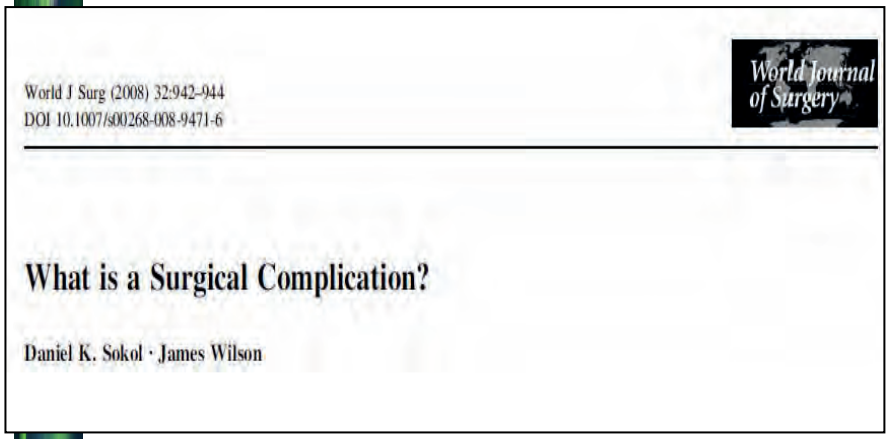

World J Surg (2008) 32:939–941
DOI 10.1007/s00268-008-9584-y

World Journal of Surgery

EDITORIAL

What Is a Surgical Complication?

Daniel Dindo · Pierre-Alain Clavien


World J Surg (2008) 32:942–944
DOI 10.1007/s00268-008-9471-6

World Journal of Surgery

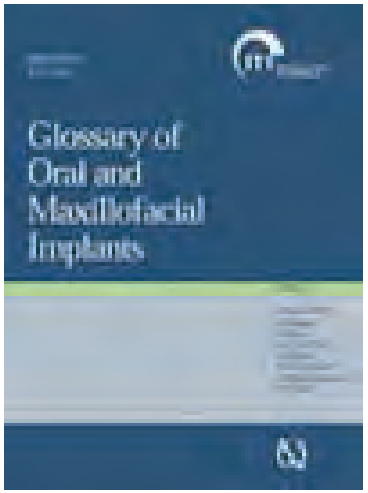
What is a Surgical Complication?

Daniel K. Sokol · James Wilson

Any deviation from the ideal postoperative course that is not inherent in the procedure and does not comprise a failure to cure.

Any undesirable, unintended and direct result of an operation affecting the patient which would not have occurred had the operation gone as well as could reasonably be hoped.

Complications in implant dentistry



<u>Complication</u>: *"An unexpected deviation from a normal treatment outcome"*

Circular logic - what is a *normal* treatment outcome? ..under vastly alternating premises?

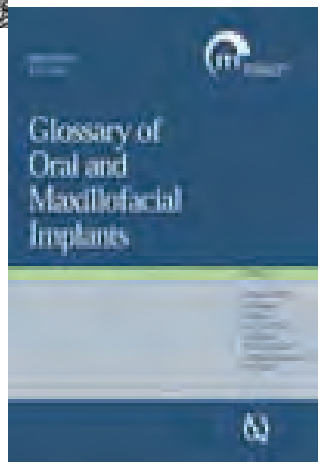
deviation="away from", i.e. includes also "better"

Complications in implant dentistry

at times a term used….

- as a gracious label for what is actually **an adverse outcome of the treatment**?

"Complication" in implant dentistry

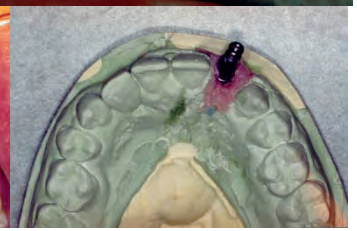


«Esthetic complication»

«Complication caused by the malposition of an implant or by the lack of peri-implant bone or soft tissues.

Such complications can be a major concern for clinicians, since removal of the implant may be required.»

“Esthetic complication” or “adverse outcome”?



Source: Dr M Lin, Toronto

A “complication” or an adverse outcome?

Source: Dr M Lin, Toronto

Complications in implant dentistry

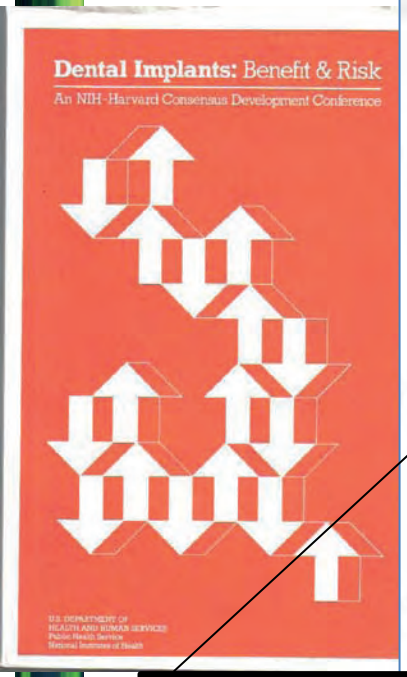
at times a term used….

- as a gracious label for what is actually **an adverse outcome of the treatment**?

«Complications» in the pre-Brånemark era

Blade implant - Mandibular staple bone plate - Subperiostal implant

1980



DATA COLLECTION SHEET--UNILATERAL FREE-END
SUBPERIOSTEAL IMPLANTS--continued

5. Provide scores for the implant, just as was done in item 4 at the following time intervals. Always use data from the last patient visit in the year, regardless of when the implant was done--for example, if a patient was seen in February and October, use the October date.

	Year					
	73	74	75	76	77	78
Mobility						
X-ray						
Gingival health						
Pocket depth						

6. Complications:

__Permanent anesthesia
__Mandibular fracture
__Loss of maxillary alveolar ridge
__Osteomyelitis
__Oroantral or oronasal fistula
__Adjacent teeth affected adversely by implant
__Pain for more than 1 month after insertion
__Systemic infection secondary to implant
__Other (specify) _____
__None

7. If the implant failed, was the patient in worse condition than if the implant had not been placed?

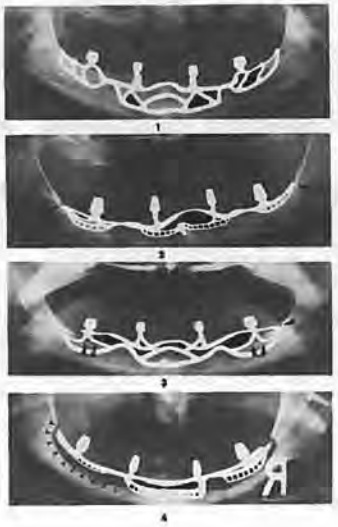
STANDARDIZED SUBPERIOSTEAL IMPLANT EVALUATION CRITERIA

1. Categorize the implant you are evaluating at its worst area according to the criterion numbers for mobility, X-ray, and gingival health. For pocket depth, follow instructions.

Mobility

1 Absolutely immobile
2 Palpable but not visual movement
3 Visually mobile but less than .5 mm total buccolingual movement
4 Greater than .5 mm but less than 1 mm total buccolingual movement
5 Greater than 1 mm total buccolingual movement

RADIOGRAPHIC SCORES



X-ray (Radiograph) (see photographs at right)

1 No evidence of bone loss
2 Bone loss at distal strut evidenced by sinking (implant in contact with bone)
3 Bone loss at distal strut as in type 2 above, but obvious resorption at secondary strut
4 Complete bone loss (no implant-bone contact)

Gingival Health (see photographs, p. 74)

1 No inflammation
2 Marginal inflammation 2 mm or less
3 Inflammation greater than 2 mm but less than 4 mm
4 Inflammation greater than 4 mm and/or fistula

6. Complications:

__Permanent anesthesia
__Mandibular fracture
__Loss of maxillary alveolar ridge
__Osteomyelitis
__Oroantral or oronasal fistula
__Adjacent teeth affected adversely by implant
__Pain for more than 1 month after insertion
__Systemic infection secondary to implant
__Other (specify) _____
__None

«Complications» in the pre-pre-Brånemark era

Source: Monty Python and the Holy Grail (1975)

Complications in implant dentistry

at times a term used….

- as a gracious label for what is actually an adverse treatment outcome?
- without recognizing the connotation of the word in terms of **legal implication, and for regulatory bodies as well as patient complaint agencies** ?

Norsk Pasientskadeerstatning

Tandlægeforeningens Patientforsikring

Kontakt Cookies FAQ Søg

Læs op Kommentar Favorit Print Tip en ven

- Anmeld en skade
- Årsberetninger
- Kontakt os
- Love og regler
- Pjecer
- Om Patientforsikring

Søg

Søg efter: komplikation

Søg

Søger efter "***komplikation***"

Viser resultaterne **1** til **2** ud af **2**

Hvilke skader kan erstattes? 81%

*... Hvis skaden kunne være undgået ved at man havde valgt en anden ligeværdig behandlingsmetode (anden ligeværdig metode). Hvis der er tilstødt en **komplikation**, der er mere omfattende end hvad man som patient med rimelighed må tåle (tålereglen). Specialistreglen Anmeldelsen af en skade vil blive ... og de forventede følger, hvis sygdommen ikke blev behandlet. Desuden skal skaden og de efterfølgende gener også være sjældent forekommende*

Størrelse: 9.0 K - Oprettet: 04-12-12 - Ændret: 04-07-13 11:44

Sti: /For patienter/Hvilke skader kan erstattes?

Kapitel 1 65%

*... eller 4) hvis der som følge af undersøgelse, herunder diagnostiske indgreb, eller behandling indtræder skade i form af infektioner eller andre **komplikation**er, der er mere omfattende, end hvad patienten med rimelighed må tåle. Der skal herved tages hensyn til dels skadens alvor, dels patientens ...*

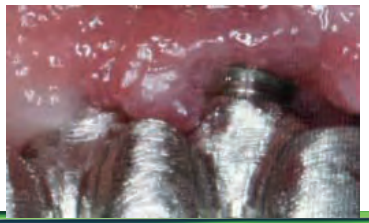
Størrelse: 13.8 K - Oprettet: 19-12-12 - Ændret: 04-07-13 11:44

Sti: /Love og regler/Patientforsikringsloven (PFL)/Kapitel 1

The removal of an implant(s)

- A “complication “?
- A health care failure - “Behandler-svigt ”?
- An unexpected post-treatment inconvenience?
- An adverse outcome?
- Within range of what may occur?
- Professional,
  - underperformance?
  - error?
  - negligence?
- Unexpected, but still within standard of care?

2005.6.10	Extraction all teeth 2Q , periodontitis	Clinician 1 &2
2005.11.4	4 implants, 21, 22, 23, 24 & RPD	
2007.2.21	Healing abutments	
2007.3.6	Xrays, fixture level impressions etc.	Clinician 3
2007.3.23	iFDP Q2, 21-26	



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Clinician 1 &2

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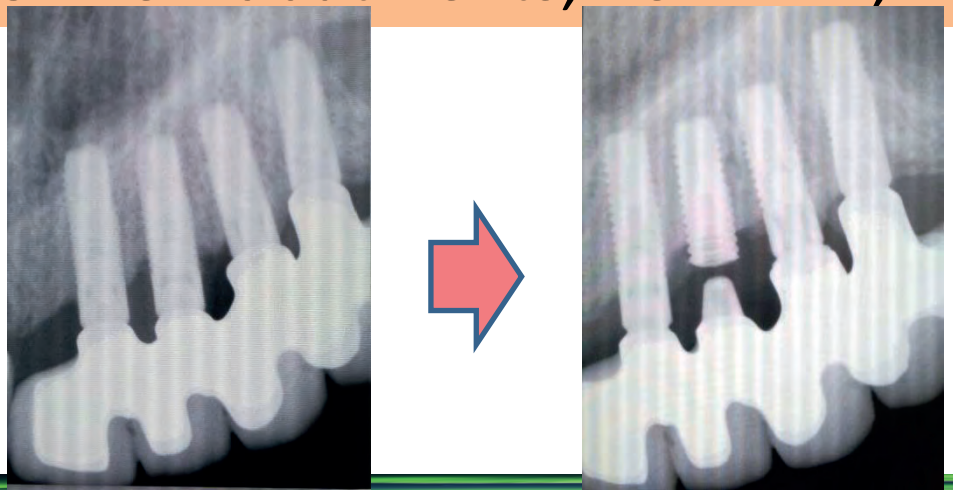
Clinician 3

|

2009.3.31	Screw fractures, bridge 21&24, abutment 22
2009.4.1	New screws. Diagnosed bruxism → splint
2009.9.23	Fractures, bridge screw 21, implant 22
2009.10.23	New abutments, new iFDP, 21-25



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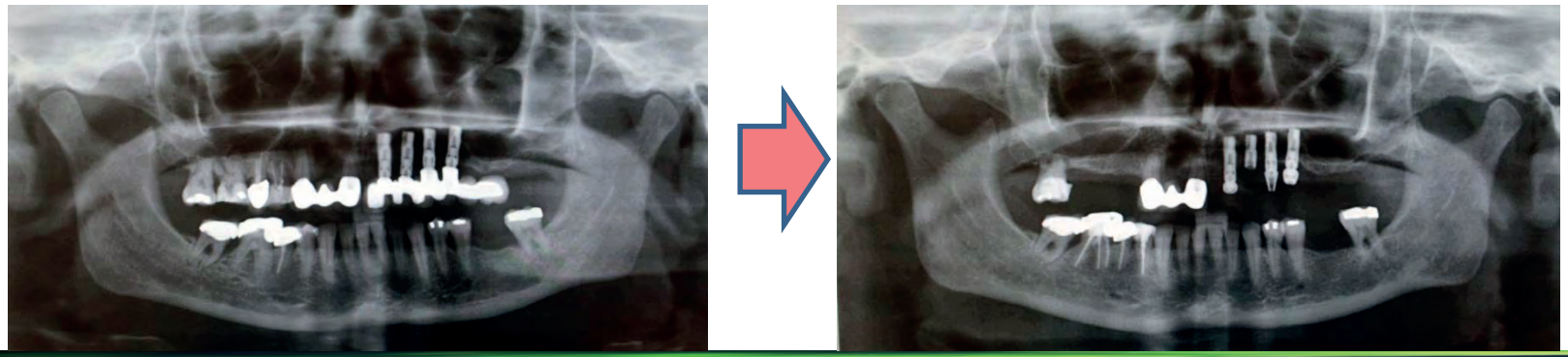
2009.12.8	Fractures, bridge screws 21&24
2009.12.16	New screws&abutments, temporary RDP

Clinician 1 &2

Clinician 3



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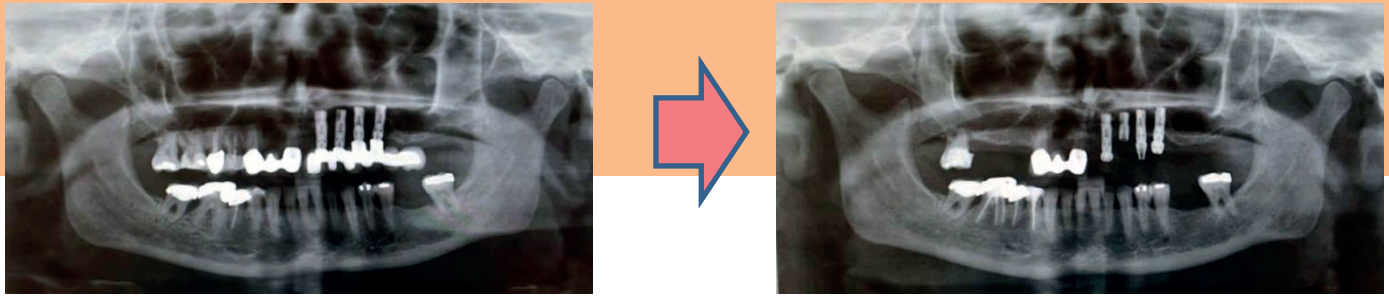
Clinician 3



Clinicians 4,5,6 & 7

2010 – 2012 Second opinions from 4 different dental specialists

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2009.12.8	Fractures, bridge screws 21&24
2009.12.16	New screws&abutments, temporary RDP
2010 – 2012	Second opinions from 4 different dental specialists
2012.6.28	All implants removed
2013. 2.20	Patient claims professional negligence of clinician #3.

Clinician 1 &2

Clinician 3

Clinicians 4,5,6 & 7

Clinician #8

Realistic) treatment objectives must be resolved before therapy

← under given pre-conditions : what is realistic ?→

Adverse ← compromised→ Intended

Minimally acceptable

("ideal" is just a figment of imagination)

Complication

Risk factors for:

A. Complications
B. Adverse outcomes

Complications in implant dentistry

at times a term used….

- as a gracious label for what is actually an adverse treatment outcome?
- without recognizing the connotation of the word in terms of legal implication, and for regulatory bodies as well as patient complaint agencies?
- erroneously to designate a **risk factor** for **complications or adverse outcomes**, e.g., a comorbid condition of the patient

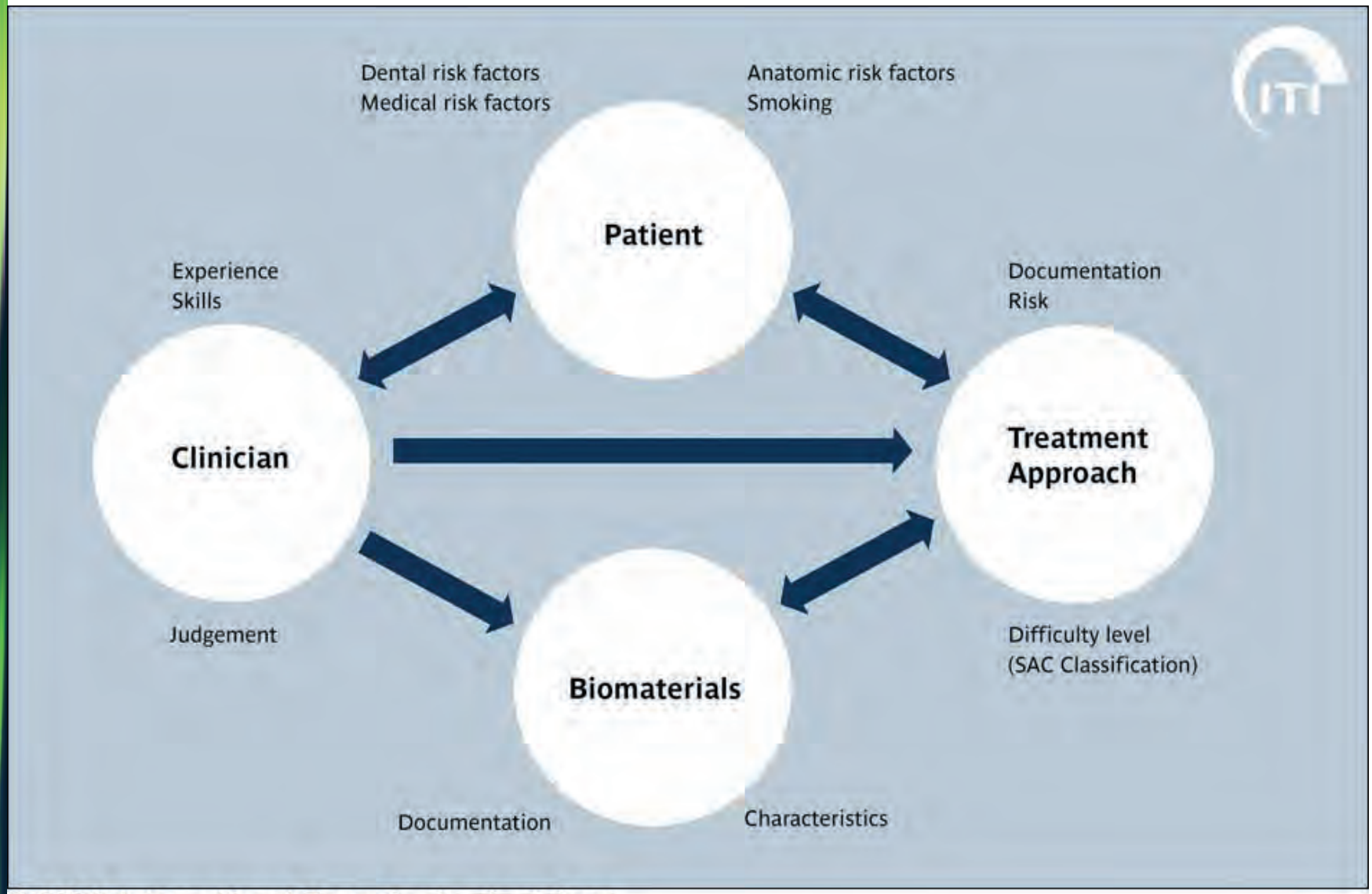
Factors associated with **higher risk** for **complications and adverse outcomes** re. wisdom tooth removal

1. Inadequate clinical examination and diagnosis
2. Underlying systemic disease that may interfere with healing
3. Presence of associated disease
4. Anatomical position of tooth
5. Root morphology
6. Local anatomical relationships
7. Status of adjacent teeth
8. Limited access to operation field
9. Patient cooperation/compliance
10. Bulk and density of supporting bone
11. Ankylosis

The Royal College of Surgeons of England 2007

Factors associated with **higher risk** for **complications and adverse outcomes** related to implant surgery & restoration

All factors influence outcomes



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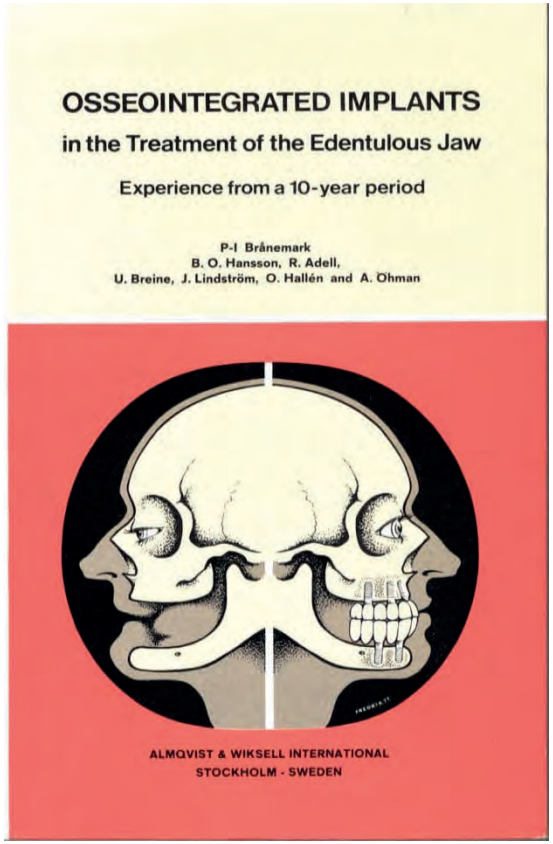
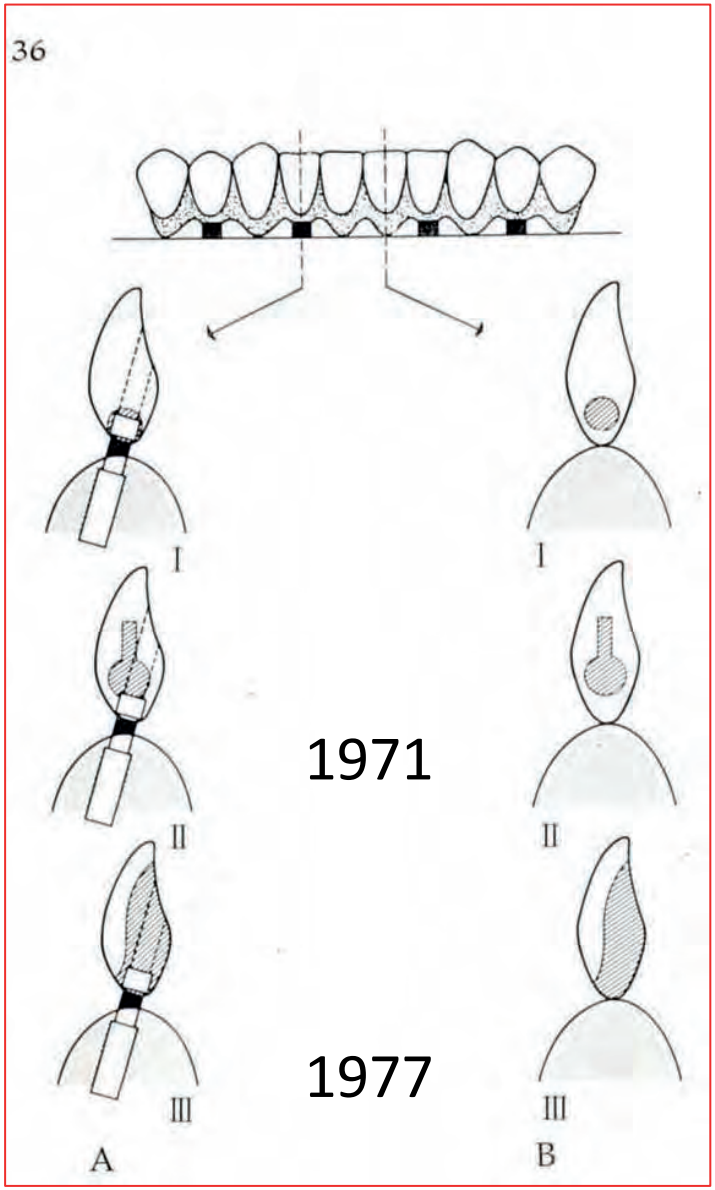
- erroneously to designate a risk factor for complications or adverse outcomes, e.g., a comorbid condition
- that conceals the fact that post-treatment regular maintenance care is necessary to improve the chances of extended clinical performance over a life-time

Treatment outcomes in prosthodontics

- Restore form and function..
  - To last for the rest of the patients life?

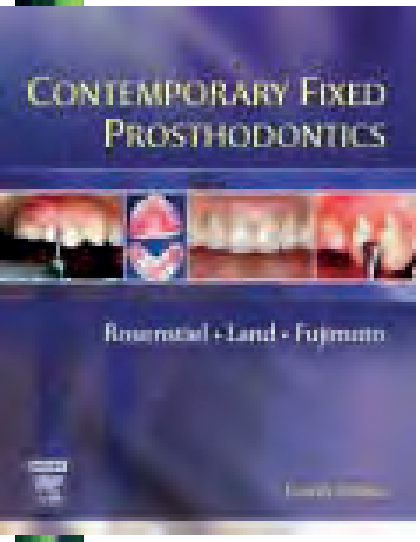
~1965→ Brånemark research group

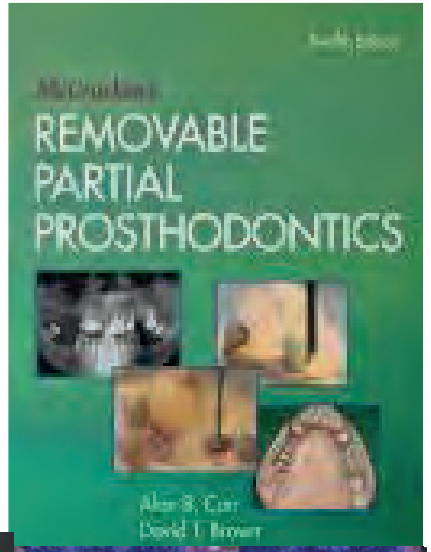




No references to «complication».
Terms used are «clinical course», «bridge function», «biological failures» and «technical failures»

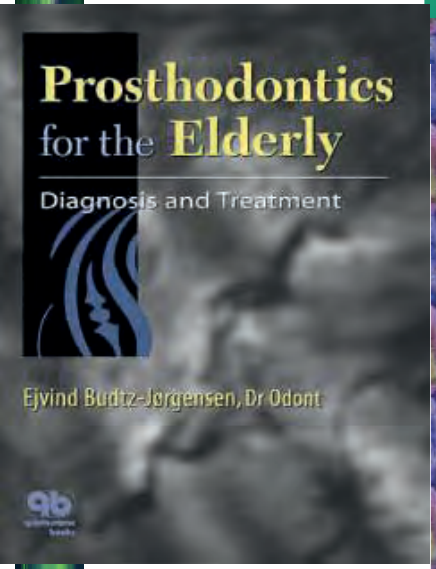
«Complication» as a term is not used in core books in prosthodontics. Chapter titles: «Postoperative (-treatment) / Maintenance care»

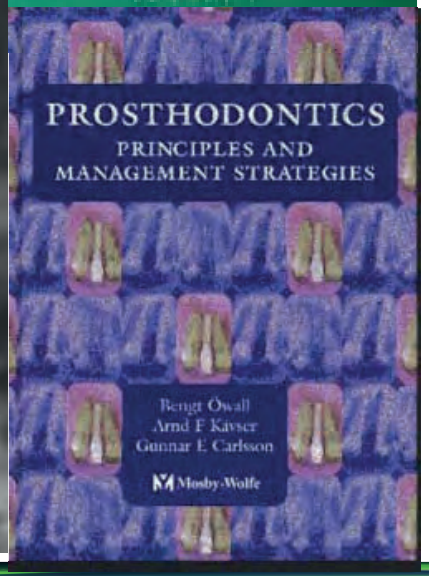


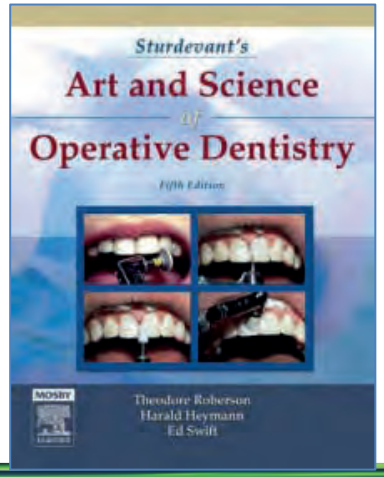


Terms:

«Failure; survival; performance; replacement; discrepancies; longevity»







«problems»

Adverse events necessitating an intervention to conserve or restore

Individual implant(s)

Implant loss

Implant fracture

System Component

- Fracture
- Deformation
- Loosening

Supra-structure

Framework fracture

Deformation

Loosening

Veneer wear

Surface fractures

Persisting pain

Sensory disturbance

Soft tissue

- Swelling
- Hyperplasia
- Fistula
- Suppuration
- Other issues

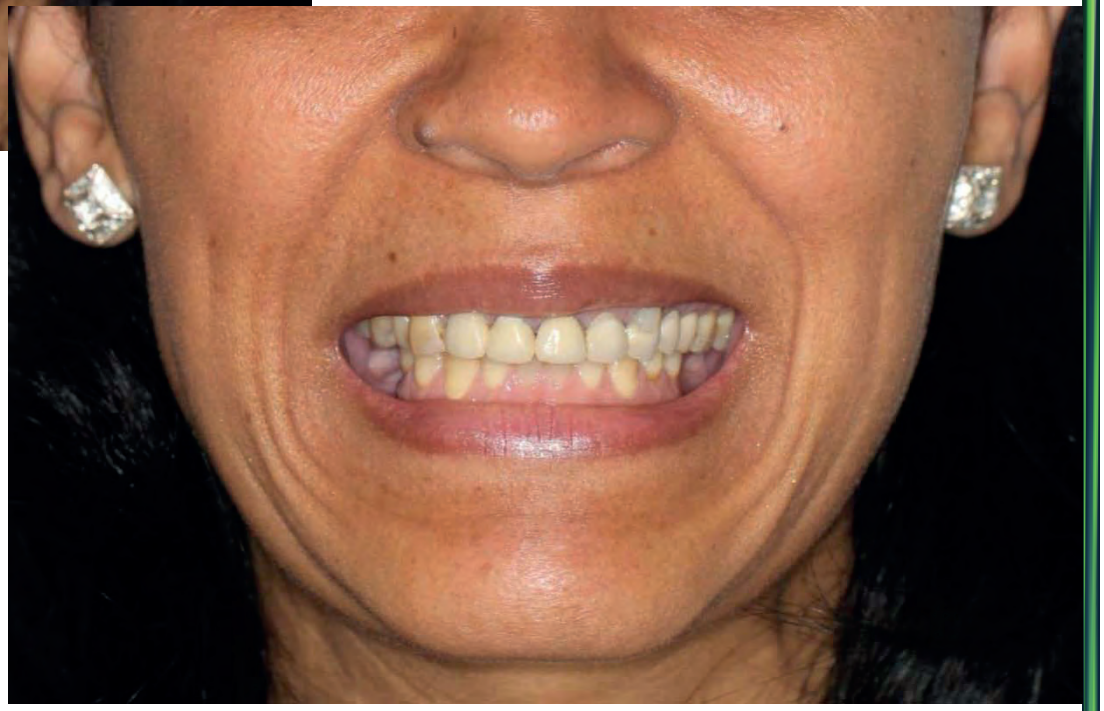
Patient dissatisfaction with

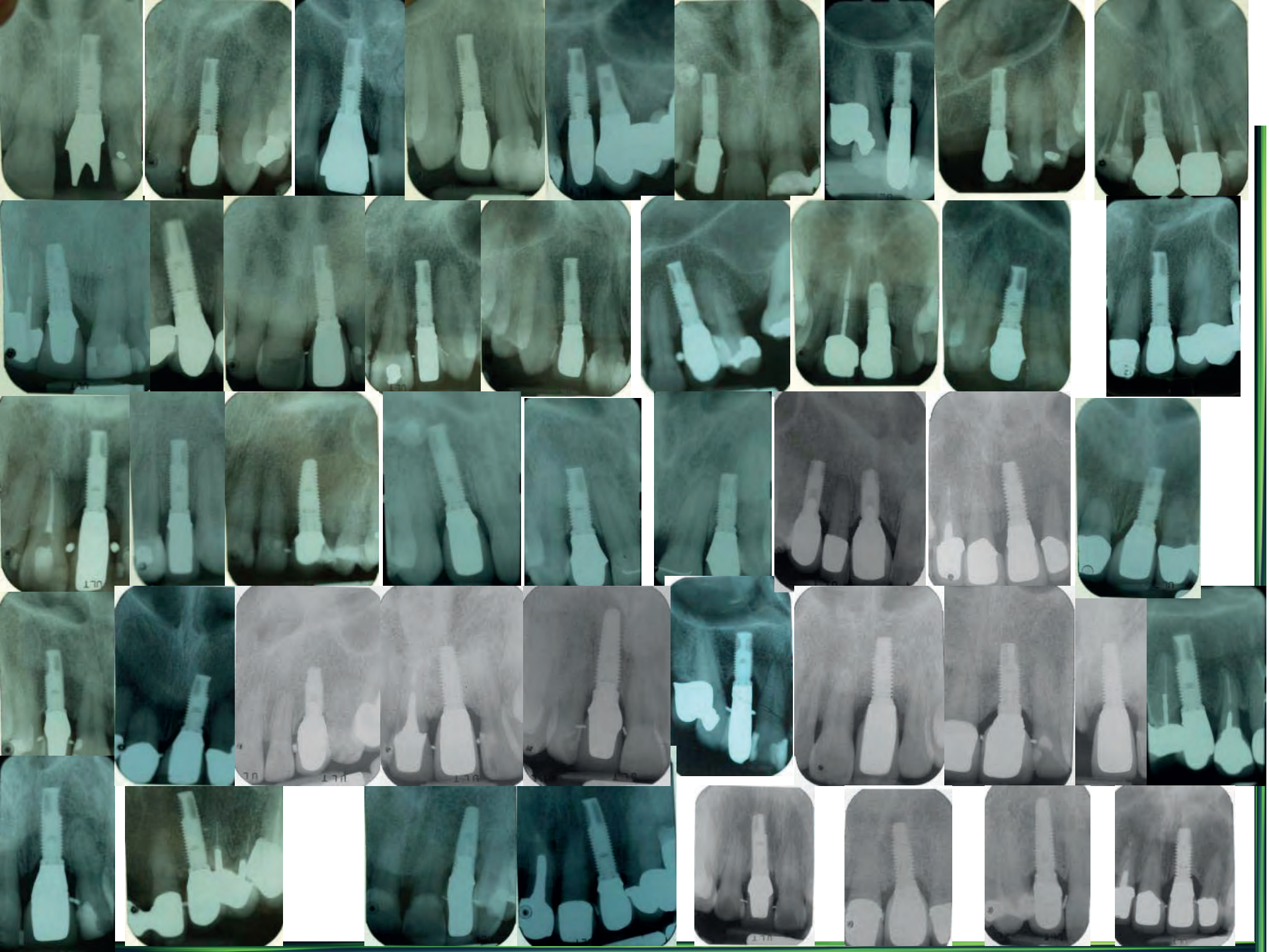
- Esthetics
- Function
  - Speech

Treatment outcomes in prosthodontics

- Restore form and function..
  - To its utmost perfection?
    - According to which criteria – patient or clinician?

Compromised esthetics?



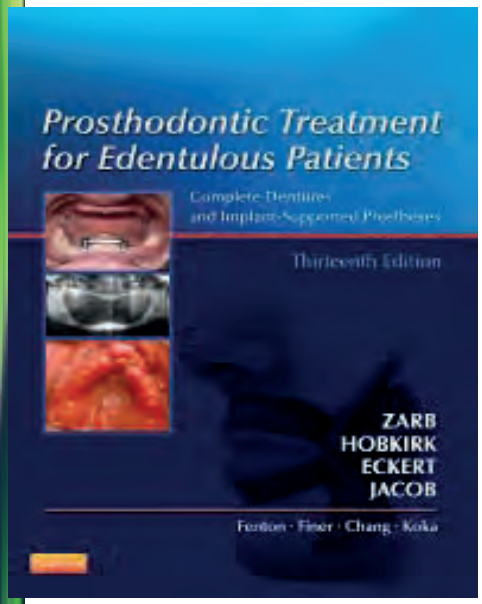


Complications in implant dentistry

at times a term used….

- as a gracious label for what is actually an adverse treatment outcome?
- without recognizing the connotation of the word in terms of legal implication, and for regulatory bodies as well as patient complaint agencies?
- erroneously to designate a risk factor for complications or adverse outcomes, e.g., a comorbid condition
- that conceals that post-treatment regular maintenance care is necessary
- to denote a problem/defect/issue that can be rectified, (in contrast to the non-amendable , i.e., “failure”)

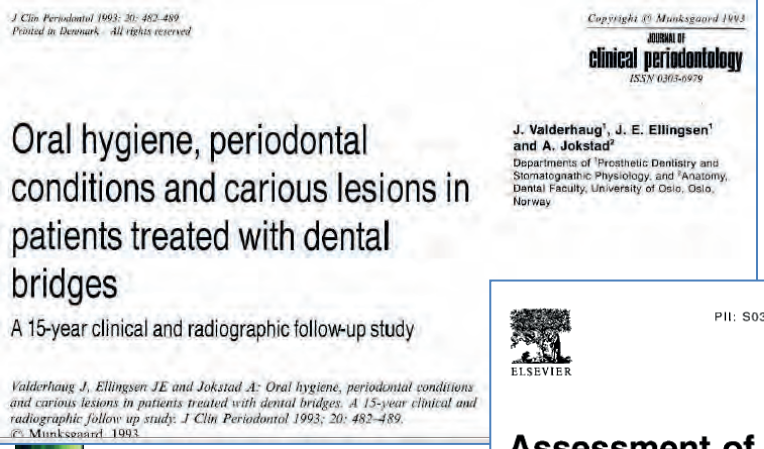
Complications in implant dentistry



13th ed. (2013):

"… is a difficulty resulting from single or multiple factors that demand additional clinical interventions" ……

"….., early versus late …. surgical versus prosthodontic …. biological, structural, functional or esthetic…. minor , moderate or severe…."



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JOURNAL OF clinical periodontology
ISSN 0303-6979

Oral hygiene, periodontal conditions and carious lesions in patients treated with dental bridges

A 15-year clinical and radiographic follow-up study

J. Valderhaug[1], J. E. Ellingsen[1] and A. Jokstad[2]
Departments of [1]Prosthetic Dentistry and Stomatognathic Physiology, and [2]Anatomy, Dental Faculty, University of Oslo, Oslo, Norway

Valderhaug J, Ellingsen JE and Jokstad A: Oral hygiene, periodontal conditions and carious lesions in patients treated with dental bridges. A 15-year clinical and radiographic follow up study. J Clin Periodontol 1993; 20: 482–489.

1993 – no use

0300-5712(95)00076-3

Journal of Dentistry, Vol. 24, No. 5, pp. 309–315, 19

0300-5712/96 $15.00 +

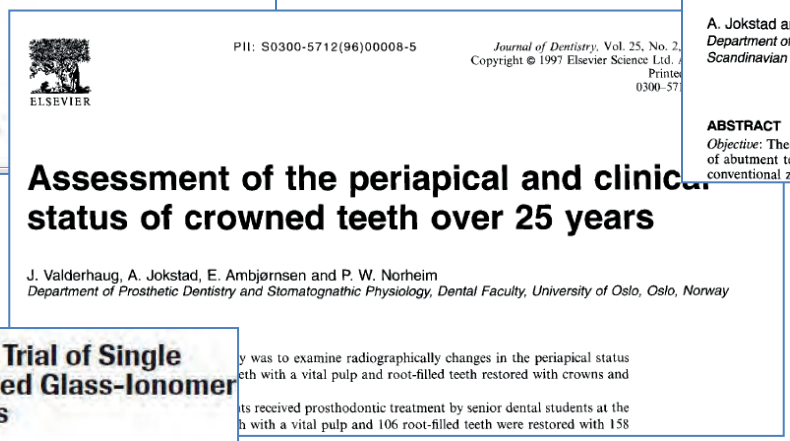
ELSEVIER

Ten years' clinical evaluation of three luting cements

A. Jokstad and I. A. Mjör*
Department of Prosthetic Dentistry and Stomatognathic Physiology, University of Oslo, Oslo, Norway, and NIOM, Scandinavian Institute of Dental Materials, Haslum, Norway

ABSTRACT

Objective: The aim of the present clinical longitudinal study was to observe, over 10 years, the prognosis of abutment teeth restored with fixed prostheses retained by two glass ionomer luting cements and one conventional zinc phosphate cement.



ELSEVIER

PII: S0300-5712(96)00008-5

Journal of Dentistry, Vol. 25, No. 2,

Printe
0300–57

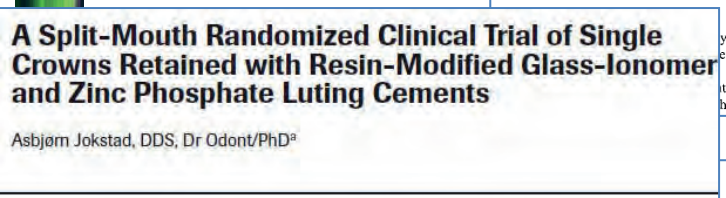
Assessment of the periapical and clinical status of crowned teeth over 25 years

J. Valderhaug, A. Jokstad, E. Ambjørnsen and P. W. Norheim
Department of Prosthetic Dentistry and Stomatognathic Physiology, Dental Faculty, University of Oslo, Oslo, Norway

y was to examine radiographically changes in the periapical status
eth with a vital pulp and root-filled teeth restored with crowns and

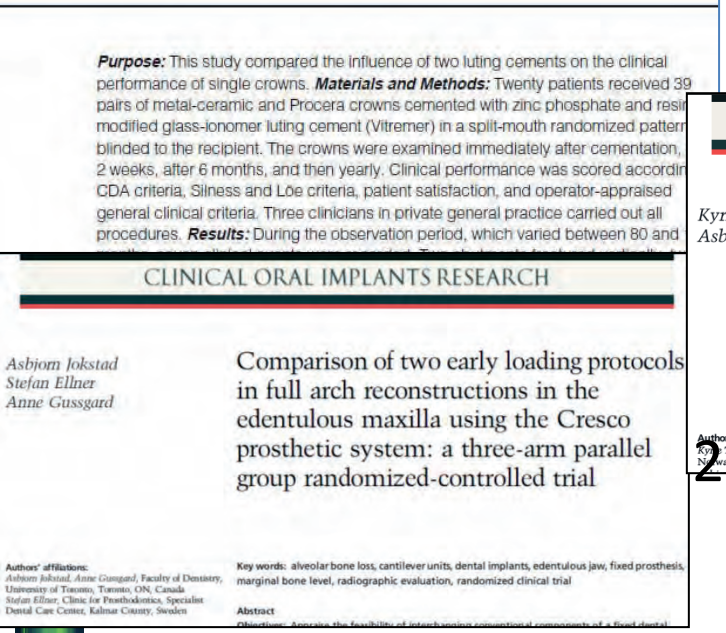
ts received prosthodontic treatment by senior dental students at the
h with a vital pulp and 106 root-filled teeth were restored with 158

1996 – no use



A Split-Mouth Randomized Clinical Trial of Single Crowns Retained with Resin-Modified Glass-Ionomer and Zinc Phosphate Luting Cements

Asbjørn Jokstad, DDS, Dr Odont/PhD[a]



Purpose: This study compared the influence of two luting cements on the clinical performance of single crowns. ***Materials and Methods:*** Twenty patients received 39 pairs of metal-ceramic and Procera crowns cemented with zinc phosphate and resin modified glass-ionomer luting cement (Vitremer) in a split-mouth randomized pattern blinded to the recipient. The crowns were examined immediately after cementation, 2 weeks, after 6 months, and then yearly. Clinical performance was scored accordin CDA criteria, Silness and Löe criteria, patient satisfaction, and operator-appraised general clinical criteria. Three clinicians in private general practice carried out all procedures. **Results:** During the observation period, which varied between 80 and

2004: "Any other adverse events, such as abutment fracture & endodontic or mechanical complications"

CLINICAL ORAL IMPLANTS RESEARCH

Asbjorn Jokstad
Stefan Ellner
Anne Gussgard

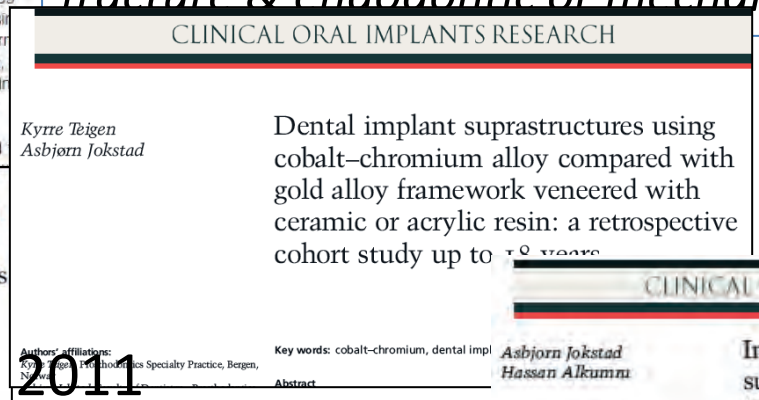
Comparison of two early loading protocols in full arch reconstructions in the edentulous maxilla using the Cresco prosthetic system: a three-arm parallel group randomized-controlled trial

Authors' affiliations:
Asbjorn Jokstad, Anne Gussgard, Faculty of Dentistry, University of Toronto, Toronto, ON, Canada
Stefan Ellner, Clinic for Prosthodontics, Specialist Dental Care Center, Kalmar County, Sweden

Key words: alveolar bone loss, cantilever units, dental implants, edentulous jaw, fixed prosthesis, marginal bone level, radiographic evaluation, randomized clinical trial

Abstract

2011



CLINICAL ORAL IMPLANTS RESEARCH

Kyrre Teigen
Asbjørn Jokstad

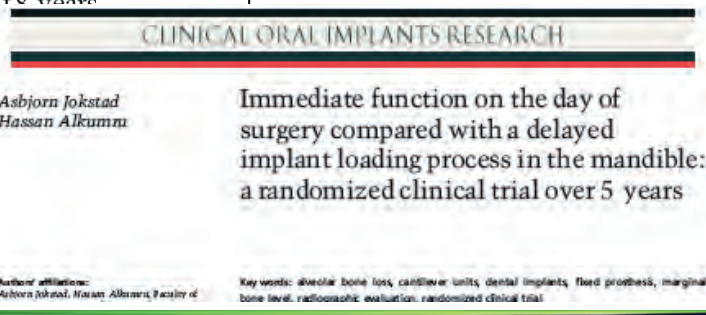
Dental implant suprastructures using cobalt–chromium alloy compared with gold alloy framework veneered with ceramic or acrylic resin: a retrospective cohort study up to

Authors' affiliations:

Key words: cobalt–chromium, dental impl

Abstract

2013



CLINICAL ORAL IMPLANTS RESEARCH

Asbjorn Jokstad
Hassan Alkumru

Immediate function on the day of surgery compared with a delayed implant loading process in the mandible: a randomized clinical trial over 5 years

Authors' affiliations:
Asbjorn Jokstad, Hassan Alkumru, Faculty of

Key words: alveolar bone loss, cantilever units, dental implants, fixed prosthesis, marginal bone level, radiographic evaluation, randomized clinical trial

Complication

- Barrier
- Difficulty
- Hindrance
- Hold-up
- Hurdle
- Impediment
- Obstacle
- Problem
- Setback
- Snag
- Technical hitch
- Tricky situation
- Trouble

Defect

- Breakdown
- Collapse
- Deficiency
- Failing
- Fault
- Flaw
- Imperfection
- Shortcoming

Maintenance

- Care
- Conservation
- Looking after
- Preservation
- Repairs
- Safeguarding
- Upholding

Per
Microsoft Thesaurus

Realistic) treatment objectives must be resolved before therapy

← under given pre-conditions : what is realistic ?→

Adverse ← compromised→ Intended

Minimally acceptable

("ideal" is just a figment of imagination)

Complication

Risk factors for:

A. Complications
B. Adverse outcomes

Prosthodontic care and Prognosis

Odontologi 2002, p139

Prognose for oral protetikk
– hva skal vi fortelle pasienten?

ASBJØRN JOKSTAD OG JON ØRSTAVIK

Det er vanskeligt at spå – især om Fremtiden.
Storm-P

Innledning

Prognose – fra gresk *pro gnosis* – kan bokstavelig oversettes som forut-kunnskap eller forut-erkjennelse. Uttrykket anvendes innen mange ulike fagområder hvor man ønsker å beskrive sannsynlig utvikling av ulike tilstander. I medisinsk sammenheng ble begrepet tatt i bruk på 1600 tallet som uttrykk for den forventede utvikling av en sykdomstilstand, basert på sykdommens generelle natur og på dens symptomatologi i det enkelte kasus. I dag kan forløpet av de aller fleste sykdomstilstander påvirkes i betydelig grad av våre behandlingsvalg, og uttrykket spesifiseres ofte ved å knytte det ikke bare til sykdommen, men også til terapivalg.

Fra diagnose til terapi, fra terapi til prognose

Protetisk tannbehandling er karakterisert ved enkelte hovedtrekk som gjør applikasjon av prognosebegrepet i tradisjonell medisinsk forstand komplisert:

- For det første benyttes proteser som erstatning for tenner hos pasienter med et vidt spektrum av bakenforliggende årsaker

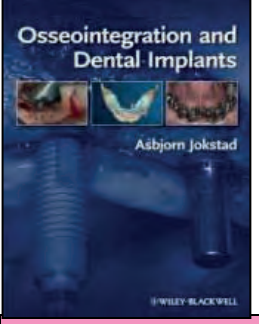
1. Hva vil skje med kvaliteten av restvevet, inklusive eventuelt rettannsettet, med eller uten protetisk behandling?

2. Hvordan vil funksjoner tilhørende det stomatognatiske systemet endres med eller uten protetisk behandling?

3. Hvordan vil pasientdefinerte kriterier, eksempelvis estetikk, funksjon, komfort endres med eller uten protetisk behandling?

4. Hva vil skje videre med en eventuelt eksisterende protese med eller uten videre behandling?

LIKELY ROOT CAUSE IN THE TREATMENT PROCESS CHAIN FOR A COMPLICATION AND/OR SUBSEQUENT ADVERSE OUTCOME



Likely root cause in the treatment process chain for a **complication** and/or subsequent **adverse outcome**

Planning phases

Interventions

Biomaterials

Patient centered considerations

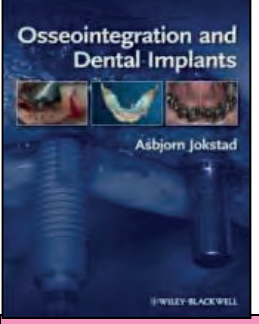
Planning Total Strategy

Diagnostic 1

Risk-factors 1

Patient Communication 1

- Lack of vertical space
- Bruxism
- Antagonist occlusion



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Patient Communication 1

Surgery phase planning

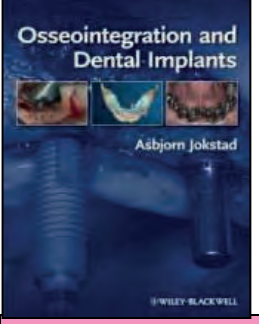
Site-optimizing 2
Grafting-material 1
Implant surgery 3
Implant system 2

Patient Communication 2

↑Force→sub-fracture/»flowering»

Hemorrhage
Infection
Delayed wound healing

- Unfavorable implant placement or alignment
  - Nerve damage, sinus perforation, adjacent tooth, submandibular space
- Lack of primary stability →
  too much countersinking
  left with inadequate stability
- Bony dehiscence / fracture
- Excessive temperature (irrigation / hard vz. bone drilling protocol)



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Implant surgery 3

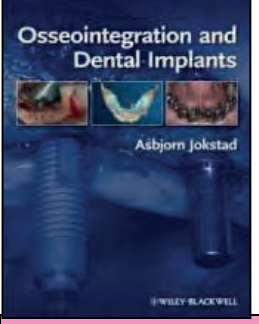
Implant system 2

Patient Communication 2

Biological response 2

- Swelling & Ecchymosis
- Wound infection/fistula
- Suture remnants
- Wound dehiscence
- Implant exposure

- No osseintegration
  1. Operator-factors
  2. Patient-factors
  3. Material-factors



Likely root cause in the treatment process chain for a **complication** and/or subsequent **adverse outcome**

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Grafting-material 1

Implant surgery 3

Implant system 2

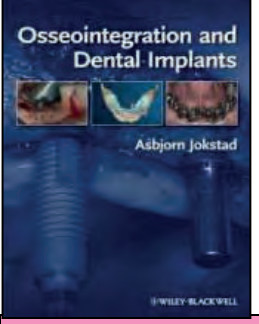
Biological response 2

Patient Communication 2

Restorative phase planning

Patient Communication 3

Sleeper due to unfavorable implant placement/alignment



Likely root cause in the treatment process chain for a **complication** and/or subsequent **adverse outcome**

Planning phases

Interventions
Biomaterials

Patient centered considerations

Planning Total Strategy

Diagnostic 1

Risk-factors 1

Patient Communication 1

Surgery phase planning

Site-optimizing 2
Grafting-material 1
Implant surgery 3
Implant system 2

Biological response 2

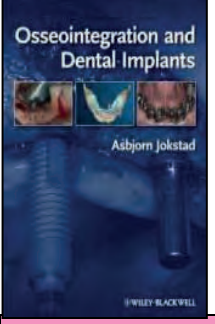
Patient Communication 2

Restorative phase planning

Hard & soft tissue restorative 4
Abutment 3
Supra-construction 4

Patient Communication 3

- Abutment connection problem due to unfavorable implant placement/alignment
- Compromised supra-construction design due to lack of VDO
- Ill-fitting implant system components



Where in the implant treatment process is the likely root cause for an **ensuing complication or later adverse outcome**?

Planning phases

Interventions

Biomaterials

Patient centered considerations

Planning Total Strategy

Diagnostic 1

Risk-factors 1

Patient Communication 1

Surgery phase planning

Site-optimizing 2

Grafting-material 1

Implant surgery 3

Implant system 2

Patient Communication 2

Biological response 2

Restorative phase planning

Hard & soft tissue restorative 4

Abutment 3

Supra-construction 4

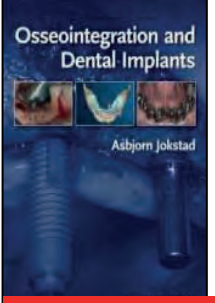
Patient Communication 3

Clinical outcomes & events 3

Maintenance & Post-operative interventions

Early post-insertion:

- Soft tissue inflammation / hyperplasia
  - access for oral hygiene
  - ill-fitting components
- Speech problems
- Cosmetic dissatisfaction
- Food entrapment



Where in the implant treatment process is the likely root cause for an ensuing complication or **later adverse outcome**?

- Soft tissue inflammation / hyperplasia / recession
- Loosening of implant system & supraconstruction components*
- Defects of implant system & supraconstruction components*
- Pain development
- Loss of implant
- Surface wear
- Screw hole empty
- TMD-TMJ

*supraconstruction, bridge screw, abutment screw, abutment, implant

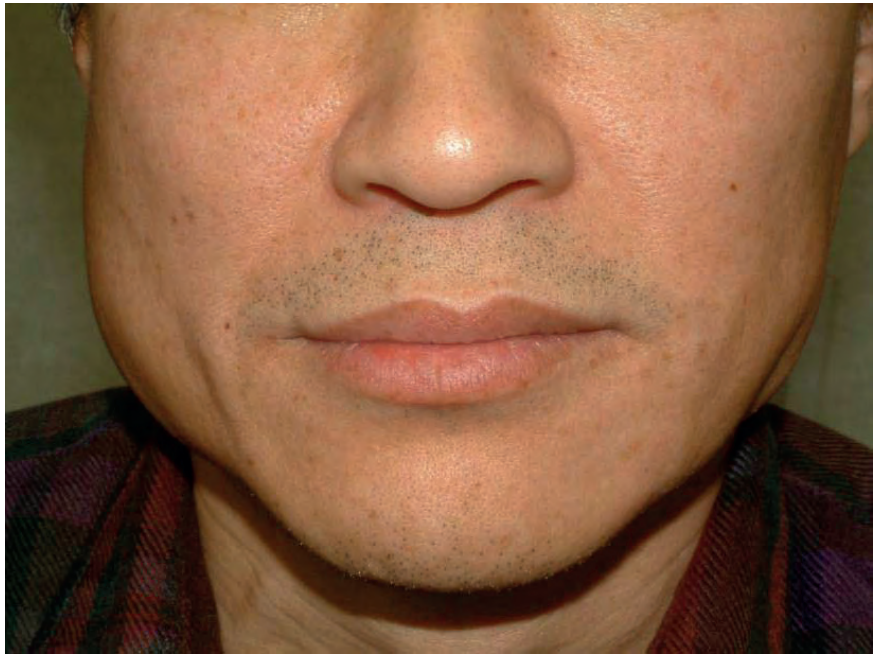
Maintenance & Post-operative interventions

REDUCING THE RISK FOR ADVERSE EVENTS

Do you want to avoid this?

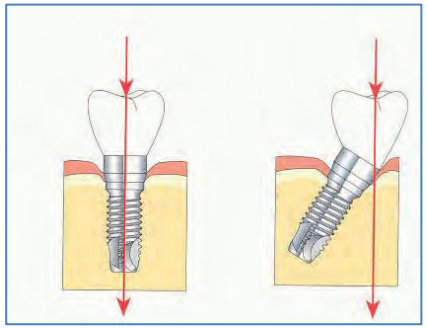
Source: Dr M Lin, Toronto

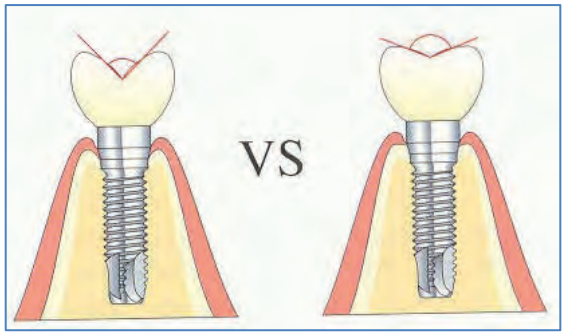
..then stay away from these guys!

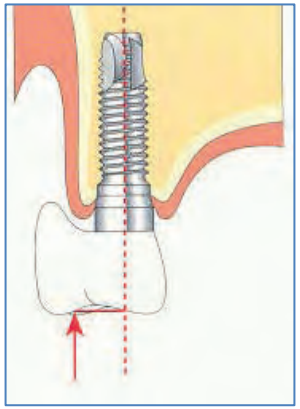


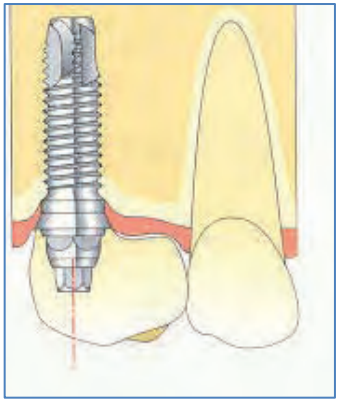
Source: Dr M Lin, Toronto

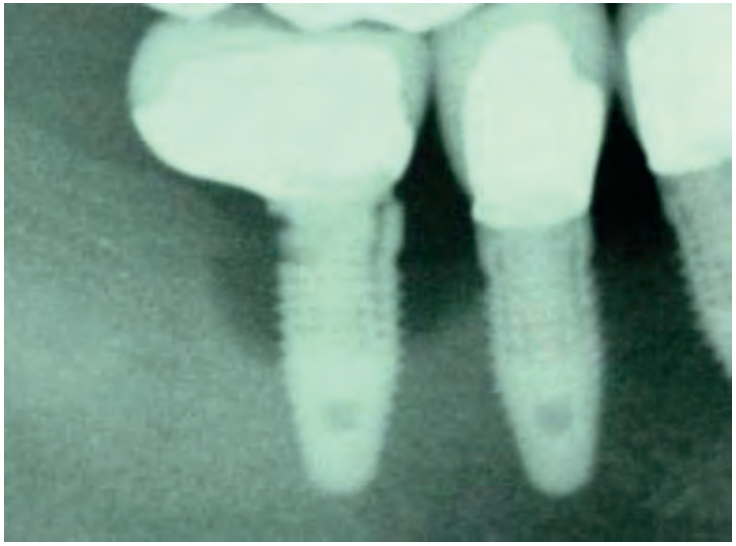
..and don’t beg for mechanical problems!

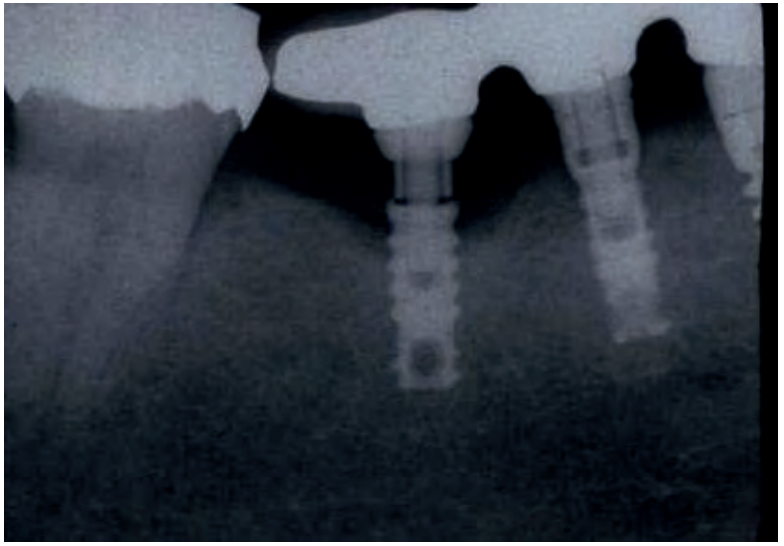












The optimal design for an FDP?

Excellent marginal fit
Withstand occlusal forces
Minimal biofilm formation
Access for oral hygiene
Satisfactory aesthetics



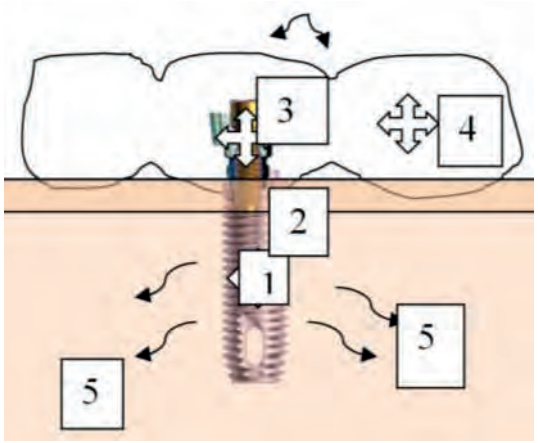


The optimal design for an iFDP?

What research data exist to establish an estimation of long term clinical function of iFDPs depending on design and combination of biomaterials?

Research for optimal design of iFDPs?

- Major emphasis on laboratory studies
- Focus on casting precision and fit to implant platforms
- Biomechanical model estimates of how supra-structure loading generate stress in:
  1. the implants
  2. the implant system components
  3. the abutment(s)
  4. the framework
  5. the bone



- Hardly any biomechanical theories have been confirmed by clinical outcomes (Bryant et al. 2007).

Guidelines for optimizing the iFDP designs are mostly empirical based

- Favourable distribution of retainers
- Framework connectors minimum 5 mm height x 4 mm width
- Freedom in centric occlusion
- Even anterior and posterior occlusal contacts
- Maxillary anterior palatal surfaces shaped to create axial load direction and to guide lateral movements
- Minimal anterior overbite and overjet
- Posterior occlusion shaped to guide occlusal forces in axial directions
- Limited steepness of cuspal inclines
- No contacts on cantilevers

Effect of composition of alloys?

Which metallic materials are currently available on the market for fabricating implant-retained FDP frameworks?

Dental Casting alloys

Au-alloy +
(Acrylic)

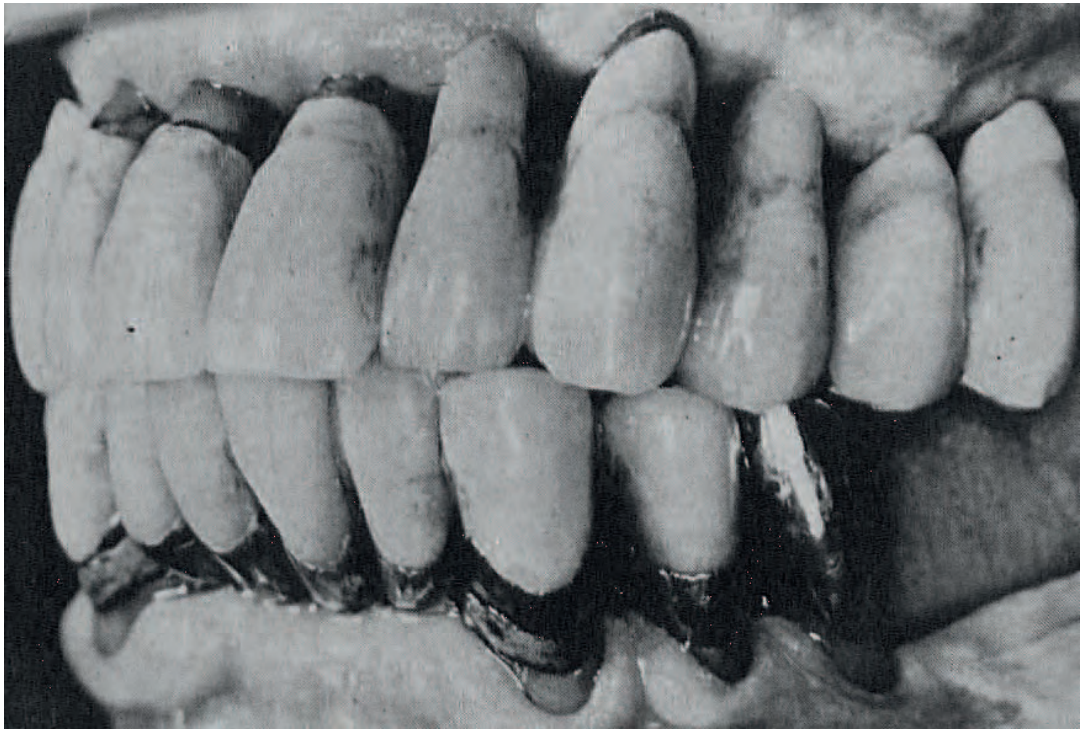
Traditional Classification from 1932

TYPE HARDNESS		USE
I	SOFT	Single surface restoration
II	MEDIUM	Inlays, onlays
III	HARD	Onlays, crowns, Short span FDPs
IV	EXTRA HARD	Post/cores; Long span FDPs, RPDs

1960 1970 1980 1990 2000 2010

Gold casting alloy+Acrylic FDPs

- Highly successful periodontal-prosthodontic FDPs with 20 years+ clinical follow-ups
- Göteborg University, Sweden
- Type 3 Au alloy+ Acrylic Resin

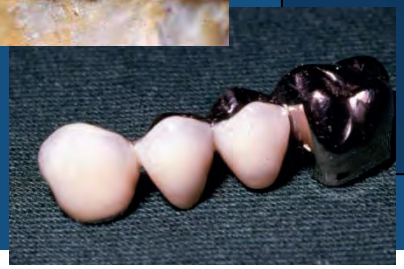


Restored 1969/73. Reports by: Nyman & Lindhe & Lundgren

Ceramic veneering of casting alloys

Au-alloy (Acrylic)

1956/1963: Au-Pt-Pd



Metal-ceramic alloys; new requirements:

- Higher fusion temperature: 165-280^{o} C higher than the ceramic sintering temperature
- Coefficient of thermal expansion near that of ceramic (7-8x10^{-6}/°C)
- The ability to form an oxide layer to provide a strong bond to the ceramic

1960 1970 1980 1990 2000 2010

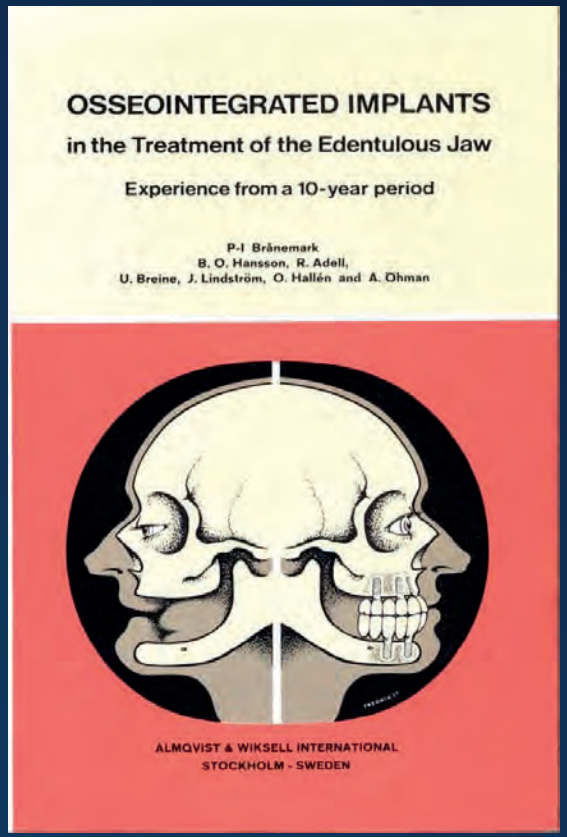
Casting alloys for veneering

Au-alloy (Acrylic)

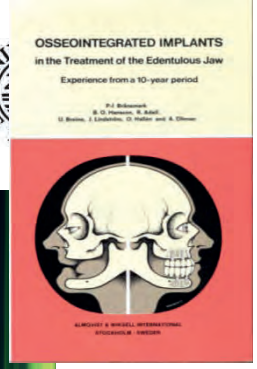
1956: Au-Pt-Pd

Cast Co-Cr-(Acrylic)

~1965→ Brånemark research group



1960 1970 1980 1990 2000 2010



~1965→ Brånemark research group

"High core strength while facilitating anticipated modifications of the supra-structure during the implant technology development"

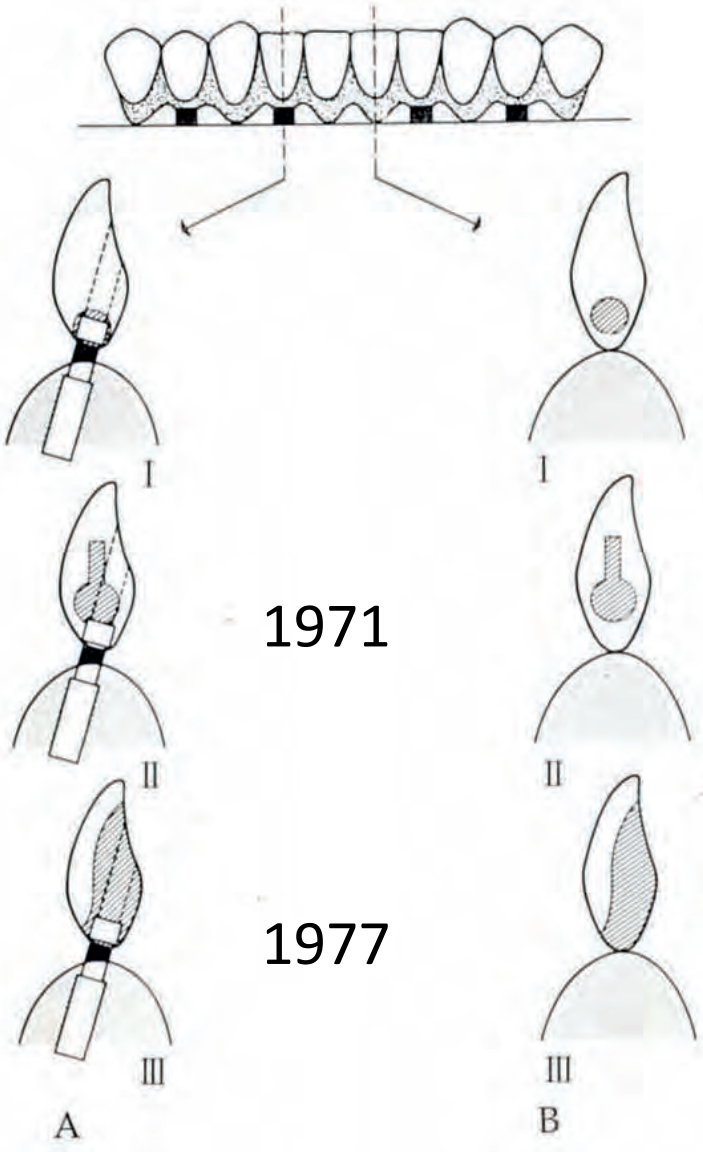
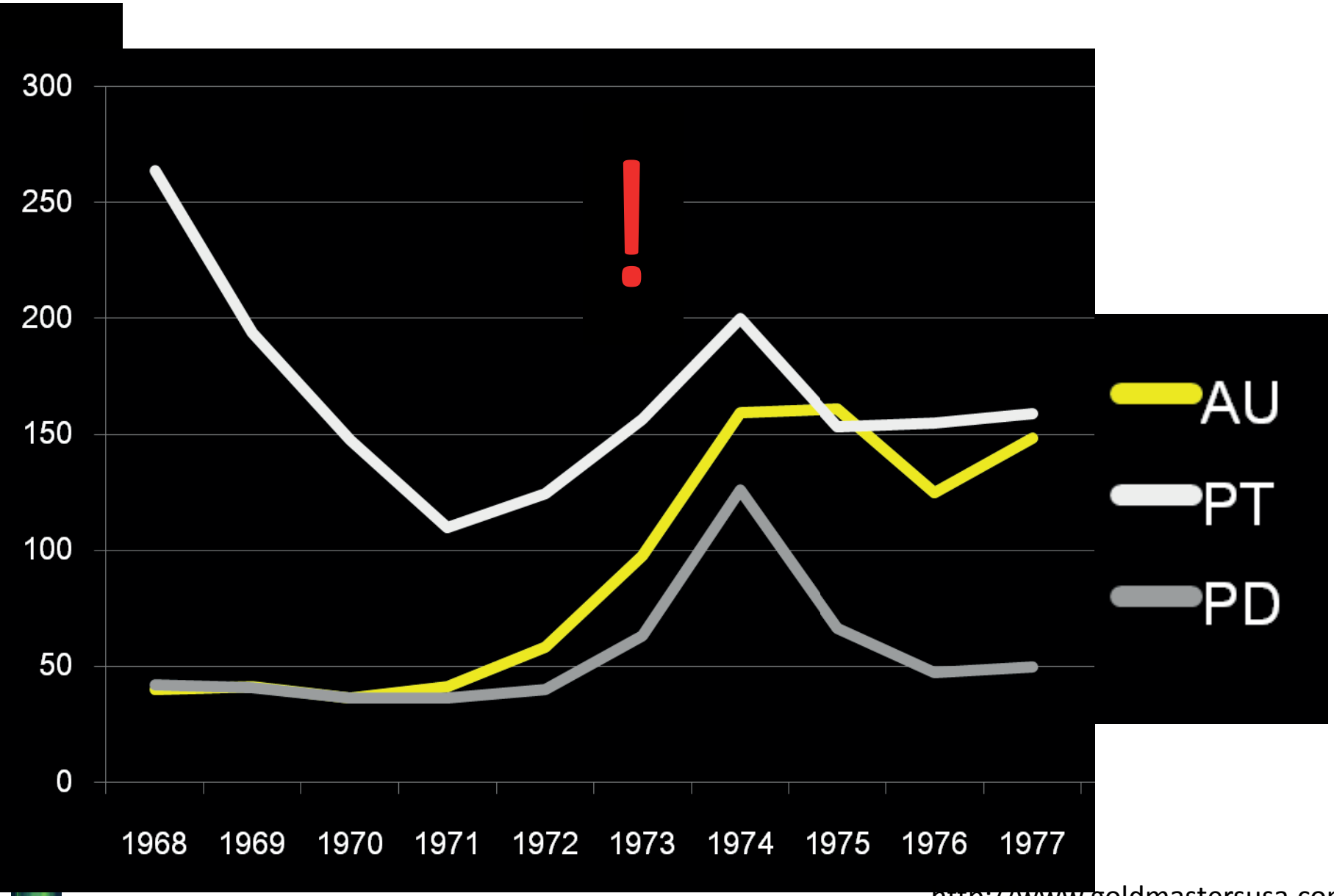


Fig. 21. Three bridge designs used in the methodological development. A) Design at abutments. B) Design at pontics. I and II were used during the initial and development project periods. I) Thin chrome-cobalt-molybdenum bar soldered to abutment attachment cylinders with acrylic teeth in an acrylic base. II) is constructed mainly as I), but with a more sturdy bar. III) Conventional bridge design consisting of a gold base with acrylic or porcelain facings.

Costs of precious metals, mid-70'ies



http://www.goldmastersusa.com

Casting alloys for veneering end-70'ies

Au-alloy (Acrylic)

Au-Pt-Pd

1977:
Au-Pd

1974:
Pd–Ag/Ag-Pd

Cast Cobalt-Chromium-(Acrylic)

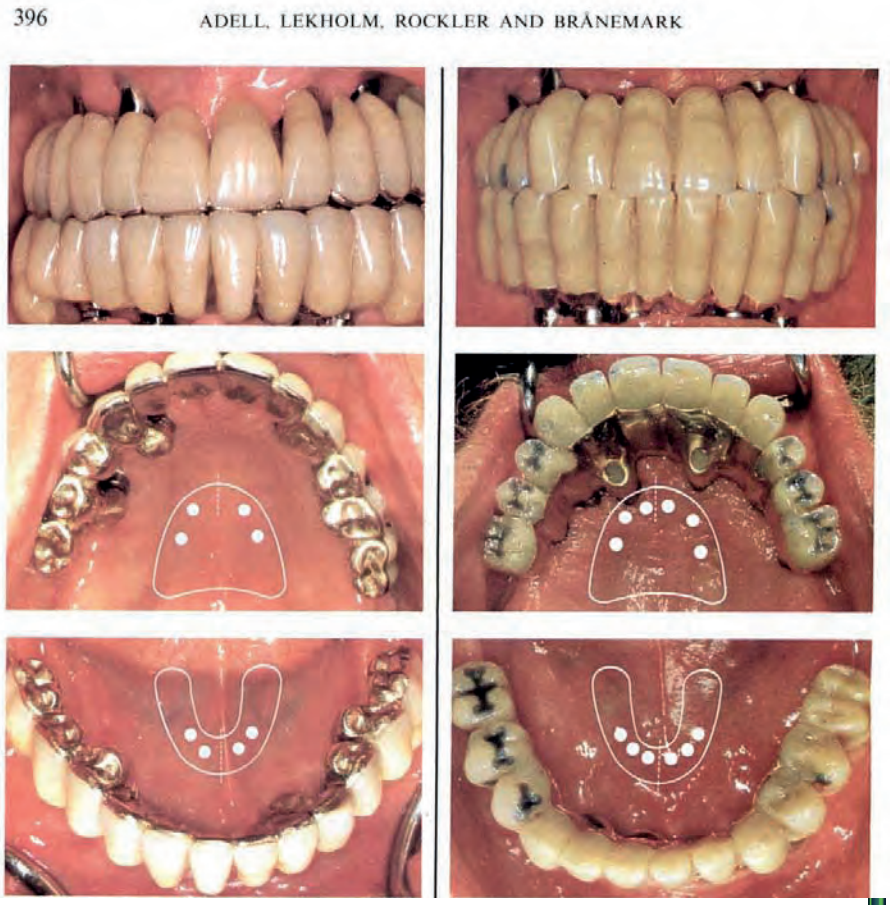
Requirements of alloys for dental restorations

- Castability
- Ease of finishing and polishing
- Corrosion resistance
- Rigidity
- Compatibility with veneering material
- Cost

1960 1970 1980 1990 2000 2010

iFDPs (made in Sweden)

- Co-Cr phased out and replaced by type-3 Au alloy
- No scientific data or rationale reported in the literature
- Due to concerns in Sweden about “oral galvanism” / electrochemical incompatibility of alloys?

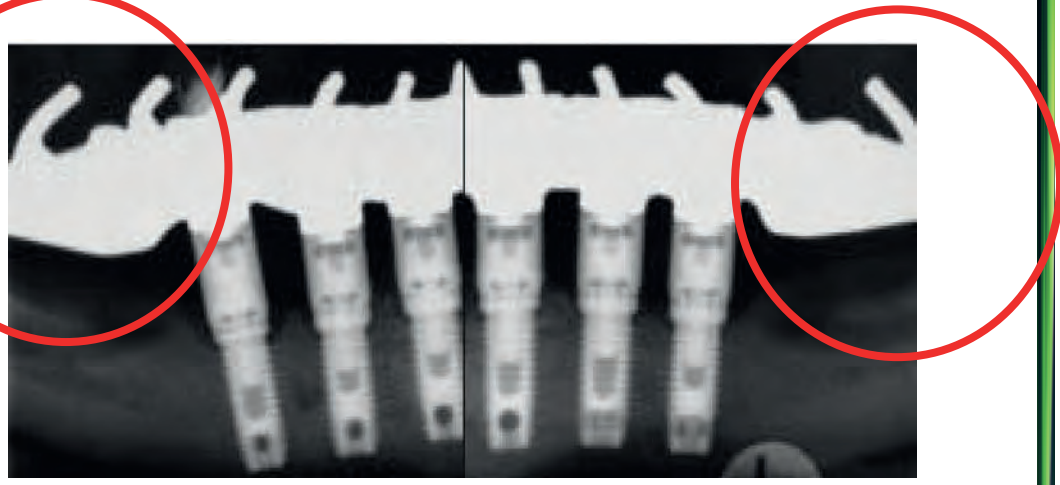


Co-Cr Type 3 Au-a.

Adell et al. IJOMS ㊗ ㊗

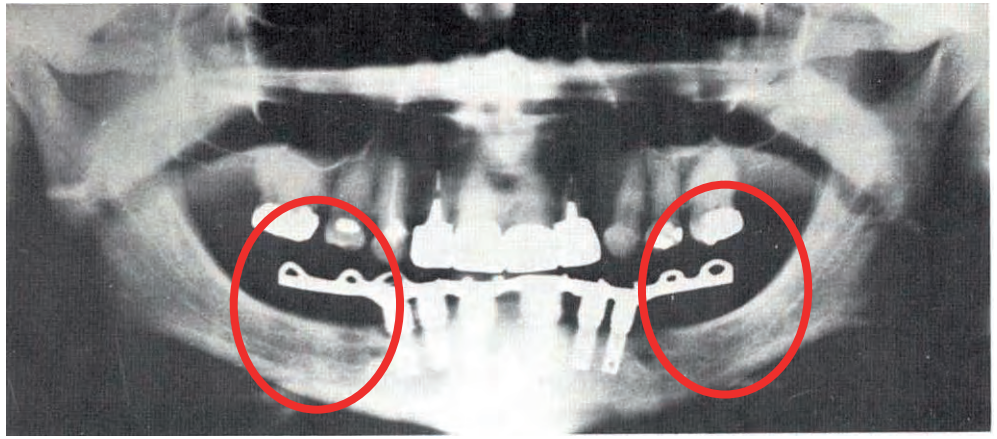
Prosthodontic SOPs developed by Drs. PO Glantz , B Hedegård, G Carlsson

Type 3 Au-alloys+ Acrylic teeth have stood the test of time!



20 years post-i.-placement. Lindquist & Carlsson 1979 → Ekelund et al. IJP 2003

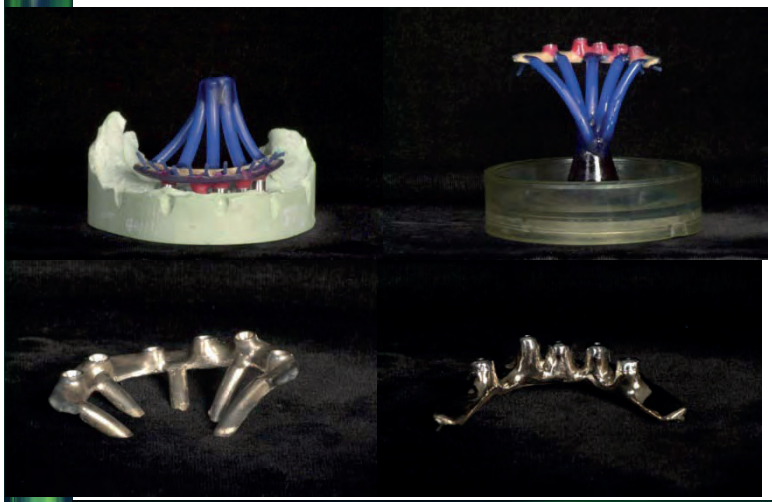
Cantilevers have consistently since the 70ies been made in Scandinavia to create 10-12 FDP units

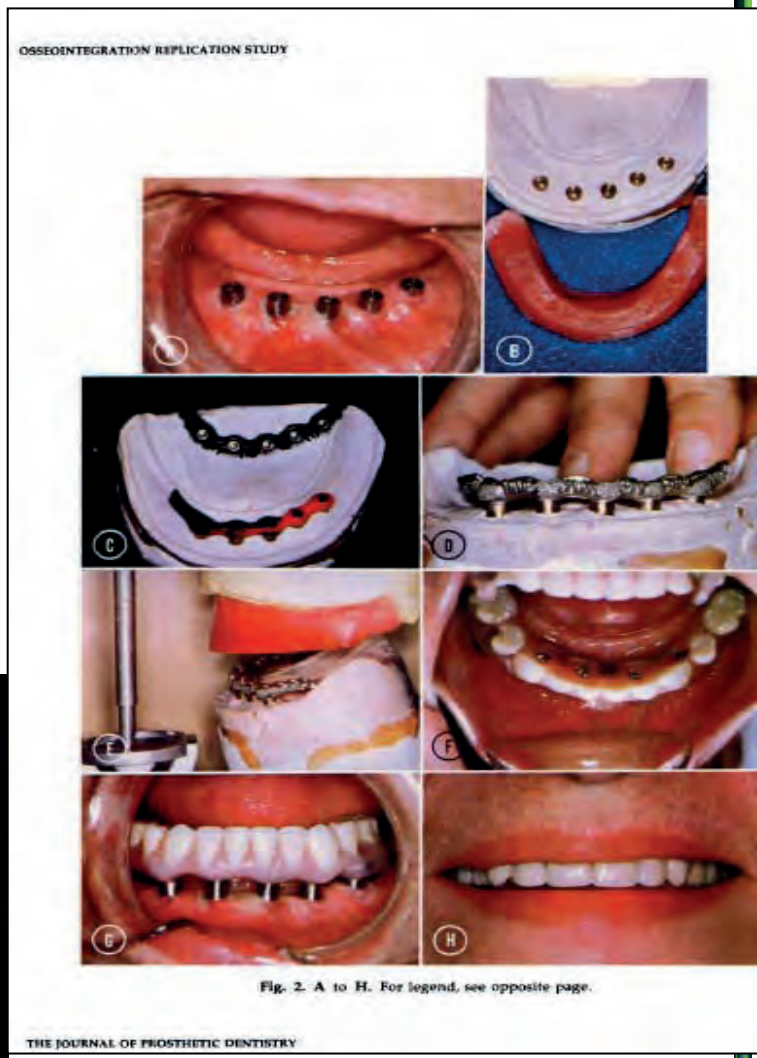


From original patient cohort (Haraldson & Carlsson , Swed Dent J 1979)

iFDPs (made in Toronto)

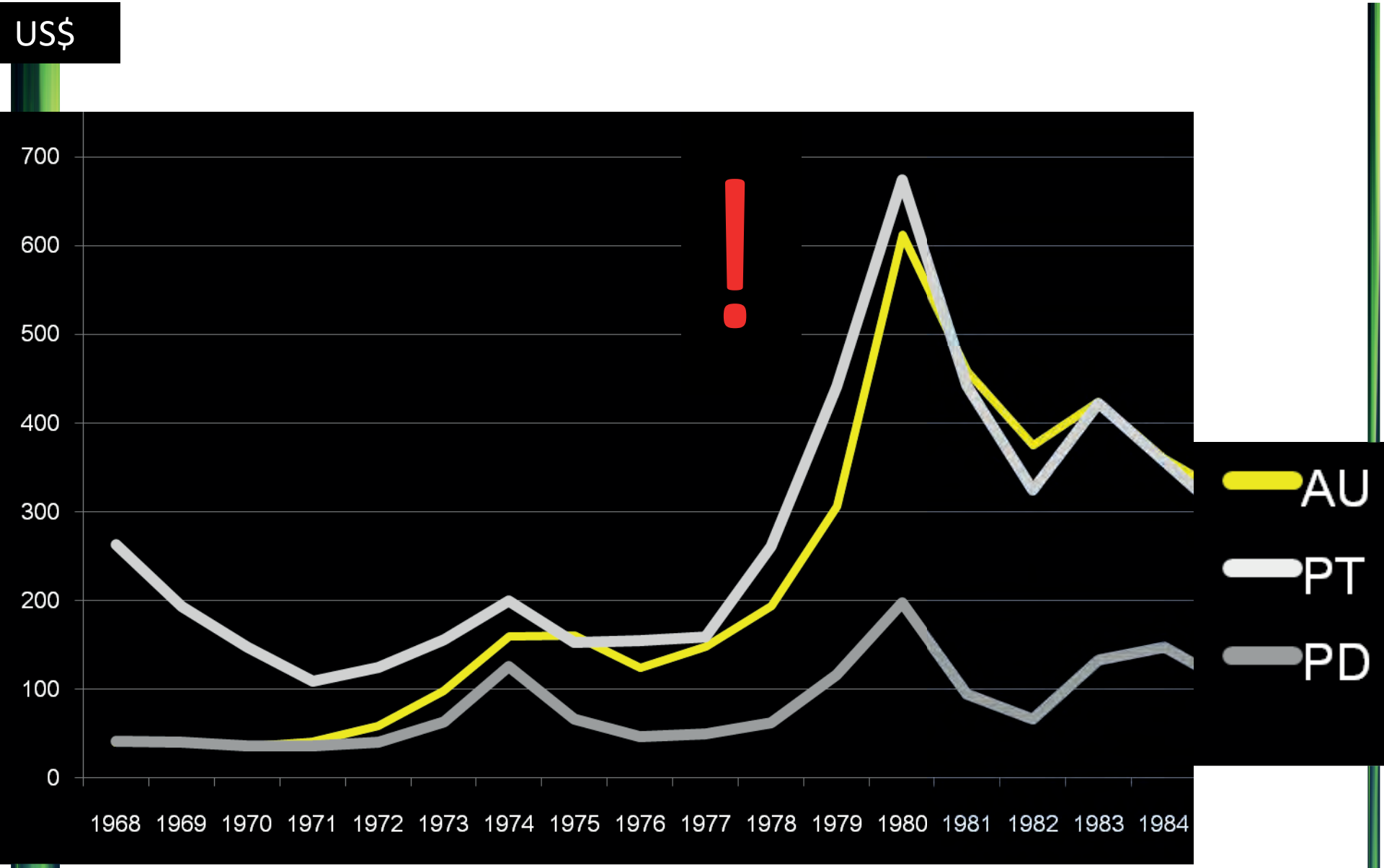
- Contain Cost
- Silver-Palladium cast alloy
  - Albacast® → Palliag M® (Type 3→4)
- Prefabricated teeth
- Precision of fit Ag-Pd vs Co-Cr (Cox/Chao/Zarb 1985/88)



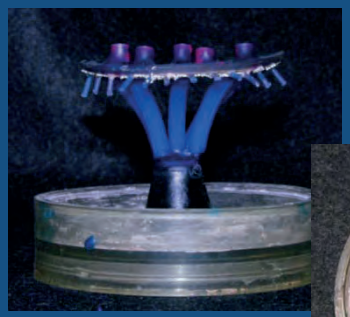


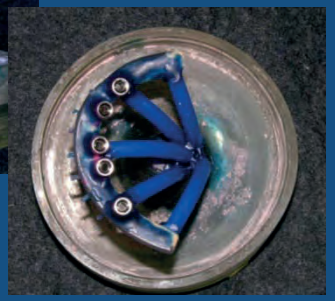
(Zarb

Costs of precious metals, early 80ies



Alloys for veneering→ ceramics





Au-alloy (Acrylic)

Au-Pt-Pd

1977: Au-Pd

Au-Pd–Ag /

1974: Pd–Ag (+/-Sn)

Pd (- Ag)

Pd-Ag-Au →

Pd-Cu

Pd-Ga

Ag-Pd

Cu-Al

Cast Cobalt-Chromium-(Acrylic)

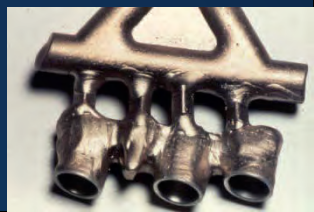
Cast Co-Cr

Ni-Cr (+/- Be)

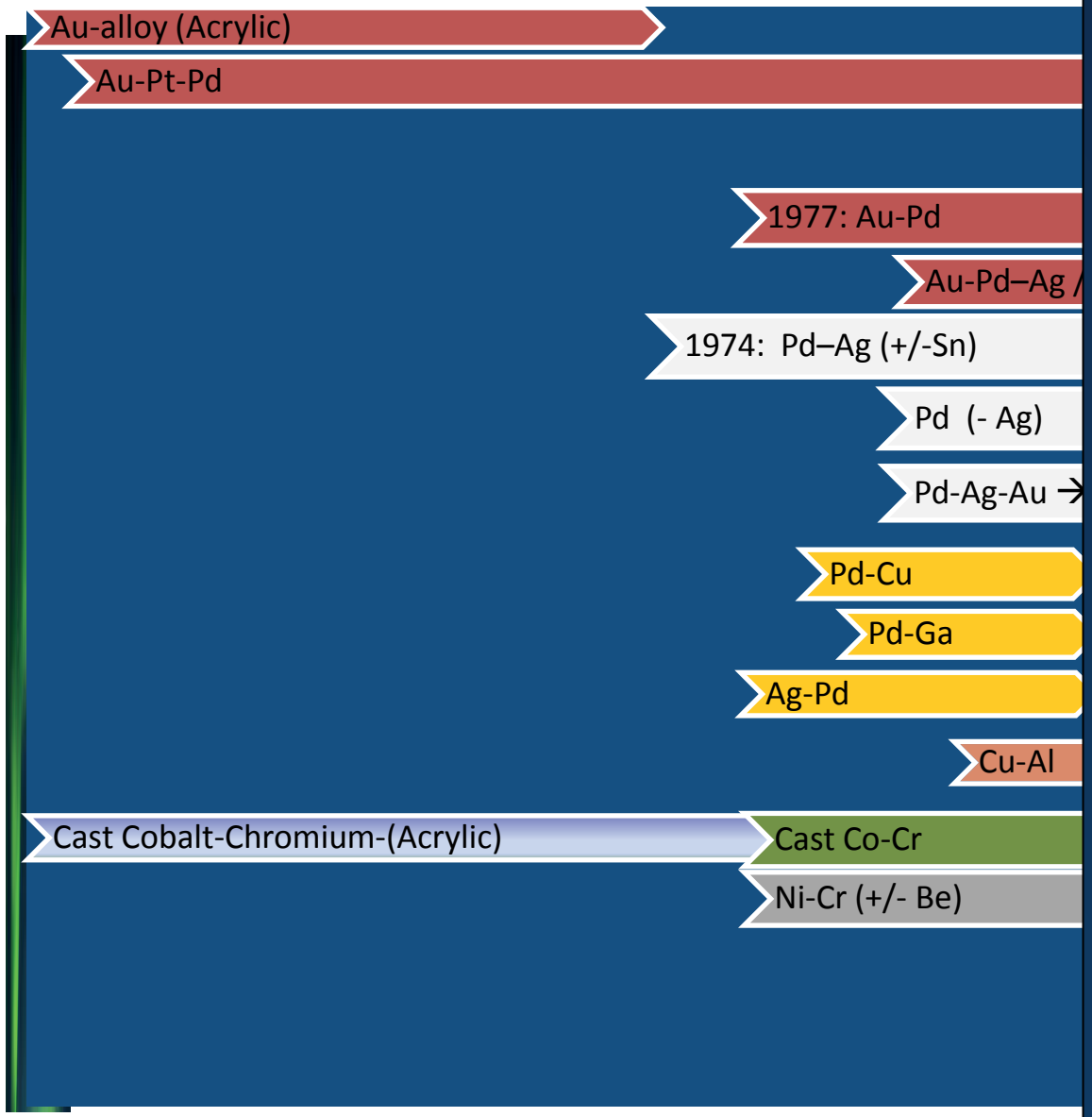
1960 1970 1980 1990

Refinements of fabrication methods

- Coefficient of thermal expansion compatibility
- Cast distortion – cast size vs soldering
- Cast surface roughness
  - Equipment
  - Casting Procedure
  - Increase/Decrease speed & maximum /minimum heat & pressure
  - Investment – Chemistry, Water : Powder
  - Spruing



Alloys for veneering → metal-ceramic

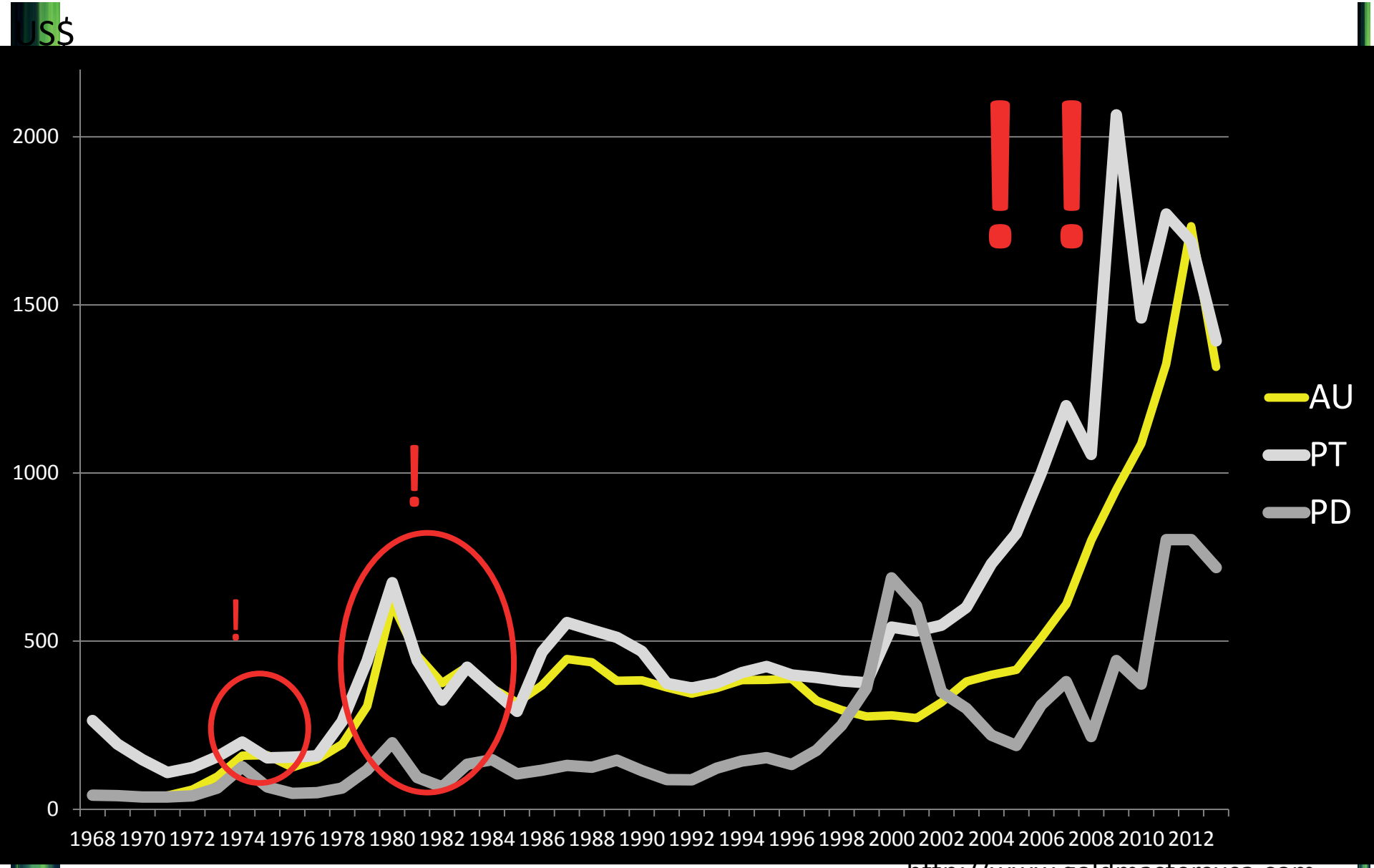


+ base metal alloy systems enters the market

Base vs Noble metal casting alloys

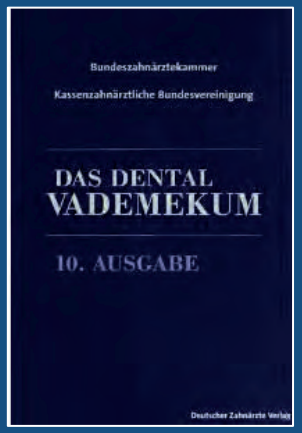
- Higher fusion and casting temperature
- Phosphate bonded investment - more complex and less controllable than gypsum bonded investment systems.
- Potential for excessive oxide formation
- Hardness → more difficult finishing & polishing
- Fit of the casting less predictable (investment procedure)
- Procedures for improving or modifying less than clinically acceptable margin adaptation / fit less predictable
- Modulus of elasticity 2x gold-alloys
- Less framework distortion during porcelain firing
- Resistance to tarnish by formation of surface monolayer of Cr- oxide

Costs of precious metals, 2013



http://www.goldmastersusa.com

Metallic alloys anno 2013



Au-Pt-Pd

Au-Pd-Pt

Au-Pt

Au-Pd

Au-Pd–Ag /In (Hi Ag /Lo Ag)

Pd–Ag (+/-In / +/-Sn)

Pd (- Ag)

Pd-Ag-Au → Pd-Ag/Cu/Ga/In-Au

Pd-Cu

Pd-Ga

Ag-Pd

Cu-Al

Cast Co-Cr

Ni-Cr (+/- Be)

Cast/Electroformed Ti /Ti-alloy

Milled Co-Cr

Milled Ti

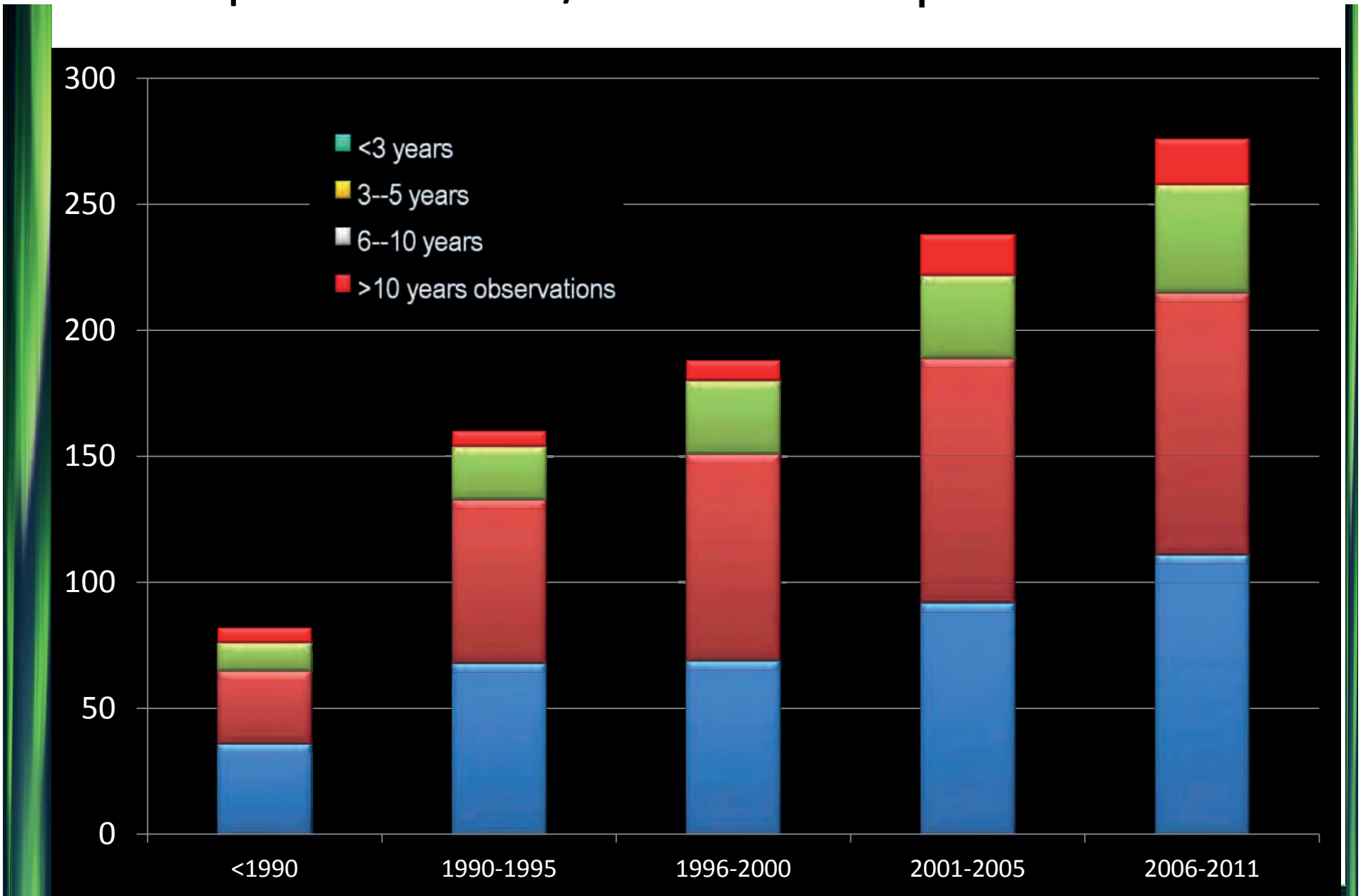
1960 1970 1980 1990 2000 2010

HOW DO THE DIFFERENT METALLIC MATERIALS PERFORM OVER TIME?

Performance of different metallic materials over time? SRs

- Ionnaidis ea. (Teeth) J Dent 2010
- Zurdo ea. (Implant) COIR 2009
- U Bern: Aglietta/Brägger/Jung/Lang/Lulic/ Pjetursson/Tan ea. (Implant/Teeth) COIR 2004a,b,2005,2007,2008,2009
- Sailer ea. (Implant) COIR 2007
- Goodacre ea. (Teeth/Implant) JPD 2003a,b

Clinical studies of prostheses retained by implants: n=738/3005 trials report on iFDPs



Academy of Osseointegration. State of the Science in Implant Dentistry Conference August 2006

SECTION 6

Does the Type of Implant Prosthesis Affect Outcomes in the Partially Edentulous Patient?

Hans-Peter Weber, DMD[1]/Cortino Sukotjo, DDS, MSc, PhD[2]

Purpose: *Implant restoration of the partially edentulous patient has become highly predictable. The scientific information on the specifics of restorative designs and their influence on the long-term outcome is sparse. The main objective of this systematic review was to determine what scientific evidence exists regarding the influence of prosthodontic design features on the long-term outcomes of implant therapy (implant success and survival, prosthesis success and survival) in the partially edentulous patient.* ***Materials and Methods:*** *Four questions of primary interest regarding implant prosthodontic design options were selected by the 2 reviewers: abutment type, retention type (cemented, screw-retained), support type (implant support alone versus combined implant-tooth support), and the type of restorative material. Inclusion and exclusion criteria were formulated and applied to a total of 1,720 titles. The list of titles was primarily based on a PubMed-type search provided by the State of the Science of Implant Dentistry workshop leadership. It was supplemented by a hand search of relevant journals at the Countway Library of the Harvard Medical School and of a personal collection of relevant*

cemented versus screw-retained restorations. Little to no usable information was available on restorative materials and their influence on the outcome.

Most of the studies were conducted in an institutional environment, such as university dental schools,

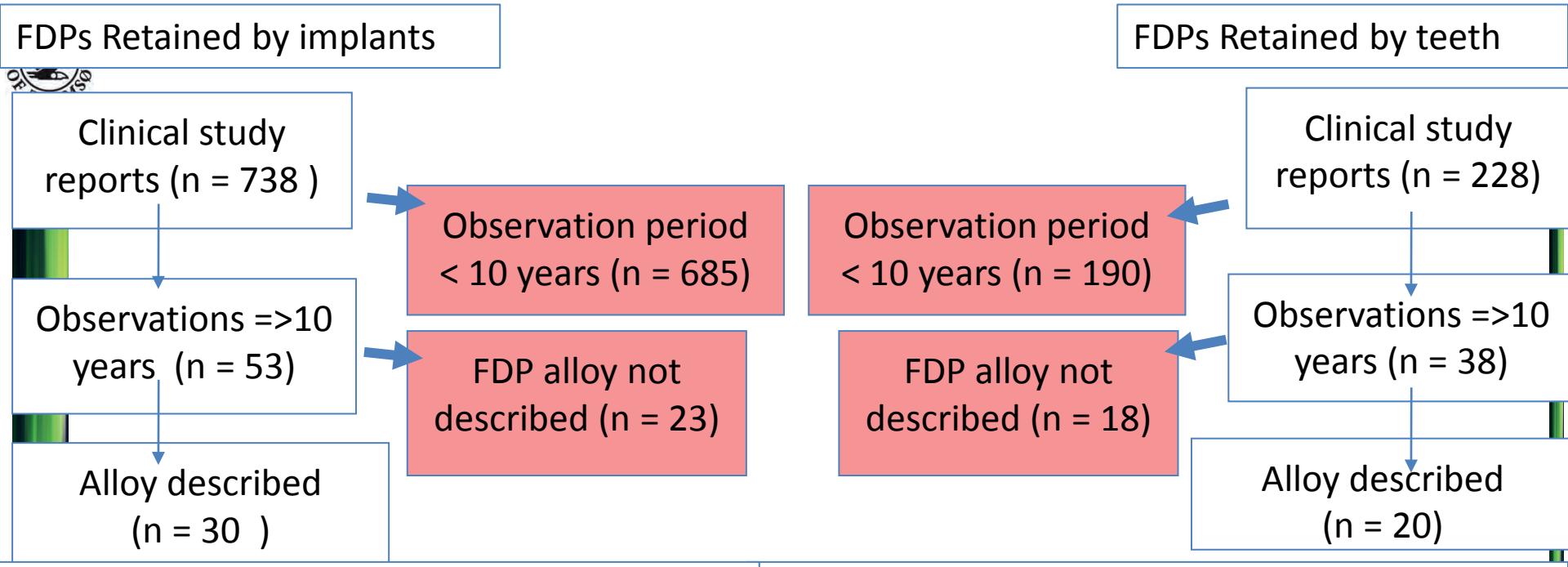
SECTION 5

Does the Type of Implant Prosthesis Affect Outcomes for the Completely Edentulous Arch?

S. Ross Bryant, DDS, MSc, PhD[1]/
David MacDonald-Jankowski, BDS, LLB, MSc, FDSRCPS(UK), DDRRCR[2]/Kwonsik Kim, DMD, MS, PhD[3]

Purpose: *A systematic review, including meta-analysis, was conducted to answer the question "Does the type of implant prosthesis affect outcomes for the completely edentulous arch?" The current paper was to assess the impact of fixed or removable prosthesis type on implant survival and success outcomes.* ***Materials and Methods:*** *Pertinent literature was identified through December 31, 2005 using a PubMed search strategy and hand-searching of relevant journals, a personal library, and reference lists from included studies. Inclusion and exclusion criteria were applied to the titles and abstracts and subsequently to the full text of included references. The 72 included studies reported oral implant survival or success, crestal bone levels or loss, and/or prosthesis success or maintenance differentiated by arch and by prosthesis type (fixed or removable, splinted or nonsplinted) established either in 1-year randomized clinical trials or 5-year observational studies.* ***Results:*** *Statistical analysis revealed only a site-specific rather than a design-specific finding that implant survival for mandibular fixed prosthesis*

between fixed and removable prosthesis types in edentulous arches. The possible effects of other variations in prosthetic type (such as splinting, rotational characteristics, prosthetic materials, and the number of implants) as well as the effect on crestal bone loss and prosthesis success and maintenance outcomes, are not addressed in detail in this paper. As most commonly reported in implant outcome studies,



AgPd: Albacast/PalliagM: Attard/Bryant/Wyatt /Zarb 1998-04 a,b,c,d,e,f,g,h,I,j,k l

Type3Au: Lindquist /Carlsson /Jemt /Ekelund 1994-03 a,b,c,d,e,f
Åstrand ea. 2008
"Gold alloy": Gunne ea 1999
"Gold or Co-Cr": Brånemark /Adell /Jemt/Ivanoff 1977-2000 a,b,c,d
Cp1/Cp2 Ti & "cast gold ": Örtorp & Jemt 2006-09 a,b,c,d,
"**precious alloy" / "cast gold"**: Eliasson ea 2006
"precious/semi-precious alloy : Lekholm ea 1999

Type4Au: Degudent U: DeBacker ea, 2006-08a,b,c,d,e,f
Type3Au: KAR Gamma: Valderhaug ea 1980-97a,b,c,d
Type 3Au: Sjöding: Karlsson ea 1989

Au-Pd/ Ni-Cr (several): Anderson / Vet.Adm. 1993
"Co-Cr": Öwall ea, 1991

"Gold": Lindhe & Nyman 1984
Glantz ea 1993
Yi ea 1996&97
Hämmerle ea 2000
"High noble": Walton 1997
"Precious alloy": Sundh & Ödman 1997

Comparison Au vs Co-Cr

CLINICAL ORAL IMPLANTS RESEARCH

Kyrre Teigen
Asbjørn Jokstad

Dental implant suprastructures using cobalt–chromium alloy compared with gold alloy framework veneered with ceramic or acrylic resin: a retrospective cohort study up to 18 years

Authors' affiliations:
Kyrre Teigen, Prosthodontics Specialty Practice, Bergen, Norway

Key words: cobalt–chromium, dental implant, gold alloy, suprastructure, veneering material

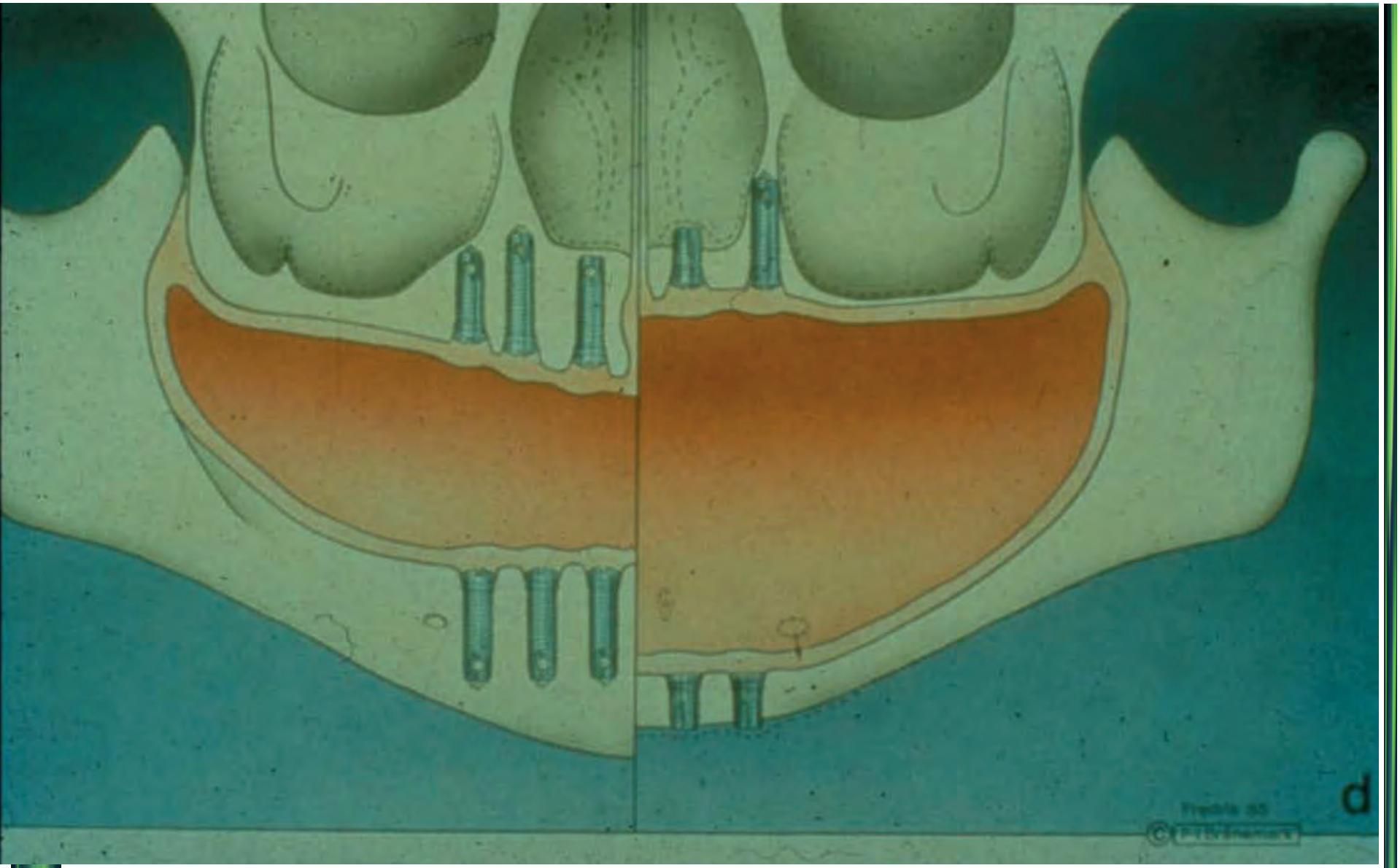
Abstract

Cobalt-Chrome – Ceramic

From: Kourkouta et al. Br Dent . 2007

Our current understanding of optimal choice of iFDP design and biomaterial selection should perhaps be reconsidered because of:

1. vertical space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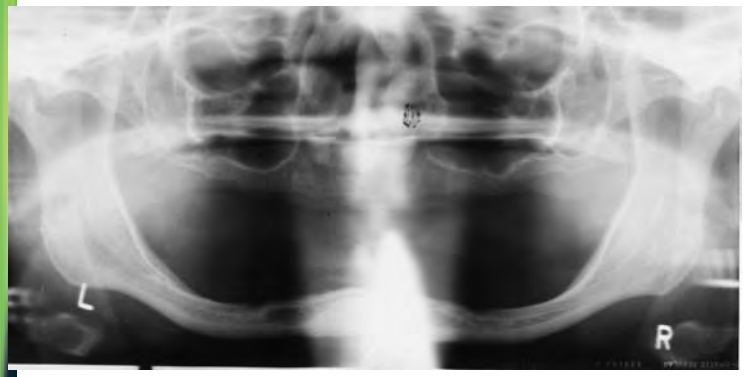
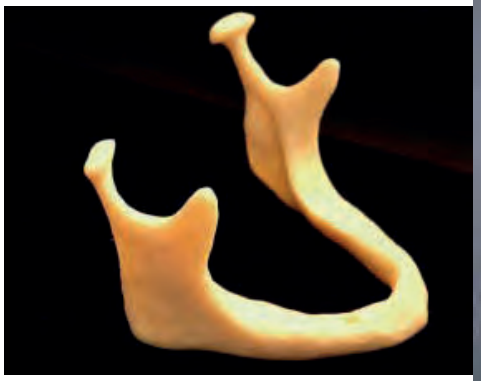
Our edentulous patients today are different from the ones in 1980ies!!



10.2.1980. case
B8756_Study 1

Our edentulous patients today are different from the ones in 1980ies!!

The average edentulous patient 2010

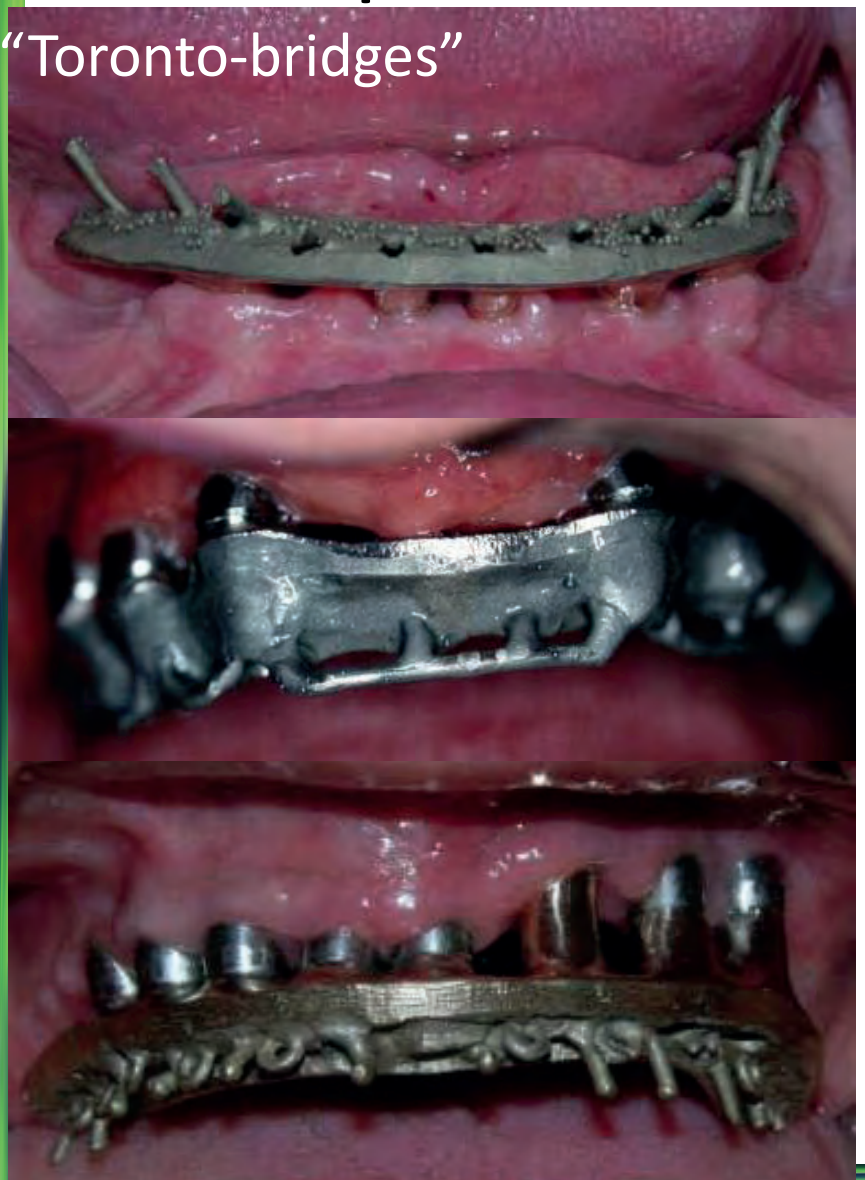


The average edentulous patient 1980

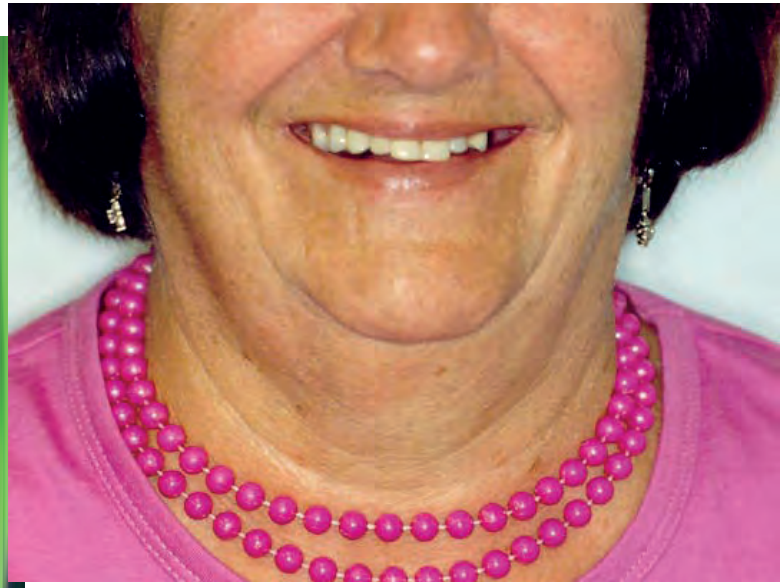
Vertical space increases with period of edentulousnes

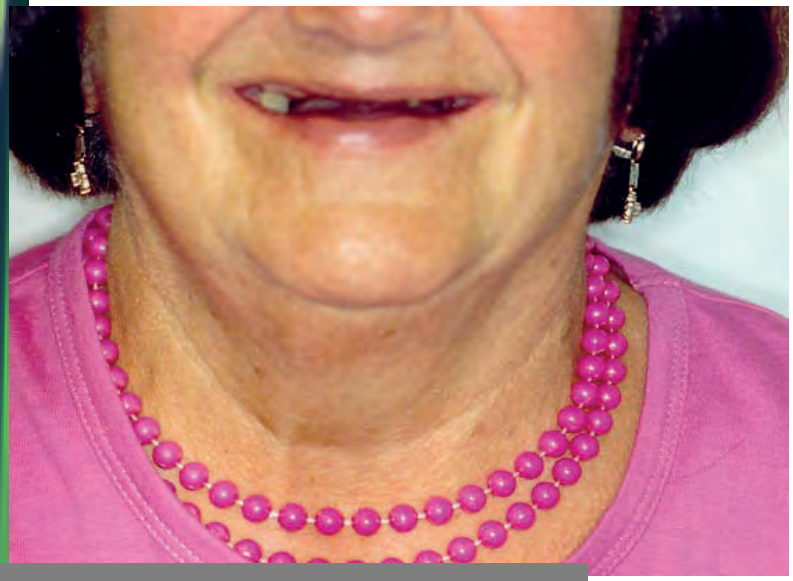
Zarb H夜 裂Ÿ
least 5 years
Quirynen/Naert/vanSteenberghe
夜 dB Ÿ edentulousness
0-
Meijer/Visser/Raghoebar 夜 Ÿ

Supra-structures require much vertical bulk space- some more than others

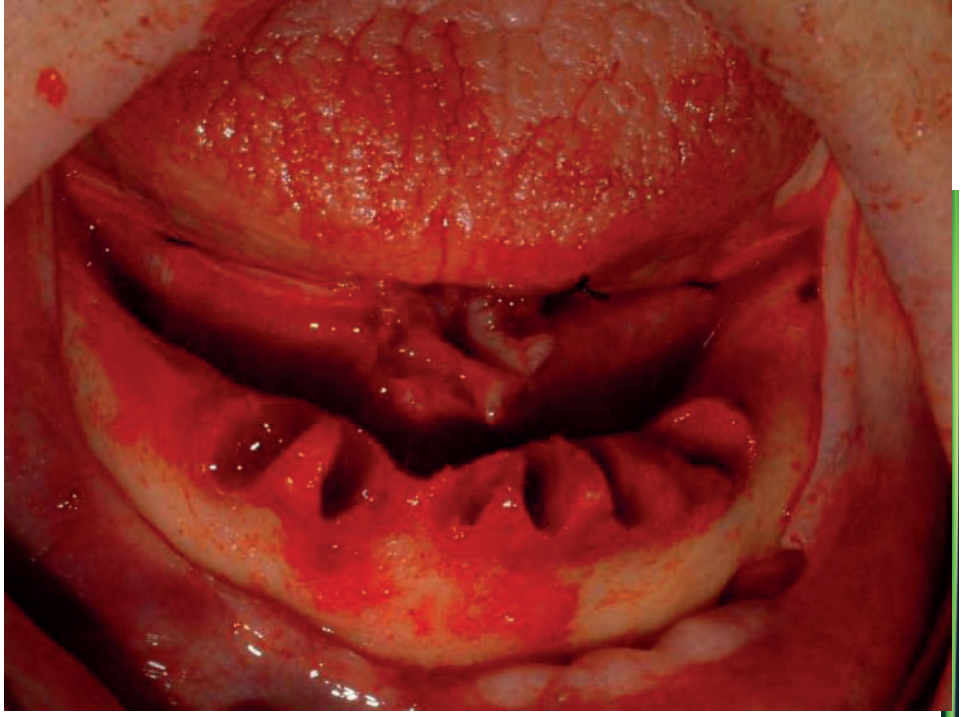
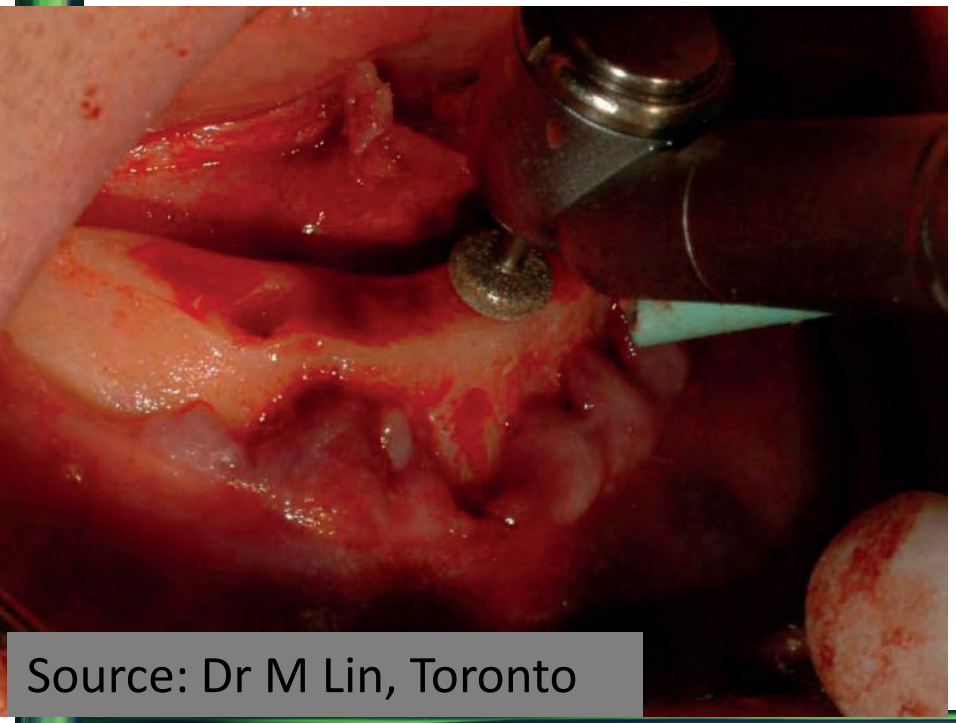
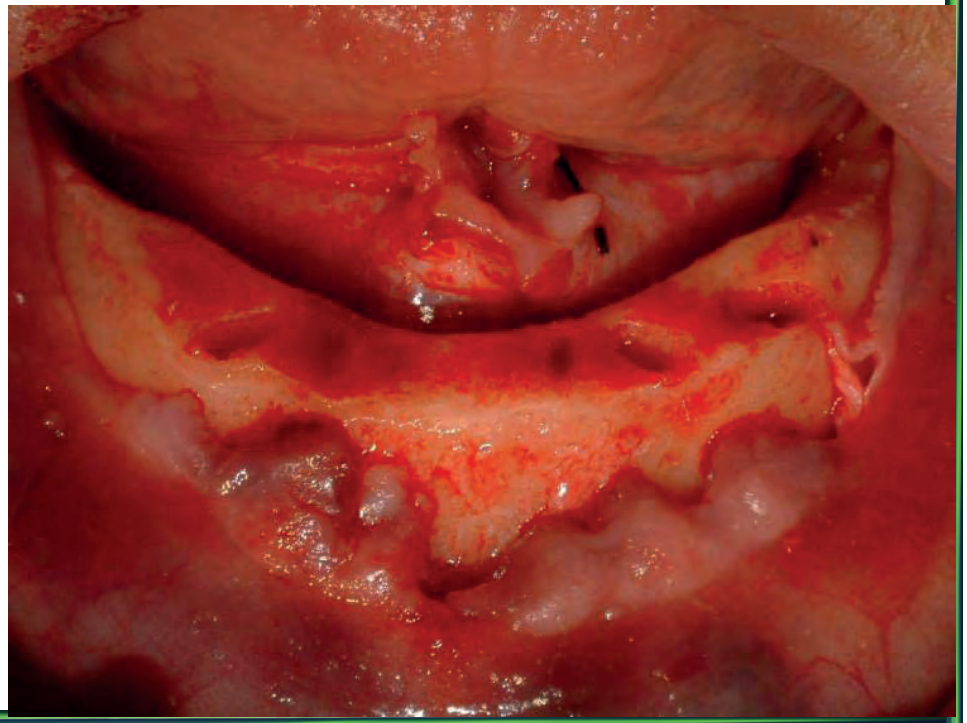


Prepare adequate vertical space for the suprastructure - 1

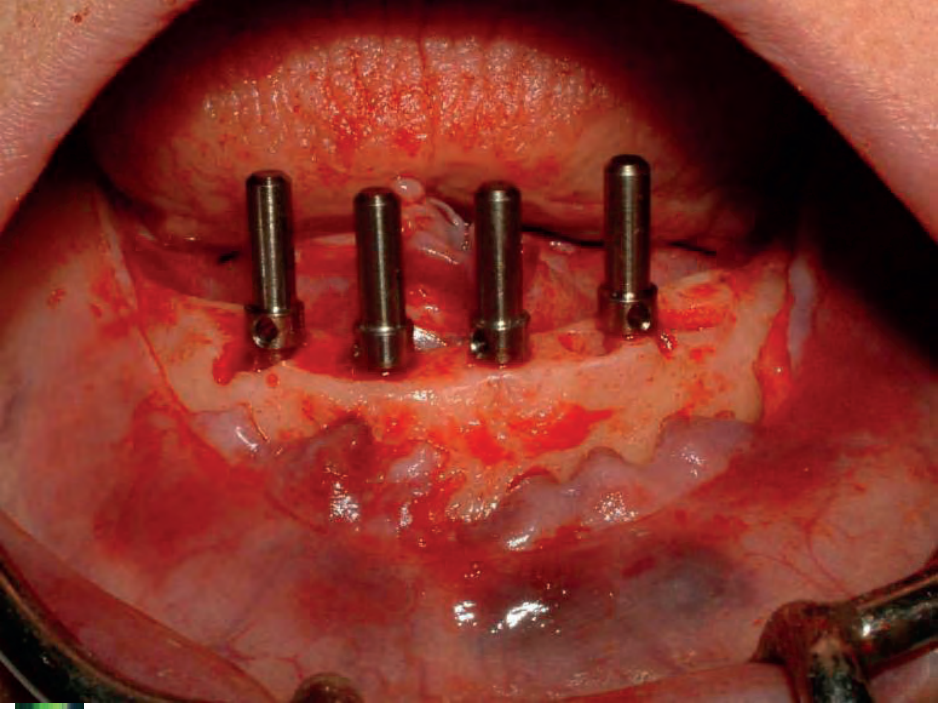


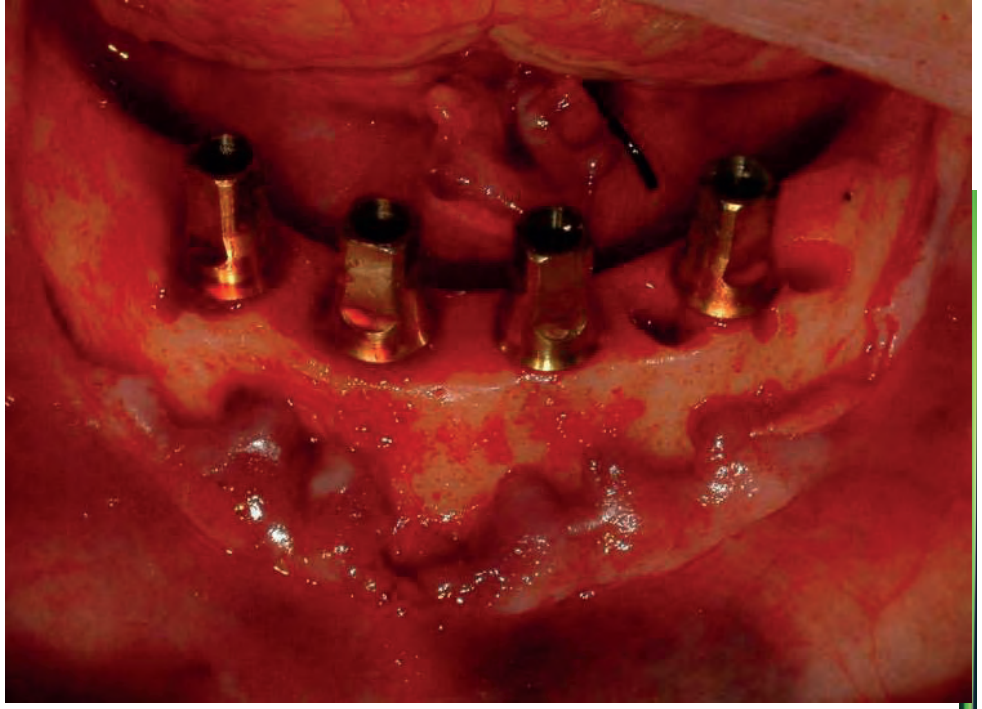


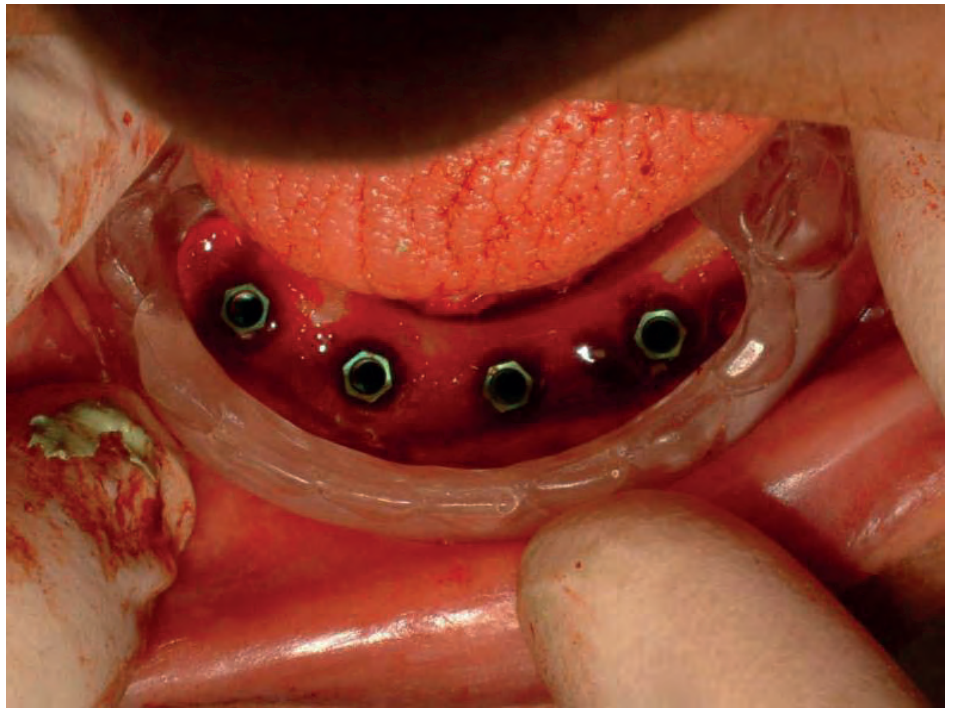
Source: Dr M Lin, Toronto

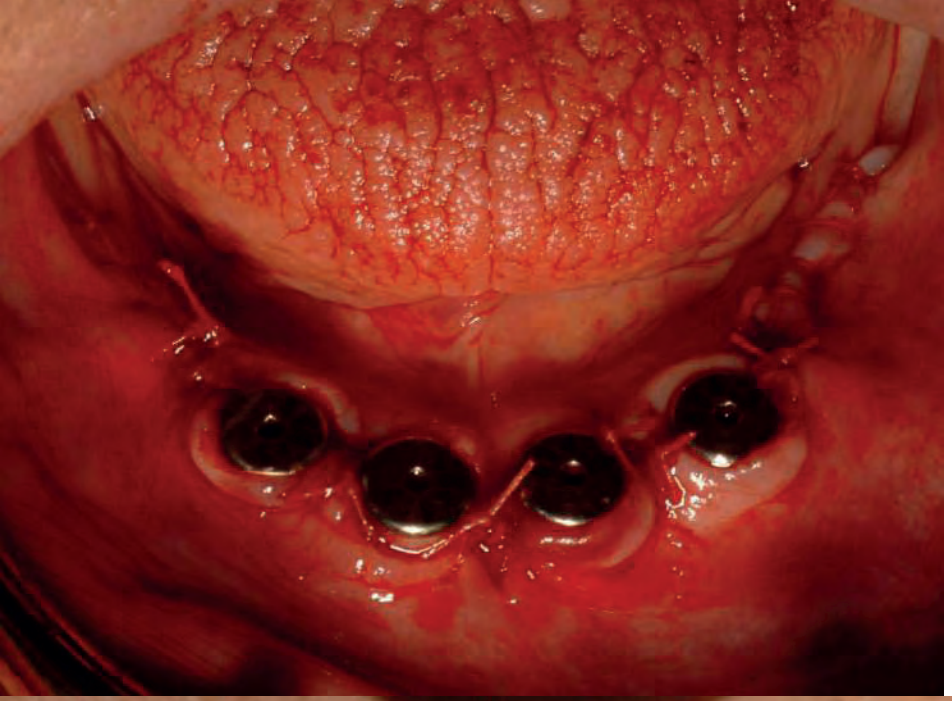
Source: Dr M Lin, Toronto







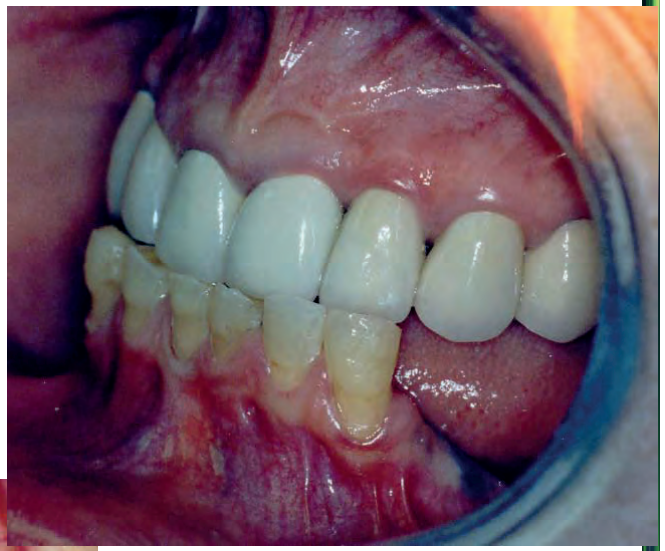
Source: Dr M Lin, Toronto



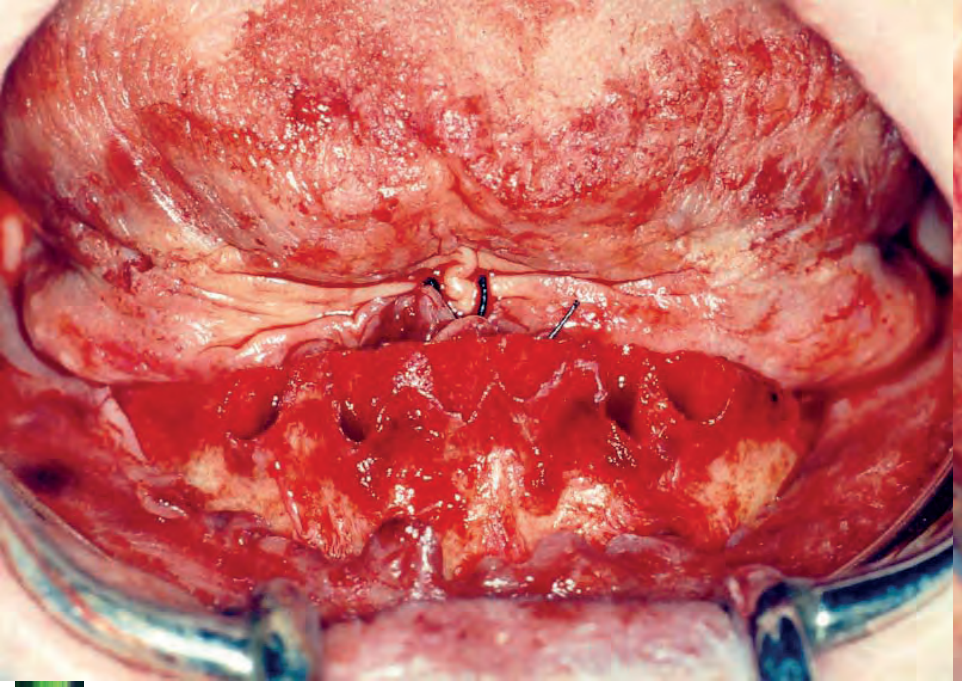
Source: Dr M Lin, Toronto

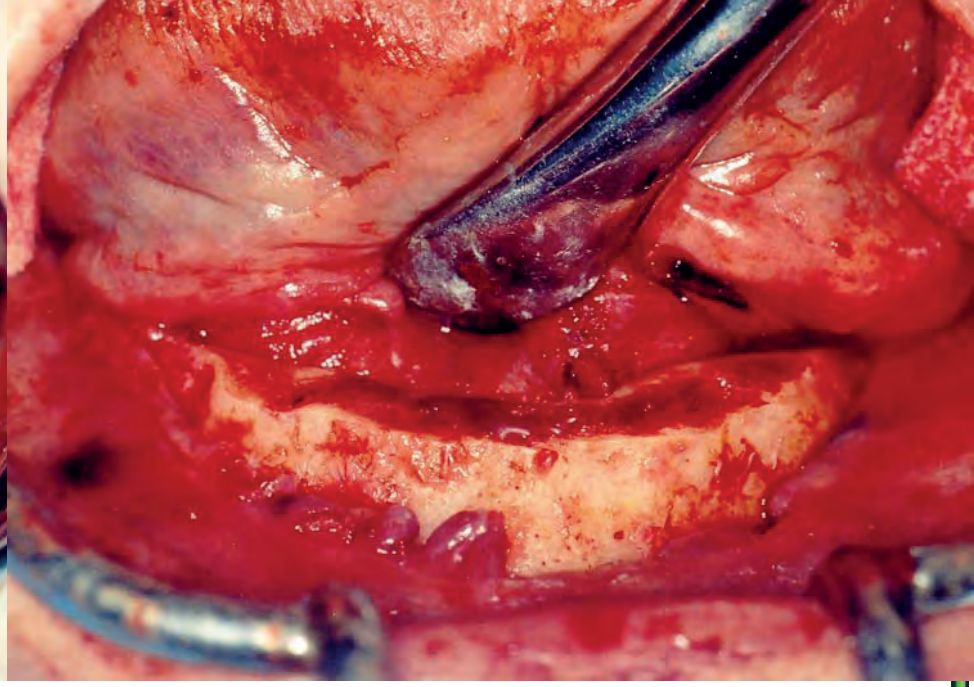
Source: Dr M Lin, Toronto

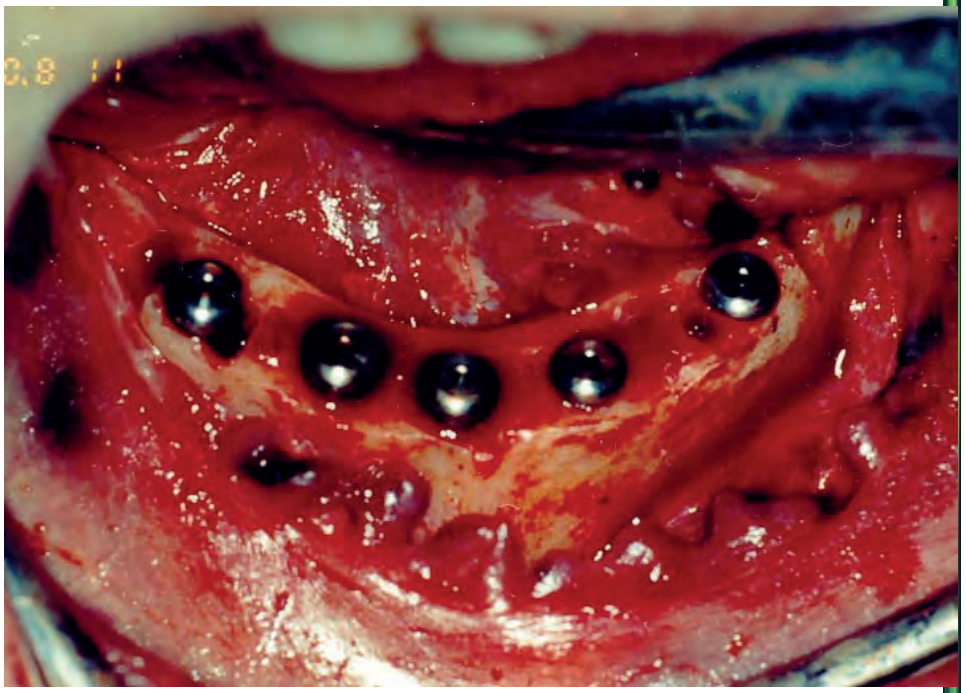
Prepare adequate vertical space for the suprastructure - 2



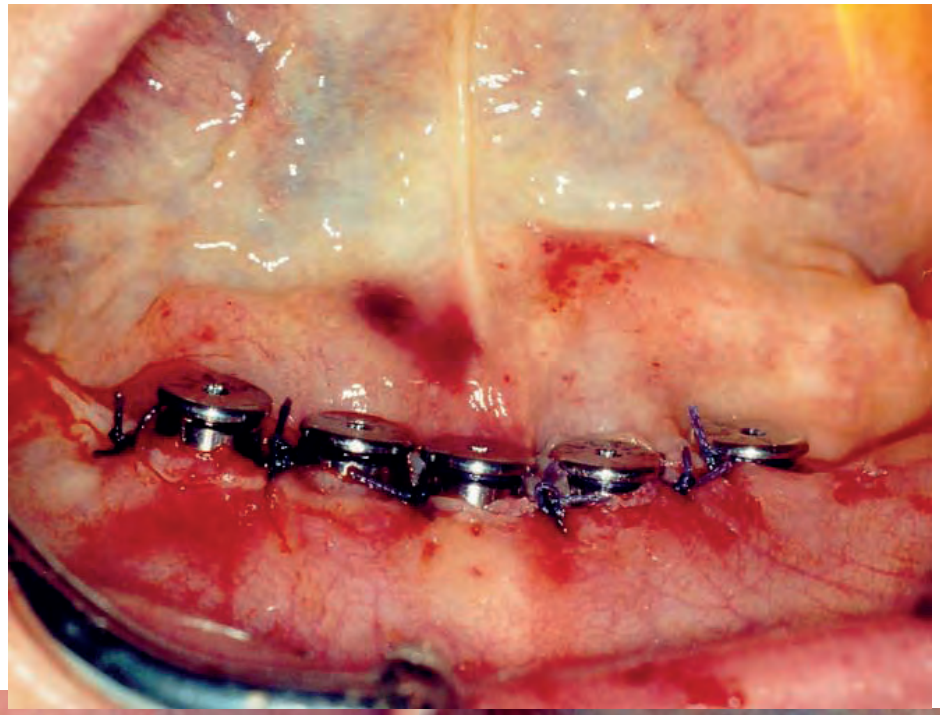
Source: Dr M Lin, Toronto

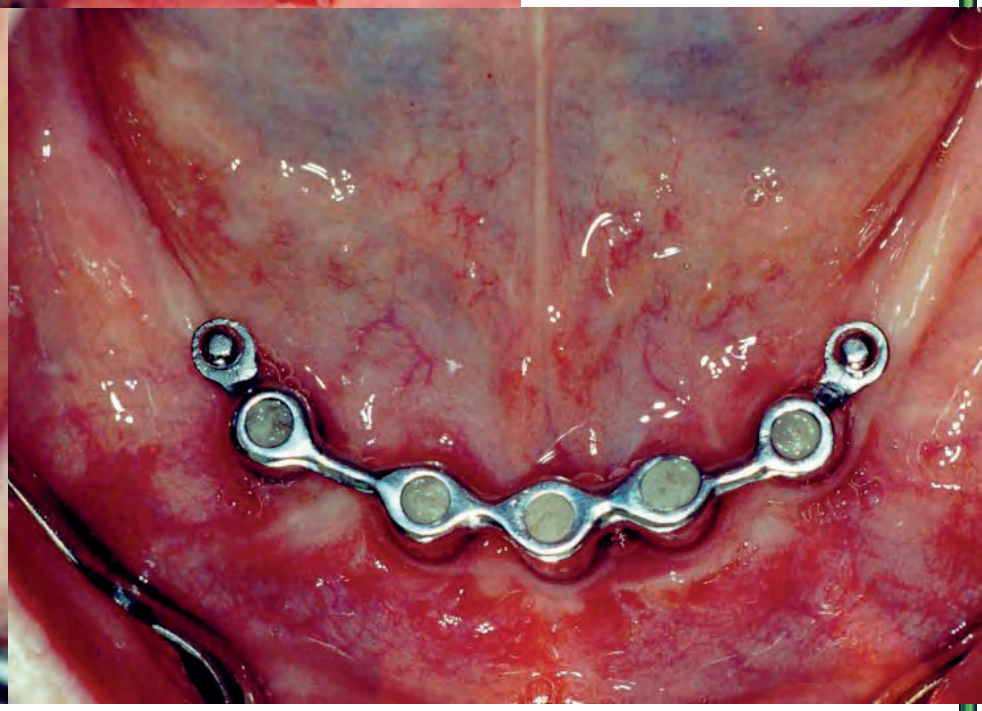






Source: Dr M Lin, Toronto





Source: Dr M Lin, Toronto

Source: Dr M Lin, Toronto

Source: Dr M Lin, Toronto

Our current understanding of optimal choice of iFDP design and biomaterial selection should perhaps be reconsidered because of:

1. vertical space
2. **cantilevers**

Cantilever risk confusion - SRs

1. Romeo & Storelli Clin Oral Implants Res 2012 : *"..there is no increase in complication rate due to the presence of the cantilever"*
2. Aglietta et al. Clin Oral Implants Res 2009: *<<short span>> ...no detrimental effects can be expected on bone levels due to the presence of a cantilever extension per se"*
3. Zurdo et al. Clin Oral Implants Res 2009: *"...may be associated with a higher incidence of minor technical complications"*

Cantilever risk confusion - SRs

1. Romeo & Storelli Clin Oral Implants Res 2012 : *"..there is no increase in complication rate due to the presence of the cantilever"* **(n=6)**
2. Aglietta et al. Clin Oral Implants Res 2009: *<<short span>> ...no detrimental effects can be expected on bone levels due to the presence of a cantilever extension per se"* ***(n=5)***
3. Zurdo et al. Clin Oral Implants Res 2009: *"...may be associated with a higher incidence of minor technical complications"* **(n=3)**

Recent studies

- Maló et al. The prognosis of partial implant-supported fixed dental prostheses with cantilevers. A 5-year retrospective cohort study. Eur J Oral Implantol 2013: ***there is a relatively high frequency of complications to cope with in these rehabilitation. (28%)***

- Kim P, et al. The impact of cantilevers on biological and technical success outcomes of implant-supported fixed partial dentures. A retrospective cohort study. Clin Oral Implants Res 2013 : ***the length of the cantilever arm was positively correlated with implant failure, technical complications and bone loss ≥1.5 mm.***

Stress and deformation of a FDP

- A beam with a *regular geometric body* deform upon *central vertical loading* predictably:

$$D = \frac{F}{E} * \frac{L^3}{W * H^3} * \text{constant}$$

- Often applied to intra-oral FDP designing
- Available 3-D space intra-orally is self-limiting
- Determined by the maxilla-mandible anatomy and -vertical relationship

Stress and deformation of a FDP with a cantilever

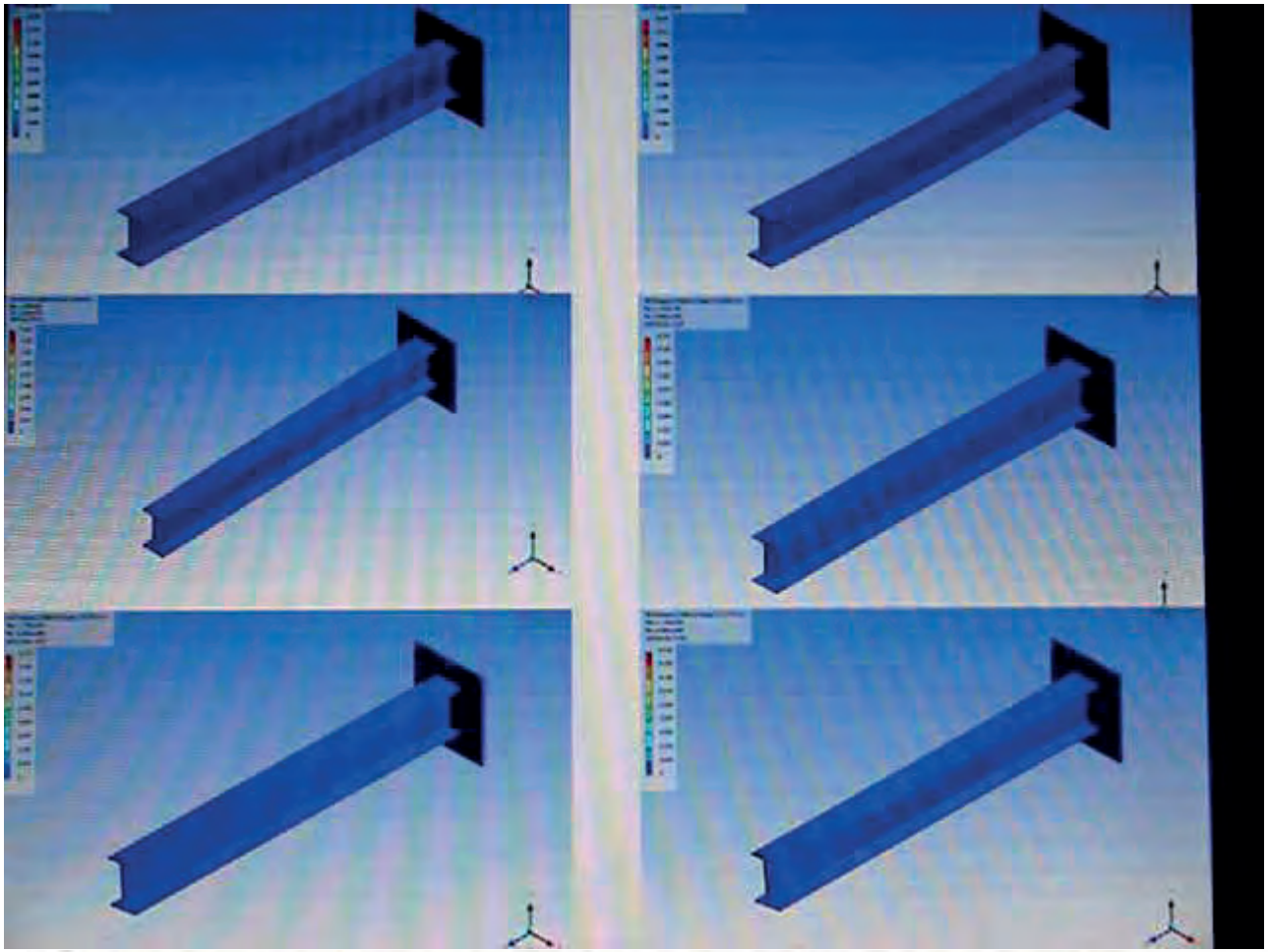
- Additional vertical and rotational force vectors introduced in the structure and retainers
- Force vectors vary with location, magnitude and direction of the point loading
- Estimating the bending of FDP cantilevers is complex, even for regular geometric bodies:

Estimating the bending of a regular form cantilever is complex

Vertical bending

Lateral bending

Torsional bending



For free, harmonic vibrations the Timoshenko-Rayleigh equations take the form

$$EI\,\frac{\mathrm{d}^4\hat{w}}{\mathrm{d}x^4} + m\omega^2\left(\frac{J}{m} + \frac{EI}{kAG}\right)\frac{\mathrm{d}^2\hat{w}}{\mathrm{d}x^2} + m\omega^2\left(\frac{\omega^2 J}{kAG} - 1\right)\hat{w} = 0$$

From: wikipedia.org

Stress and deformation of the supra-construction with cantilevers

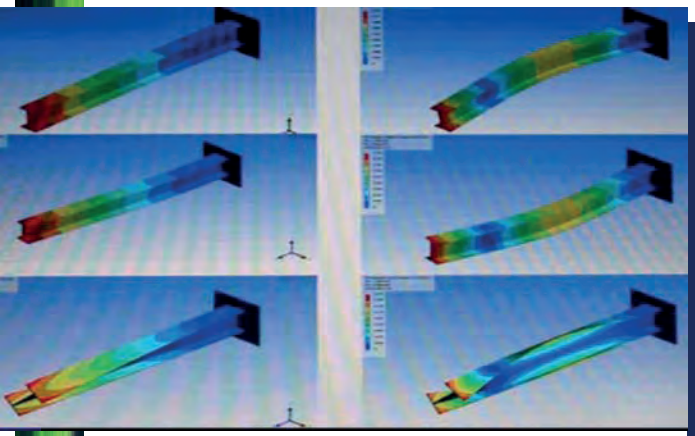
Additional vertical and rotational force vectors

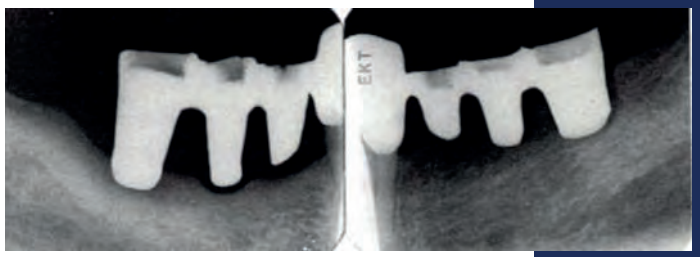
Location, magnitude and direction of the point loading?

Theoretical estimation of cantilever bending is complex

In irregular geometric bodies made from different materials the interactions complexity between point loads and force vectors increases further - are mathematical estimations at all possible?

Cantilevers - theory and practice?





Öwall et al. Int J Prosth 1991

(n=11, 1-20+ yrs)

-

Co-Cr + acrylic teeth

Placement 1968

3/11 framework fractures

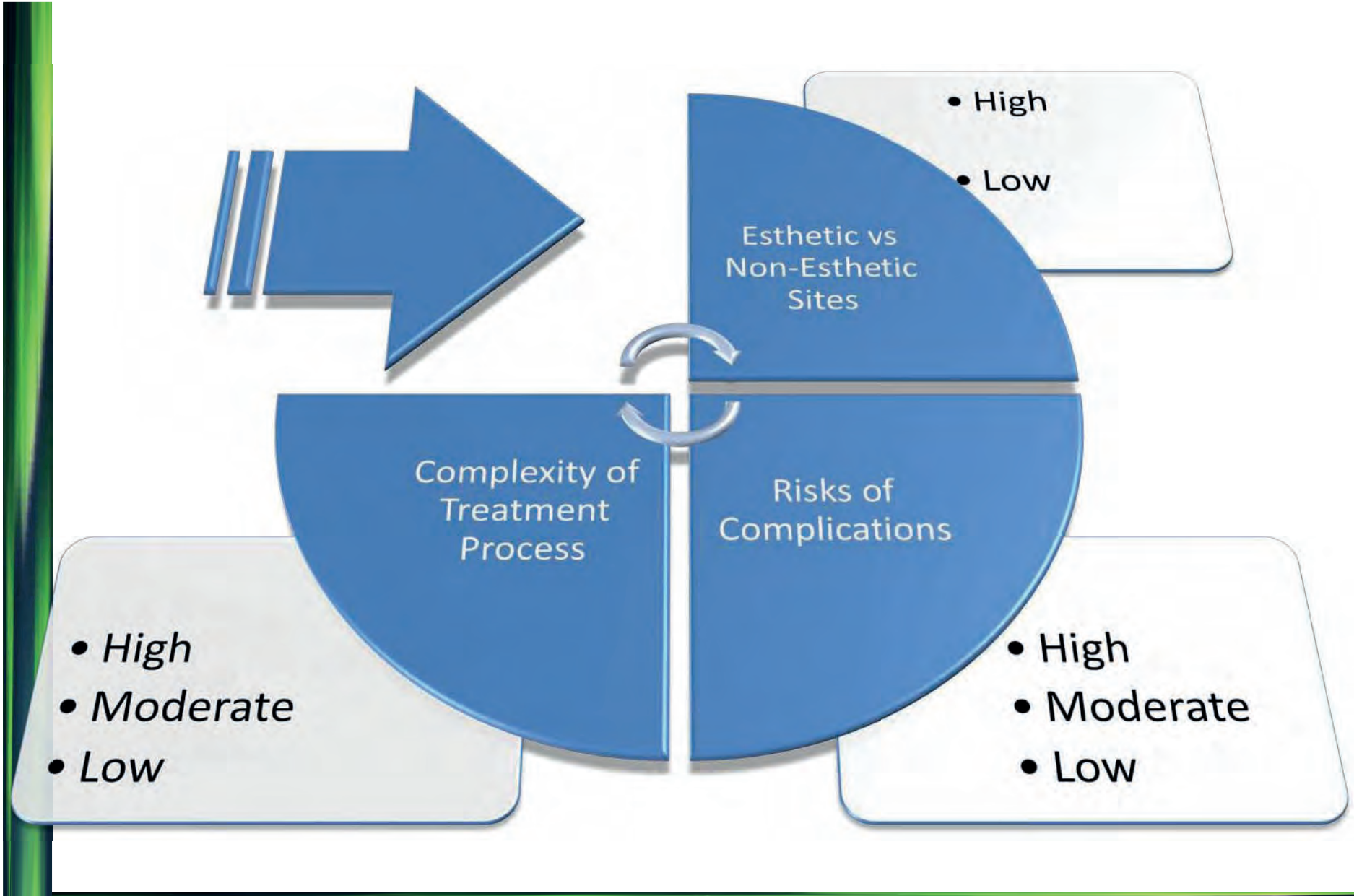
The SAC Assessment Tool

click to continue

S *Straightforward*
A *Advanced*
C *Complex*

http://www.iti.org/var/external/sac-tool/default-1000.htm

General Determinants of the SAC classification



Assessment of
Surgical Cases

Assessment of
Restorative Cases

This tool is based on a book entitled "The SAC Classification in Implant Dentistry" jointly published by the ITI and the Quintessence Publishing Group. It comprises the proceedings of a consensus conference organized by the ITI in 2007 with the aim of providing normative guidelines for various types of restorative and surgical cases based on a system referred to as the SAC (Straightforward, Advanced and Complex) Classification system.

Please note that certain assumptions have been made in the establishment of this SAC Classification. To review them, click on "Assumptions" in the menu bar below.

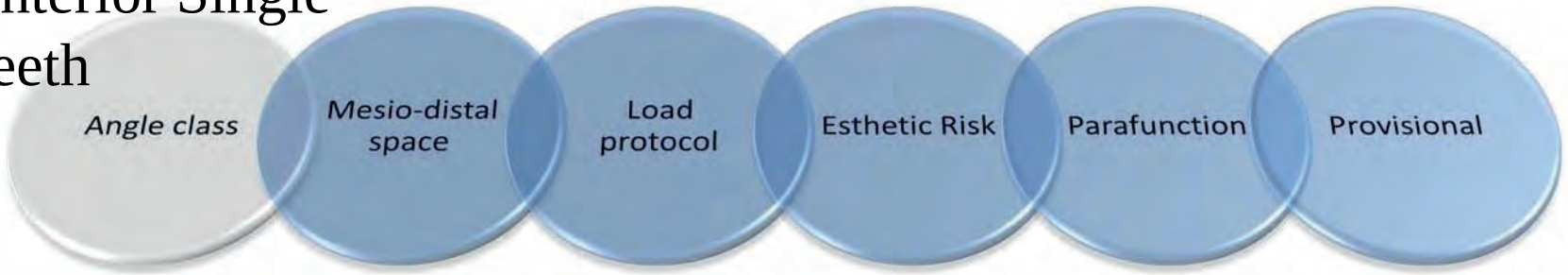
Modifying Factors determining the SAC classification

General Determinants of the **Surgical** SAC classification

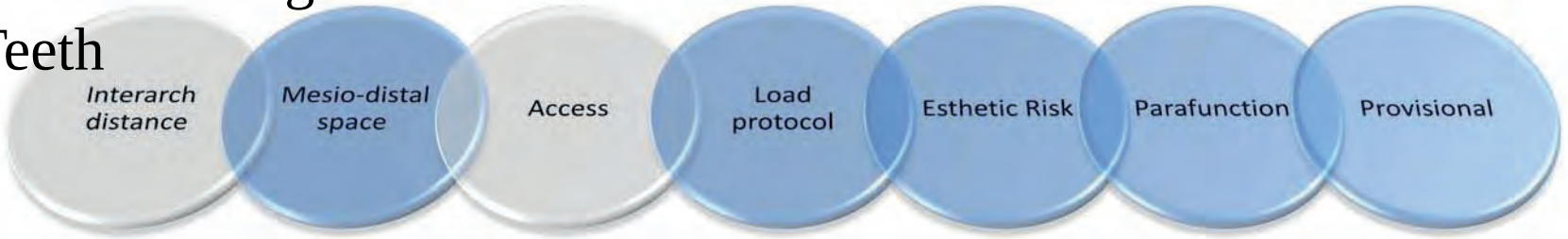
Risk Assessment
- High
- Moderate
- Low

General Determinants of the **Restorative** SAC classification

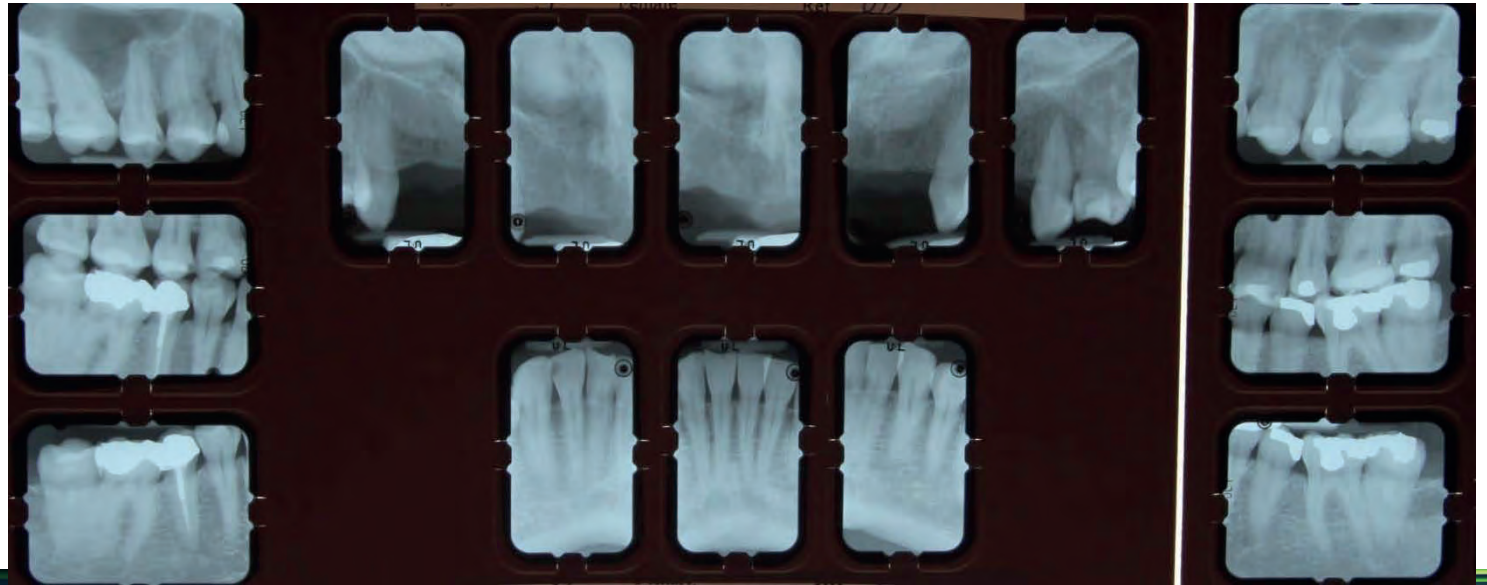
Anterior Single Teeth



Posterior Single Teeth



Posterior edentulous spaces





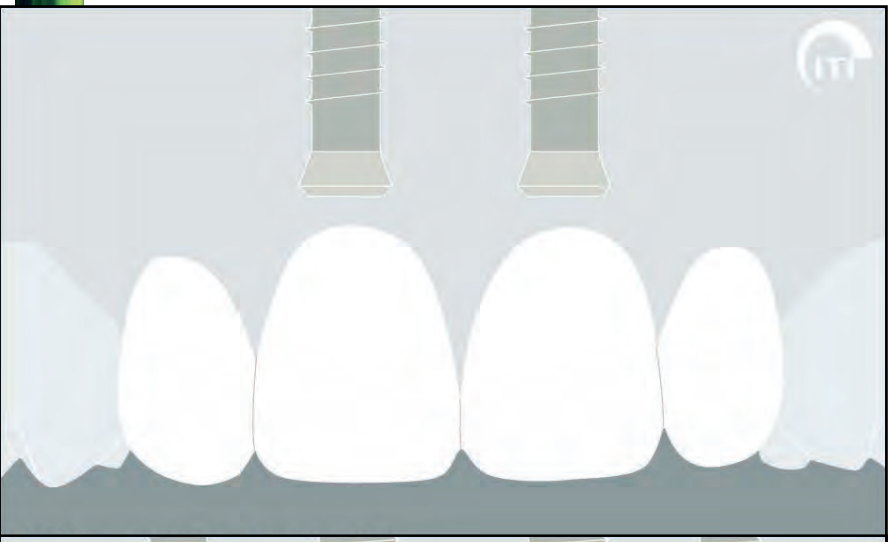
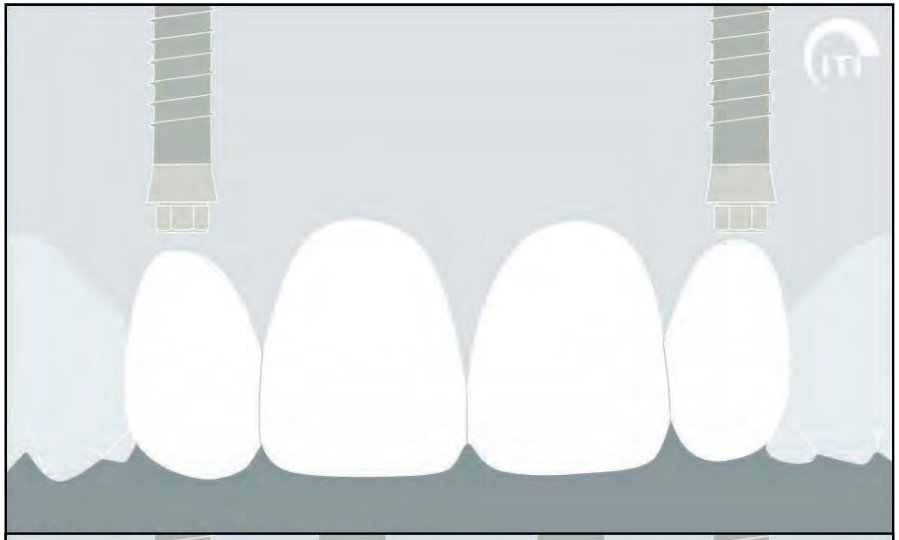
Esthetic Risk Factor	Level of Risk		
	Low	Moderate	High
Medical status	Healthy, co-operative patient with an intact immune system.		Reduced immune system
Smoking habit	Non-smoker	Light smoker (< 10 cigs/day)	Heavy smoker (> 10 cigs/day)
Patient's esthetic expectations	Low	Medium	High
Lip line	Low	Medium	High
Gingival biotype	Low scalloped, thick	Medium scalloped, medium thick	High scalloped, thin
Shape of tooth crowns	Rectangular		Triangular
Infection at implant site	None	Chronic	Acute
Bone level at adjacent teeth	≤ 5 mm to contact point	5.5 to 6.5 mm to contact point	≥ 7 mm to contact point
Restorative status of neighboring teeth	Virgin		Restored
Width of edentulous span	1 tooth (≥ 7 mm)	1 tooth (≤ 7mm)	2 teeth or more
Soft tissue anatomy	Intact soft tissue		Soft tissue defects
Bone anatomy of alveolar crest	Alveolar crest without bone deficiency	Horizontal bone deficiency	Vertical bone deficiency

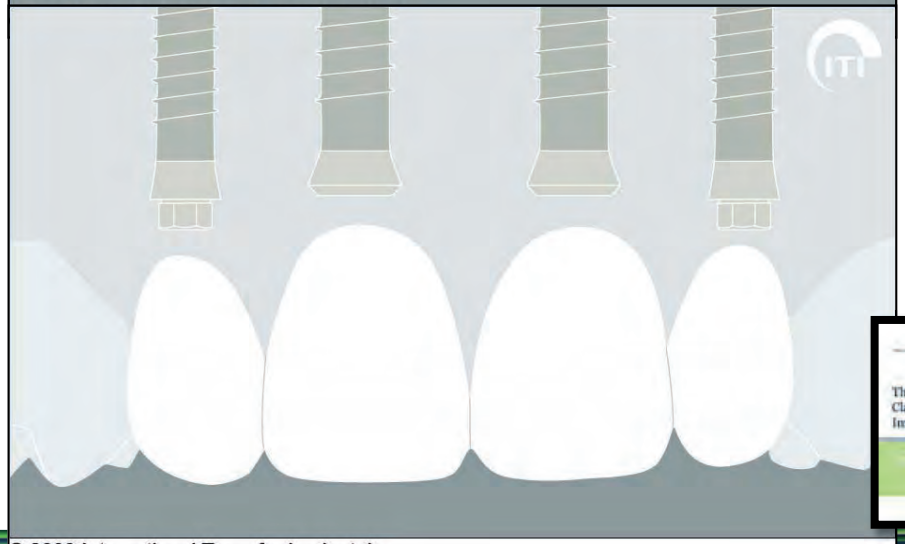
Issue	Degree of Difficulty		
	Low	Moderate	High
Oral Environment			
General Oral Health	No active disease		Active disease
Condition of adjacent teeth	Restored Teeth		Virgin teeth
Reason for tooth loss	Caries/Trauma		Periodontal Disease, or occlusal parafunction
Restorative Volume			
Inter-arch distance	Adequate for planned restoration.	Restricted space, but can be managed.	Adjunctive therapy will be necessary to gain sufficient space for planned restoration.
Mesio-distal space	Sufficient to fit replacements for missing teeth	Some reduction in size, or number of teeth will be necessary	Adjunctive therapy will be needed to achieve a satisfactory result.
Span of restoration	Single tooth	Extended edentulous space	Full arch
Volume and characteristics of the edentulous saddle	No prosthetic soft-tissue replacement will be necessary		Prosthetic replacement of soft tissue will be needed for esthetics or phonetics
Occlusion			
Occlusal Scheme	Anterior guidance		No guidance
Involvement in occlusion	Minimal involvement		Implant restoration is involved in guidance.
Occlusal para-function	Absent		Present
Provisional Restorations			
During implant healing	None required	Removable	Fixed
Implant supported provisionals needed	Not required.	Restorative margin <3mm apical to mucosal crest	Restorative margin >3mm apical to mucosal crest
Loading Protocol	Conventional or early loading		Immediate loading
Materials/Manufacture	Resin based materials ± metal reinforcement	Porcelain fused to metal.	
Maintenance Needs	Low	Moderate	High



General Factors	Assessment	Notes
Medical contraindications	None	
Smoking habit	None	
Growth considerations	None	
Site Factors	**Assessment**	**Notes**
Bone volume	Deficient	Horizontal bone augmentation in a staged approachrequired using autologous cortico-cancellous bone block
Anatomic risk	Low	
Esthetic risk	High	As determined by the ERA
Complexity	High	Immediate placement and flapless approach increases treatment complexity.
Risk of complications	High	Implant placement with staged procedures High risk of surgical complications with the bone graft, and donor site morbidity. Complications may significantly affect treatment outcomes
Loading protocol	Conventional or Early	
SAC Classification	Complex	



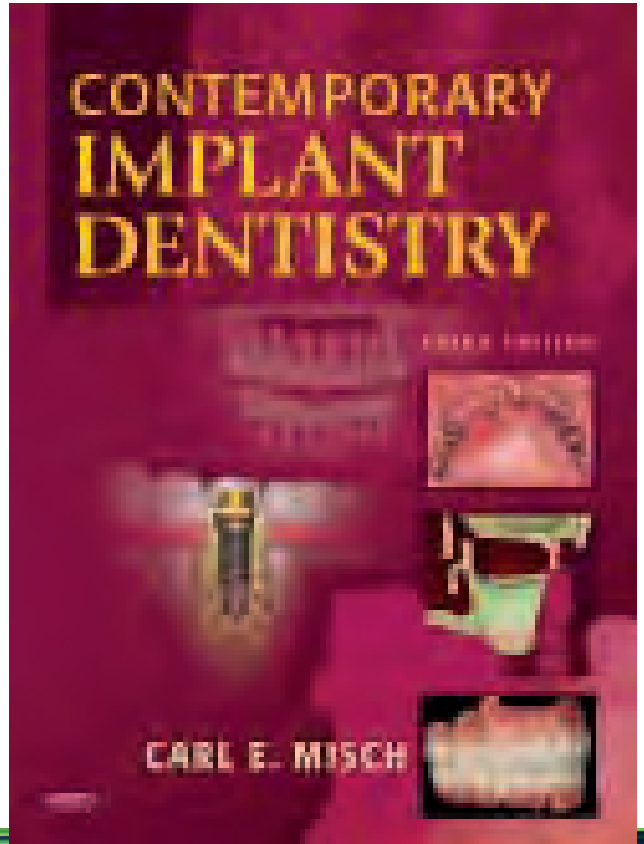






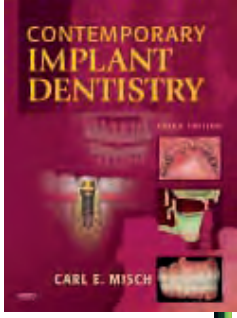
The SAC
Classification in
Implant Dentistry

Prosthetic concepts for predictable success according to some:

	Evidence basis
1) No pontics	**None**

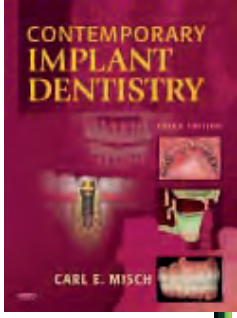


Prosthetic concepts for predictable success according to:

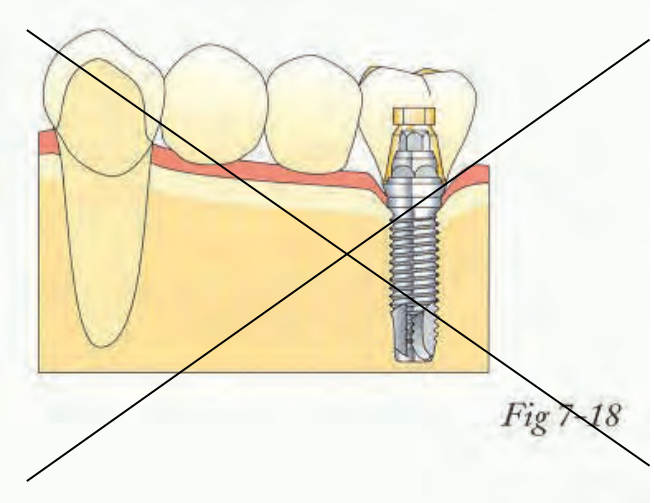


	Evidence basis
1) No pontics	None
2) No cantilevers	**Conflicting**

Prosthetic concepts for predictable success according to:



	Evidence basis
1) No pontics	None
2) No cantilevers	Conflicting
3) No connection to natural teeth	**Supported**



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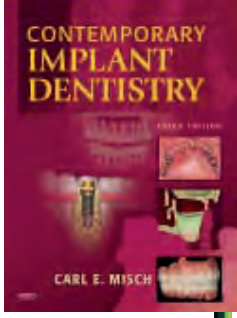
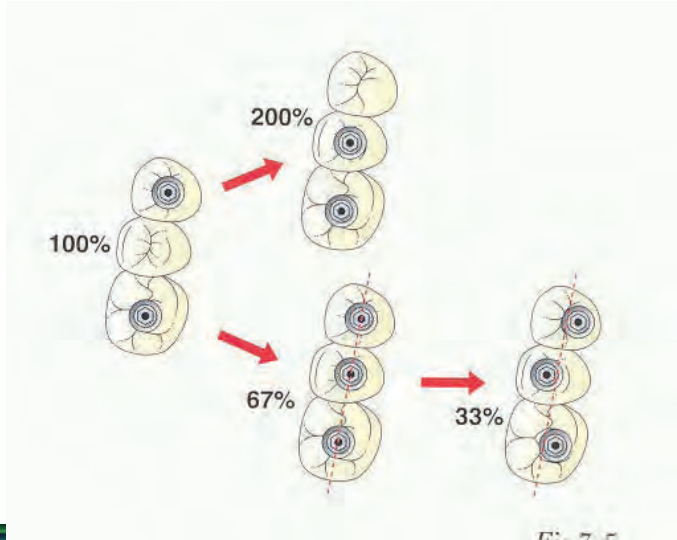


	Evidence basis
1) No pontics	None
2) No cantilevers	Conflicting
3) No connection to natural teeth	Supported
4) Splinting of implant crowns	**Theoretical**



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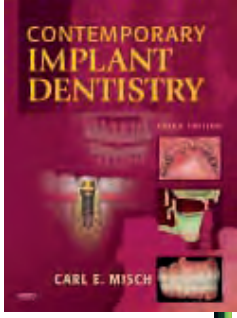


	Evidence basis
1) No pontics	None
2) No cantilevers	Conflicting
3) No connection to natural teeth	Supported
4) Splinting of implant crowns	Theoretical
5) Minimize occlusal table	**Supported**

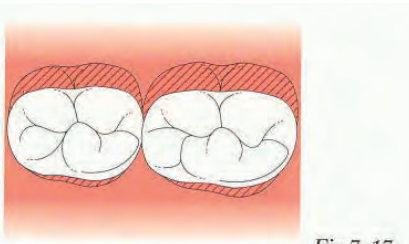


Fig 7-17

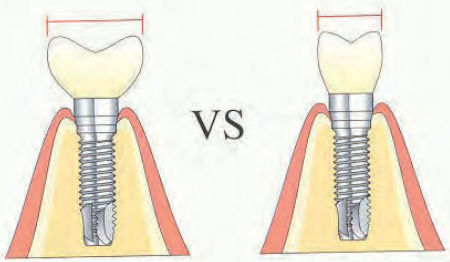
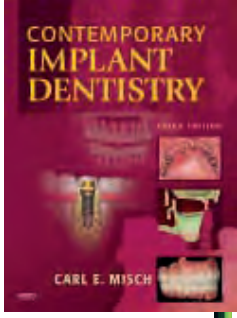


Fig 6-38

Prosthetic concepts for predictable success according to:



	Evidence basis
1) No pontics	None
2) No cantilevers	Conflicting
3) No connection to natural teeth	Supported
4) Splinting of implant crowns	Theoretical
5) Minimize occlusal table	Supported
6) Implant protected occlusal scheme	**Theoretical**
7) Progressive bone loading concept on softer bone	**Theoretical**

Thank you for your kind attention