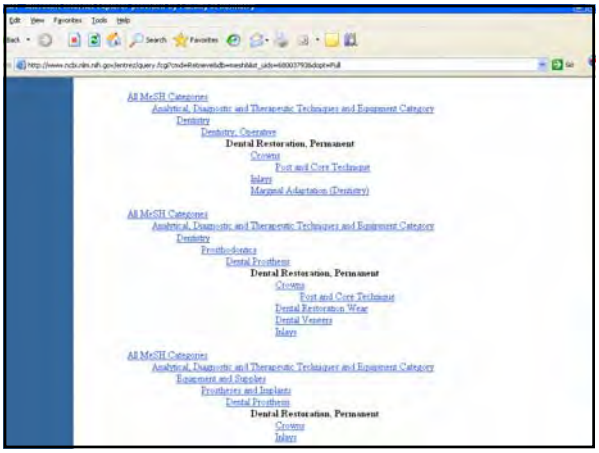
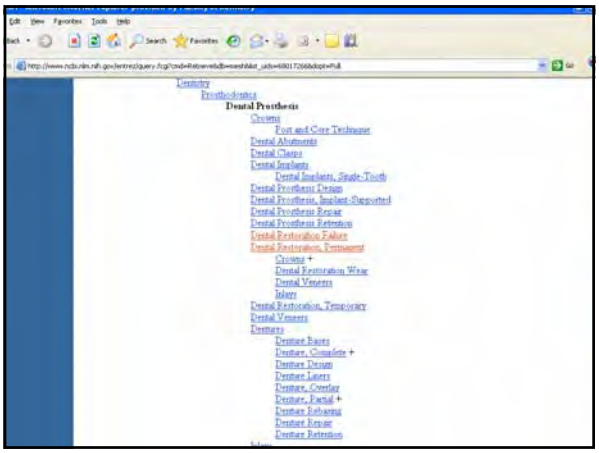
Clinical performance of alloys and metal ceramic restorations

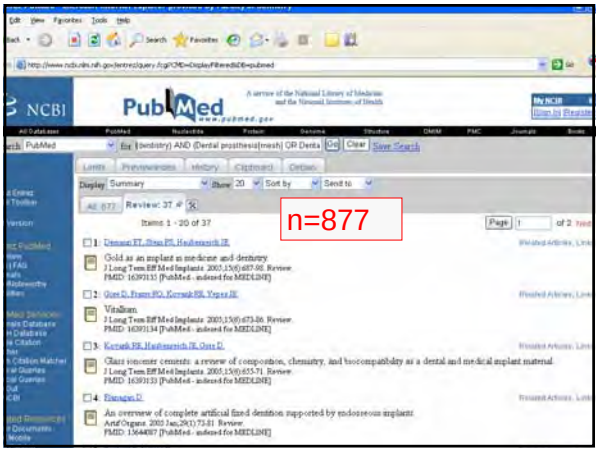
Asbjørn Jokstad

How many reports with focus on clinical performance of alloys and metal ceramic restorations can be identified?

2







How many reports related to the topic can be identified?

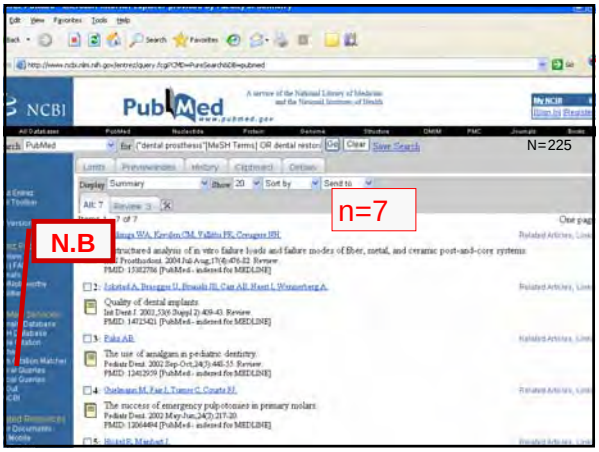
How are these approx. 877 reports characterized on the basis of their study design?

6

Strength of evidence
Clinical performance of alloys and metal ceramic restorations

1: Systematic reviews	
2: Clinical evidence	
3: Laboratory experiments	
4: Opinions, descriptive studies, narrative reports, etc.	
	877

7



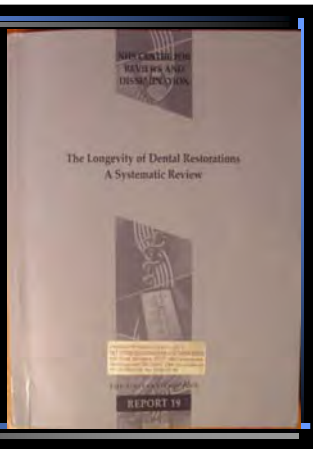
AIM:

Determine longevity of different dental restoration materials &

address cost-effectiveness

337 page report

1999.



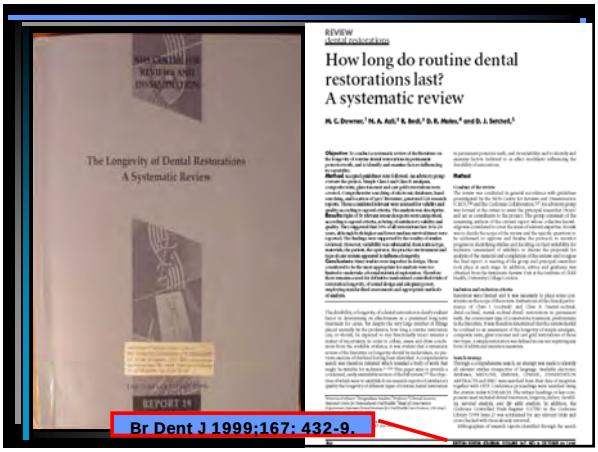
Effectiveness bulletin

What type of filling? Best practice in dental restorations

Effective Health Care

Dental restorations: what type of filling?

NHS CENTRE FOR REVIEWS AND DISSEMINATION



The Longevity of Dental Restorations
A Systematic Review

REPORT 18

REVIEW
dental restorations

How long do routine dental restorations last?
A systematic review

Br Dent J 1999;167: 432-9.

2. International ESPE Dental Symposium

150 Experts Discuss "Adhesive Dentistry"

Restorative materials: An evidence based review

Reviewing more than 500 clinical studies, Dr. Hickel analyzes the longevity rates and reasons for failure of direct resin [redacted], amalgam, and glass-ionomer cement restorations in Class I and Class II posterior cavities.

By Professor Dr. Reinhard Hickel (as presented at the 2nd International ESPE Dental Symposium in Philadelphia, May 2000)

Improved care and a dramatic decrease in caries in developed countries coupled with patient demand for increased esthetics are changing the face of dentistry. New restorative materials and new techniques also are significantly affecting the way dentists practice.

No change has been more dramatic than the decreased use of amalgam for posterior restorations. Sparked in part by controversy over amalgam's environmental impact and biocompatibility, clinicians in the last 15 years have been abandoning amalgam in favor of the newer tooth-colored restoratives.

In Germany, for example, three-quarters of all cavities in 1985 were restored using amalgam1; 10 years later, amalgam accounted for only 30% of the restorations placed.

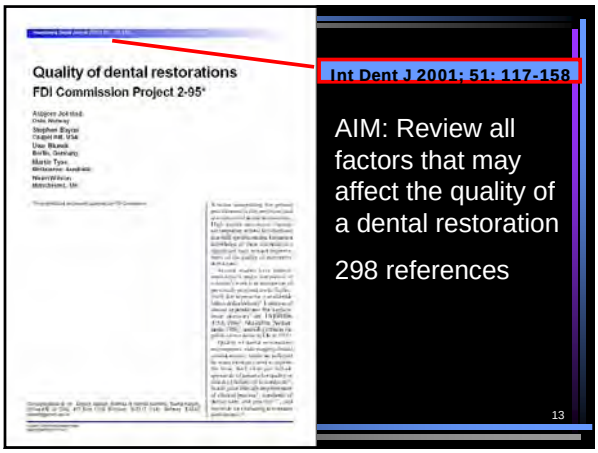
In other countries the decline has been even more dramatic. By 1995 only 40% of all restorations placed by Swedish dentists were amalgam. And, last year politicians there announced their decision that insurance companies would not pay for amalgam restorations beginning in the year 2001.2

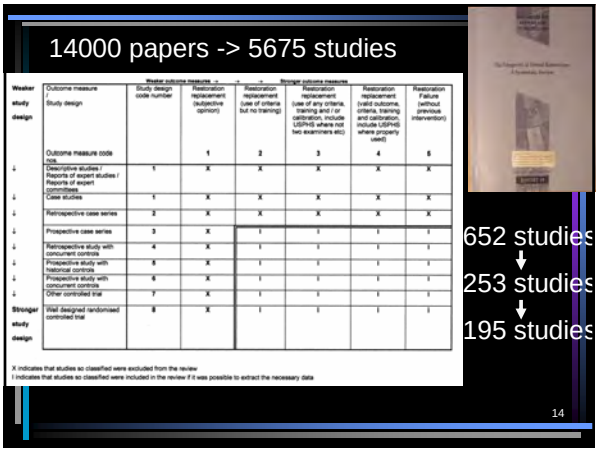
But some countries have been slower to transition to the contemporary restoratives. In 1986 in the United States, 65% of all fillings placed were amalgam;2 nine years later, 50% of fillings were still being restored with amalgam.

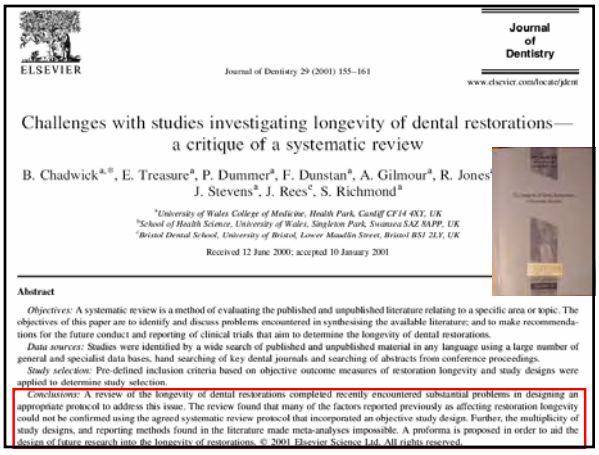
U.S. dentists are not alone. A survey3 conducted in 1999 by ESPE, under the guidance of Paul R. Casamassimo, Norm Wilson, and myself, and sent to a total of 14,000 dentists in 18 European countries and the United States, asked dentists to indicate

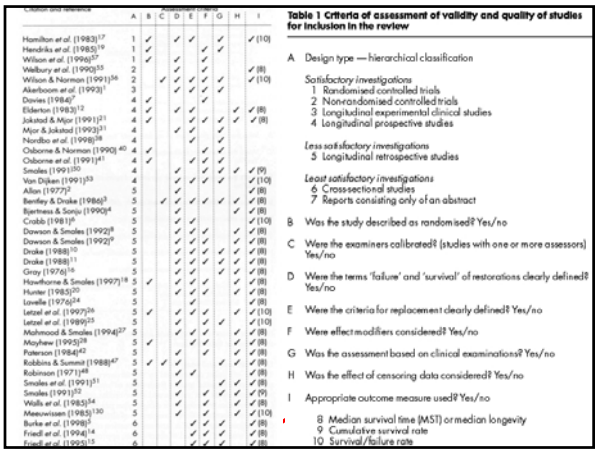
2 International ESPE Dental Symposium Philadelphia 2000

Adhesive Dentistry – Clinical and Microscopic Aspects


Quality of dental restorations
FDI Commission Project 2-95*
Int Dent J 2001; 51: 117-158
AIM: Review all factors that may affect the quality of a dental restoration
298 references
13


14000 papers -> 5675 studies
652 studies
253 studies
195 studies
14


ELSEVIER
Journal of Dentistry
Challenges with studies investigating longevity of dental restorations—a critique of a systematic review
Abstract



Criterion and reference		A	B	C	D	E	F	G	H	I	
Hamilton *et al.* (1983)[17]	1	✓			✓	✓		✓			✓ (10)
Hendriks *et al.* (1985)[19]	1	✓					✓	✓			
Wilson *et al.* (1996)[57]	1	✓			✓		✓				
Wellbury *et al.* (1990)[55]	2				✓		✓				✓ (8)
Wilson & Norman (1991)[56]	2			✓	✓	✓	✓	✓			✓ (10)
Akerboom *et al.* (1993)[1]	3				✓	✓	✓	✓			
Davies (1984)[7]	4	✓					✓				
Elderton (1983)[12]	4	✓			✓	✓				✓	✓ (8)
Jokstad & Mjor (1991)[21]	4	✓				✓	✓	✓		✓	✓ (8)
Mjor & Jokstad (1993)[31]	4				✓	✓		✓			
Nordbo *et al.* (1998)[38]	4					✓		✓			
Osborne & Norman (1990) [40]	4	✓					✓	✓			
Osborne *et al.* (1991)[41]	4	✓				✓	✓	✓			
Smales (1991)[50]	4				✓		✓	✓	✓	✓	✓ (9)
Van Dijken (1991)[53]	4				✓	✓	✓	✓			✓ (10)
Allan (1977)[2]	5				✓	✓					✓ (8)
Bentley & Drake (1986)[3]	5			✓	✓	✓	✓	✓	✓	✓	✓ (8)
Bjertness & Sonju (1990)[4]	5				✓				✓	✓	✓ (8)
Crabb (1981)[6]	5				✓	✓					✓ (10)
Dawson & Smales (1992)[8]	5				✓	✓	✓		✓	✓	✓ (8)
Dawson & Smales (1992)[9]	5				✓	✓	✓		✓	✓	✓ (8)
Drake (1988)[10]	5				✓	✓	✓	✓	✓	✓	✓ (8)
Drake (1988)[11]	5				✓	✓	✓	✓	✓	✓	✓ (8)
Ginty (1976)[16]	5				✓	✓		✓	✓	✓	✓ (8)
Hawthorne & Smales (1997)[18]	5	✓			✓	✓	✓			✓	✓ (8)
Hunter (1985)[20]	5				✓	✓	✓			✓	✓ (8)
Lavelle (1976)[24]	5					✓					✓ (8)
Letzel *et al.* (1997)[26]	5	✓			✓	✓	✓			✓	✓ (10)
Letzel *et al.* (1989)[25]	5				✓		✓	✓			✓ (10)
Mahmood & Smales (1994)[27]	5				✓	✓	✓			✓	✓ (8)
Mayhew (1995)[28]	5	✓				✓	✓			✓	✓ (8)
Paterson (1984)[42]	5				✓		✓			✓	✓ (8)
Robbins & Summit (1988)[47]	5	✓	✓	✓				✓	✓	✓	✓ (8)
Robinson (1971)[48]	5				✓	✓					✓ (8)
Smales *et al.* (1991)[51]	5				✓			✓	✓	✓	✓ (8)
Smales (1991)[52]	5				✓		✓	✓	✓	✓	✓ (9)
Walls *et al.* (1985)[54]	5				✓		✓			✓	✓ (8)
Meeuwissen (1985)[30]	5				✓		✓			✓	✓ (10)
Burke *et al.* (1998)[5]	6					✓	✓	✓			✓ (8)
Friedl *et al.* (1994)[14]	6					✓	✓	✓			✓ (8)
Friedl *et al.* (1995)[15]	6					✓	✓	✓			✓ (8)

Table 1 Criteria of assessment of validity and quality of studies for inclusion in the review

A Design type — hierarchical classification

Satisfactory investigations
1 Randomised controlled trials
2 Non-randomised controlled trials
3 Longitudinal experimental clinical studies
4 Longitudinal prospective studies

Less satisfactory investigations
5 Longitudinal retrospective studies

Least satisfactory investigations
6 Cross-sectional studies
7 Reports consisting only of an abstract

B Was the study described as randomised? Yes/no

C Were the examiners calibrated? (studies with one or more assessors) Yes/no

D Were the terms 'failure' and 'survival' of restorations clearly defined? Yes/no

E Were the criteria for replacement clearly defined? Yes/no

F Were effect modifiers considered? Yes/no

G Was the assessment based on clinical examinations? Yes/no

H Was the effect of censoring data considered? Yes/no

I Appropriate outcome measure used? Yes/no
8 Median survival time (MST) or median longevity
9 Cumulative survival rate
10 Survival/failure rate

REVIEW
dental restorations

How long do routine dental restorations last? A systematic review

M. C. Downer,[1] N. A. Ash,[2] R. Bedi,[3] D. R. Moles,[4] and D. J. Setchell,[5]

Objective To conduct a systematic review of the literature on the longevity of routine dental restorations in permanent posterior teeth, and to identify and examine factors influencing its variability.

Method Accepted guidelines were followed. An advisory group oversaw the project. Simple Class I and Class II amalgam, composite resin, glass ionomer and cast gold restorations were covered. Comprehensive searching of electronic databases, hand-searching, and location of 'grey' literature, generated 124 research reports. Those considered relevant were assessed for validity and quality according to agreed criteria. The analysis was descriptive.

Results Eight of 58 relevant research reports were categorised, according to agreed criteria, as being of satisfactory validity and quality. They suggested that 50% of all restorations last 10 to 20 years, although both higher and lower median survival times were reported. The findings were supported by the totality of studies reviewed. However, variability was substantial. Restoration type, materials, the patient, the operator, the practice environment and type of care system appeared to influence longevity.

Conclusions Many studies were imperfect in design. Those considered to be the most appropriate for analysis were too limited to undertake a formal statistical exploration. Therefore there remains a need for definitive randomised controlled trials of restoration longevity, of sound design and adequate power, employing standardised assessments and appropriate methods of analysis.

17

Clinical studies

1. Observational
2. Experimental
   1. Controlled trials
   2. Prognosis

18

Clinical studies

1. Observational
   - Replaced restorations (Retrospective)
   - Restorations in situ (Retrospective)

19

Clinical studies

1. Observational
   - Replaced restorations (Retrospective)
   - Restorations in situ (Retrospective)

20

Age of replaced restorations

Authors	Year	Sample size
Mjör et al.	2000	9805
Mjör et al.	2002	8395
Mjör et al.	2000	6761
Burke et al.	1999	4608
Friedl et al.	1995	3375
Burke et al.	2001	3196
Bay	1982	2291
MacInnis et al.	1991	2280
Burke et al.	2002	2099
Mjör & Moorhead	1998	2035

21

Clinical studies

1. Observational
   - Replaced restorations (Retrospective)
   - Restorations in situ (Retrospective)

22

How old are these restorations?

Display Abstract Sort Save Text Add to Clipboard Order

1: Acta Odontol Scand 1994 Aug;52(4):234-42

The age of restorations in situ.

Jokstad A, Mjor IA, Qvist V.

Dental Faculty, University of Oslo, Norway.

In a cross-sectional survey the age of restorations in situ was recorded in three patient groups. Group A were randomly examined regular attenders, group B were irregular attenders randomly chosen from patient treatment records, and in group C the age of posterior gold and composite resin restorations was recorded in selected regular attenders. The study material included 8310 restorations in group A, 1281 in group B, and 500 restorations in group C. The three materials amalgam, composite, and gold accounted for more than 90% of all restorations. In group A 3.3% of the restorations were scheduled for replacement. The most prevalent reasons for replacement were secondary caries, bulk fractures of the restoration, and tooth fractures. The median age of the failed restorations was fairly similar to the median age of the acceptable restorations in situ among the regular patients (group A). The data indicate median ages of 20 years for gold restorations, 12-14 years for amalgam restorations, and 7-8 years for composite resin restorations. The restoration ages were influenced by the type and size of the restoration, the restorative material used, and possibly also the intra-oral location of the restorations.

Publication Types:
- Clinical Trial
- Randomized Controlled Trial

PMID: 7985509 [PubMed - indexed for MEDLINE]

Clinical studies

1. Observational
2. Experimental

25

What is our principal clinical question/problem?

26


1. Which material group perform best?

i.e a question of <u>Therapy</u>

27

1. Which material group perform best?

2. Which product within the material group performs best?

i.e a question of Therapy

28

The best intervention? i.e a question of therapy

Study requirements:

- Random allocation of the participants to the alternative interventions
- Outcome measures of known or probably clinical importance for at least 80 per cent of participants who entered the investigation
- A statistical analysis consistent with the study design.

29

How long will these restorations last?

(At what stage is more benefit than harm done by replacing them?)

31

What will follow the intervention?... i.e a question of prognosis . Study requirements:

- An inception cohort of persons, all initially free of the outcome of interest
- Follow-up of at least 80 per cent of patients until the occurrence of either a major study criteria or the end of the study
- A statistical analysis consistent with the study design.

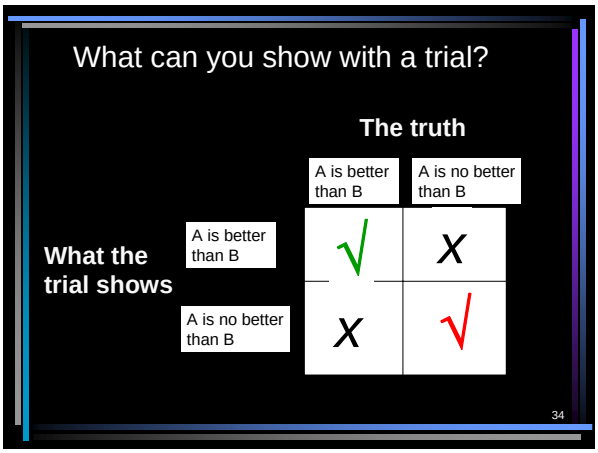
32

Clinical studies

1. Observational
2. Experimental
    1. Controlled trials
    2. Prognosis

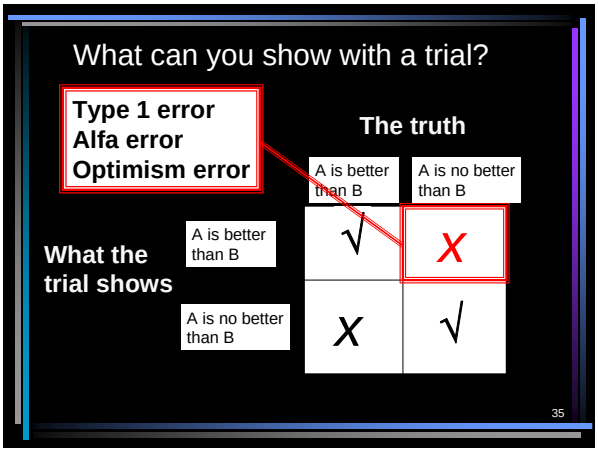
33

What can you show with a trial?



34

What can you show with a trial?

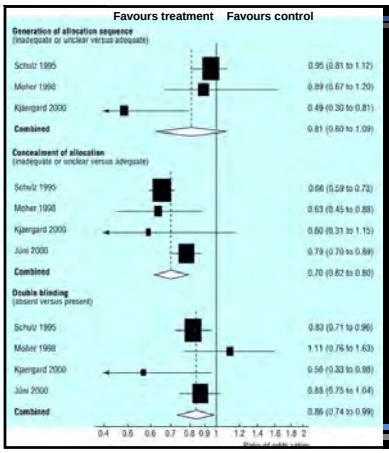


35

Type 1 error

1. Poor study design

36



Effects of inadequate (RCT) study design on results

Jüni et al.Methodological quality of controlled trials and effect estimates. BMJ 2001.

37

Type 1 error

1. Poor study design
2. Fallacies of observed clinical success
- Spontaneous remission
- Placebo response
- Multiple variables in treatment
- Radical versus conservative treatment
- Over-treatment
- Long-term failure
- Side effects and sequelae of treatment

38

What can you show with a trial?

What the trial shows	The truth: A is better than B	The truth: A is no better than B
A is better than B	√	X
A is no better than B	X	√

Type 2 error
Beta error
Pessimism error

39

Type 2 error

1. Underpowered study
2. Fallacies of observed clinical failure
   - Wrong diagnosis
   - Incorrect cause-effect correlation
   - Multifactorial problem
   - Lack of cooperation
   - Improper execution of treatment
   - Premature evaluation of treatment
   - Limited success of treatment
   - Psychological barriers to success

40

Clinical studies

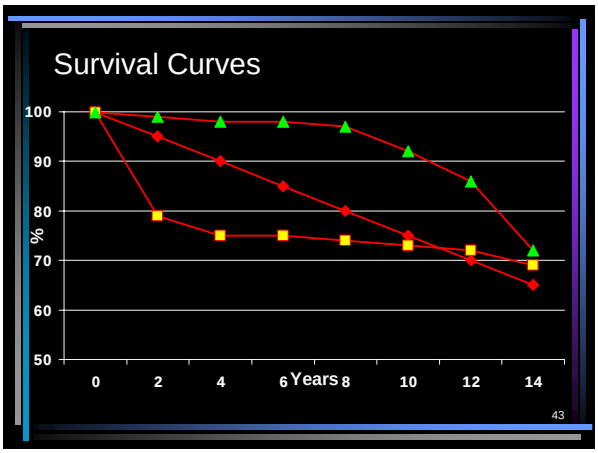
1. Observational
2. Experimental
   1. Controlled trials
   2. Prognosis

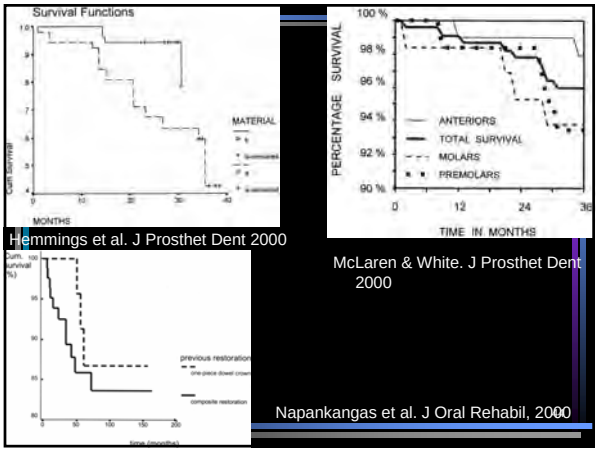
41

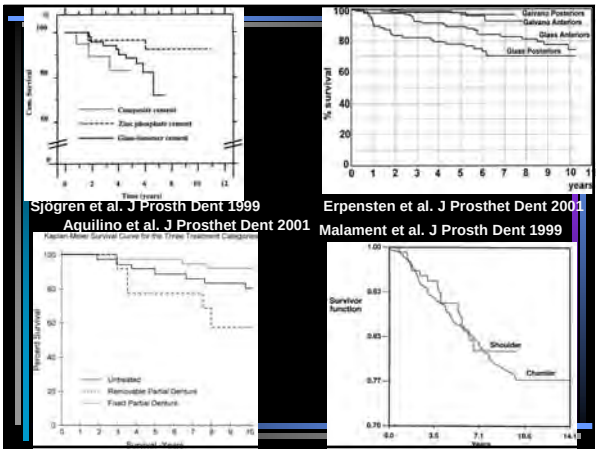
Prognosis – likelihood estimates

- Proportion of survival or success according to some specific criteria after a given temporal interval, e.g. after 1 or 5 years
- Median time of survival (in years), where 50% of the study unit, e.g. the patient, prosthesis, restorations or tooth, have failed, or
- Survival curves – describe for each time unit along a horizontal axis estimates of the proportion of the study unit that remain intact according to survival or success according to some specific criteria

42


Survival Curves
100
90
80
%
70
60
50
0
2
4
6
Years
8
10
12
14
43

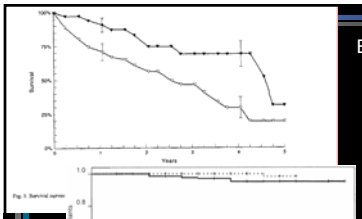

Survival Functions
MATERIAL
MONTHS
Hemmings et al. J Prosthet Dent 2000
100 %
98 %
96 %
94 %
92 %
90 %
SURVIVAL
PERCENTAGE
ANTERIORS
TOTAL SURVIVAL
MOLARS
PREMOLARS
0
12
24
TIME IN MONTHS
McLaren & White. J Prosthet Dent 2000
previous restoration
composite restoration
Napankangas et al. J Oral Rehabil, 2000


Sjögren et al. J Prosth Dent 1999
Aquilino et al. J Prosthet Dent 2001
Erpensten et al. J Prosthet Dent 2001
Malament et al. J Prosth Dent 1999
Shoulder
Chamfer

Prognosis - Precision of the likelihood estimates

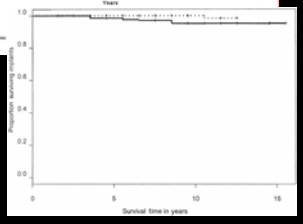
- All good clinical prognosis studies include measures of confidence intervals for prognosis-estimates
- A 95% confidence interval consists of two values that indicating an interval where we can be 95% certain that the true value lies
- A narrow confidence interval is an indication of a precise estimate of the true value

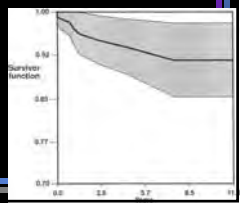
46



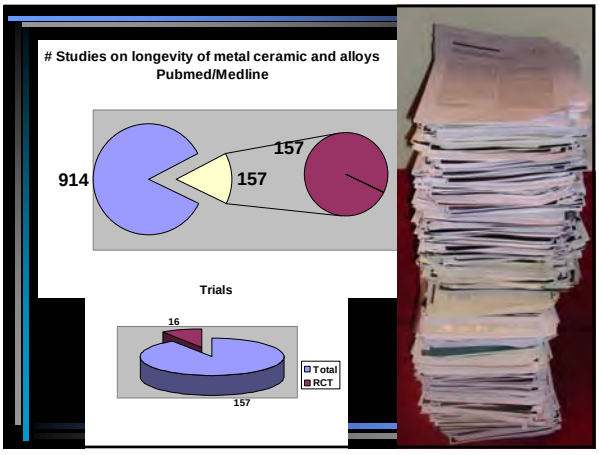
Etch bridges
Creugers et al. J Dent 2001

Implants freestand vs connected
Naert et al., Clinical Oral Implants Research, 2001





Malament et al. J Prosth Dent 1999



Strength of evidence
Clinical performance of alloys and metal ceramic restorations

1: Systematic reviews	7
2: Clinical evidence	157
3: Laboratory experiments	
4: Opinions, descriptive studies, narrative reports, etc.	
	877

49

Strength of the evidence: Clinical performance of alloys and metal ceramic restorations

1. A large volume of the literature consists of narrative reviews
2. Extrapolation from laboratory data is often used uncritically
3. Many clinical studies are not appropriately designed to demonstrate clinical superiority and/or for survival estimations

50

Strength of the evidence: Clinical performance of alloys and metal ceramic restorations

1. Large volume of literature consists of narrative reviews
2. Extrapolation from laboratory data is often uncritical
3. Clinical studies not appropriately designed to demonstrate clinical superiority and/or for survival estimations
4. Most RCTs are small & underpowered
5. Majority of clinical studies use surrogate outcomes and not patient-focused criteria
6. Most clinical trials studies are done in secondary settings- not real-life dentistry

51

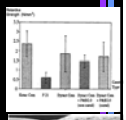
Strength of evidence
Clinical performance of alloys and metal ceramic restorations

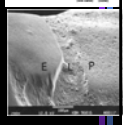
1: Systematic reviews	7
2: Clinical evidence	157
3: Laboratory experiments	340
4: Opinions, descriptive studies, narrative reports, etc.	
	877

52

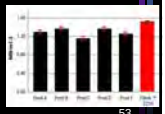
Laboratory tests - clinical relevance? 1/2

Static stresses
Compressive (crushing) strength, 1h & 24 h
Tensile strength, 15 min.
Transverse strength, 1h & 24 h
(Flexure/bending/modulus of rupture)
Modulus of elasticity (Young's Modulus)
Shear modulus





Dynamic tests
Compressive modulus
Tensile modulus
Bending modulus
Resilience
Fatigue
Fracture toughness



53

Laboratory data - clinical relevance? 2/2

Other defined tests
Flow (Creep) 3-24 h
Dimensional change 5 min -24 h
(Polymerization/setting contraction/expansion)
Hardness
Thermal Expansion Coefficient
Water solubility
Water sorption

Other undefined tests
Abrasion resistance (Wear)
Adhesion
Surface roughness
Margin leakage

Strength of evidence
Clinical performance of alloys and metal ceramic restorations

1: Systematic reviews	9
2: Clinical evidence	157
3: Laboratory experiments	340
4: Opinions, descriptive studies, narrative reports, etc.	371
	877

55

Quality and longevity of metallic restorations

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Quality of dental restorations

- Longevity curves of varying materials and lenghts of survival ?

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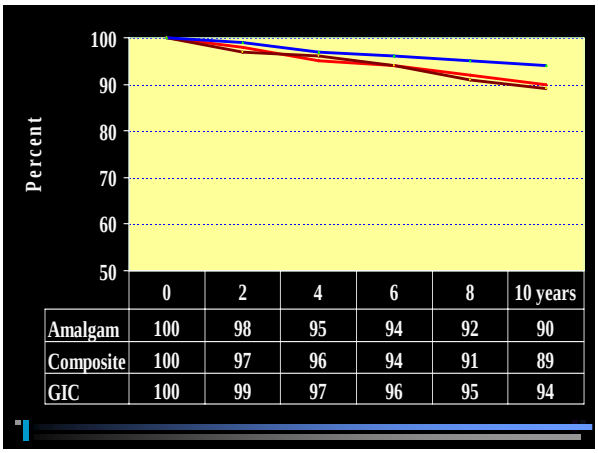

	0	2	4	6	8	10 years
Amalgam	100	98	95	94	92	90
Composite	100	97	96	94	91	89
GIC	100	99	97	96	95	94

Quality of dental restorations

- Longevity curves of varying materials and lenghts of survival ?
- odds ratios to show relationships between clinical variables and quality and longevity in various segments of patient populations.

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Quality of dental restorations

Independent variables	*Bi-variate odds ratios*	*Bivariate significance*	*95% Confidence intervals bivariate odds ratios*	*Multi-variate odds ratios*	*Multivariate significance*	*95% Confidence intervals for multivariate odds ratios*
Age group						
20-30	-	-	-	-	-	-
30-40	2.32	**	1.15 - 3.13	2.52	**	1.35 - 3.33
+40	2.63	***	1.43 - 3.08	2.63	***	1.83 - 3.8
Gender						
Male	-	-	-	-	-	-
Female	2.42	**	1.61 - 2.79	2.12	**	1.91 - 2.9
Material						
Amalgam	-	-	-	-	-	-
Composites	1.12	NS	0.13 - 1.56	1.42	NS	1.13 - 1.96
Glass ionom.	3.12	***	2.52 - 4.34	5.65	**	4.67 - 7.23
Dentists						
#1	-	-	-	-	-	-
#2	1.34	NS	0.35 - 1.61	1.04	NS	1.35 - 2.01
Location						
Mandible	-	-	-	-	-	-
Maxilla	1.55	*	1.17 - 2.04	1.15	*	1.57 - 2.14

Quality of dental restorations

- Longevity curves of varying materials and lenghts of survival ?
- odds ratios to show relationships between clinical variables and quality and longevity in various segments of patient populations.
- scoring criteria according to different evaluation systems to describe the technical excellence of restorations.

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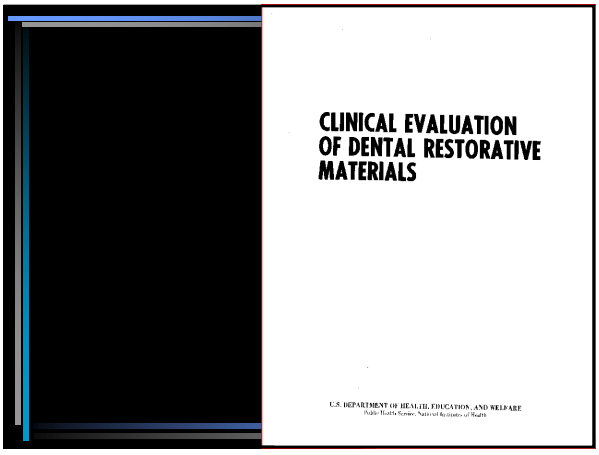
Guidelines for the Assessment of Clinical Quality and Professional Performance

Printed in the United States of America

THIS DOCUMENT MUST BE CONSIDERED IN ITS ENTIRETY AND NO SUMMARY OR ABRIDGEMENT OF THIS REPORT SHALL BE PERMITTED UNLESS FIRST REVIEWED AND APPROVED BY THE CALIFORNIA DENTAL ASSOCIATION

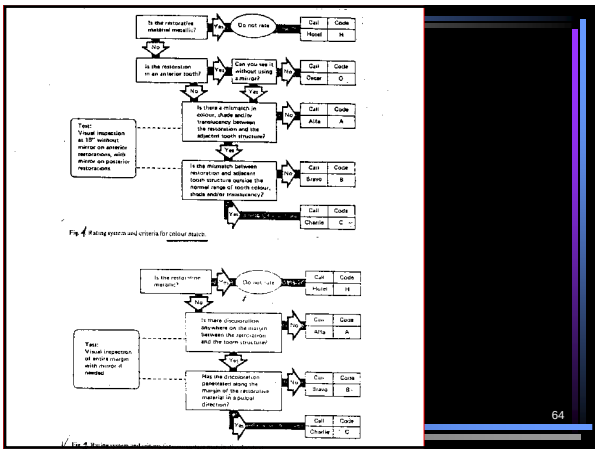
California Dental Association
P.O. Box 13749
Sacramento, California 95853
Third Edition

Table of Contents



CLINICAL EVALUATION OF DENTAL RESTORATIVE MATERIALS

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE



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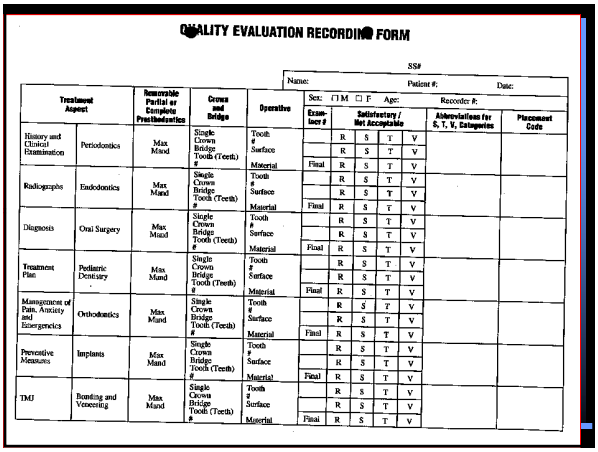

QUALITY EVALUATION RECORDING FORM

SS#

Name: Patient #: Date:

Sex: ☐M ☐F Age: Recorder #:

Treatment Aspect		Removable Partial or Complete Prosthodontics	Crown and Bridge	Operative	Exam-iner #	Satisfactory / Not Acceptable				Abbreviations for S, T, V, Categories	Placement Code
History and Clinical Examination	Periodontics	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		
Radiographs	Endodontics	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		
Diagnosis	Oral Surgery	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		
Treatment Plan	Pediatric Dentistry	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		
Management of Pain, Anxiety and Emergencies	Orthodontics	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		
Preventive Measures	Implants	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		
TMJ	Bonding and Veneering	Max Mand	Single Crown Bridge Tooth (Teeth) #	Tooth # Surface Material		R	S	T	V		
					Final	R	S	T	V		

Quality of dental restorations

The risk of jeopardising the integrity of remaining dental and oral tissues and the extent to which the form, function and properties of the tooth is imitated to the patient's satisfaction and maintained over time.

FDI Draft Statement, 2000

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“Longevity data”

Numerical measures of the quality and longevity of dental restorations can be regarded simply as a consequence of either a correct or an incorrect treatment decision approach

FDI World Dental Federation 2001

Replacement of restorations

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Which factors determine my treatment decision?

- Do we know which factors that influence our decisions to replace restorations?
- A number of both objective and subjective factors have been identified.

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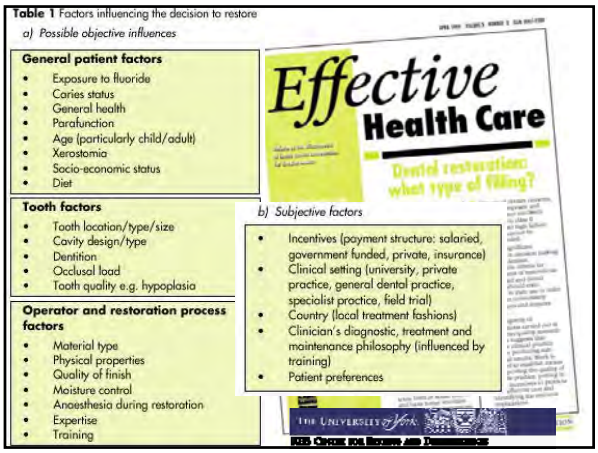

Table 1 Factors influencing the decision to restore

a) Possible objective influences

General patient factors
- Exposure to fluoride
- Caries status
- General health
- Parafunction
- Age (particularly child/adult)
- Xerostomia
- Socio-economic status
- Diet

Tooth factors
- Tooth location/type/size
- Cavity design/type
- Dentition
- Occlusal load
- Tooth quality e.g. hypoplasia

Operator and restoration process factors
- Material type
- Physical properties
- Quality of finish
- Moisture control
- Anaesthesia during restoration
- Expertise
- Training

b) Subjective factors
- Incentives (payment structure: salaried, government funded, private, insurance)
- Clinical setting (university, private practice, general dental practice, specialist practice, field trial)
- Country (local treatment fashions)
- Clinician's diagnostic, treatment and maintenance philosophy (influenced by training)
- Patient preferences

Effective Health Care

Dental restorations: what type of filling?

THE UNIVERSITY of York

What takes place when considering replacement of a restoration?

- A consideration if more good than harm is done by replacing restorations, i.e.

  a risk-benefit analysis
- What must an examination include so a risk-benefit analysis can be carried out?
- Appraisal of the presence or absence of markers of oral disease
- Error to focus attention on the appearance of the restorations.

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Restoration quality in relation to the state of oral disease

1. consider my patient's overall risk profile

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Step 1: Overall risk profile

- **Lack of compliance to a recall program or irregular dental attendance**
- **Presence of a systemic disease**
- **Medication side effects**
- **Cigarette smoking**
- **Dietary habits**
  - **Frequency of sugar intake**
  - **Availability of snacks**
- **Use of fluorides**
- **Social deprivation**
- **Low knowledge of dental disease**
- **Low dental aspirations**
- **History of repeated interventions**

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Restoration quality in relation to the state of oral disease

1. consider my patient's overall risk profile
2. look for key risk markers of oral disease

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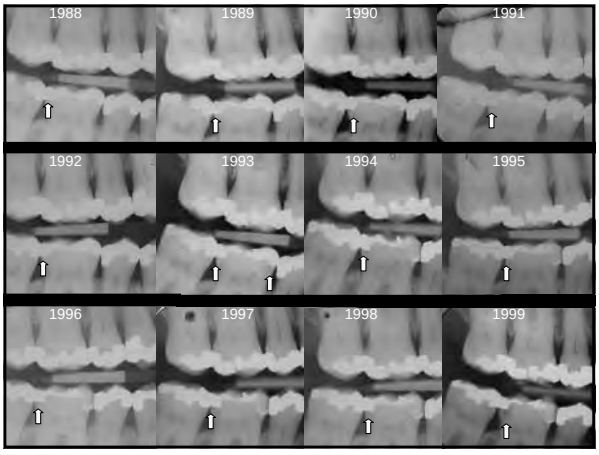

Step 2: Key risk markers of oral disease

- Previous caries experience or loss of periodontal support in relation to the patient's age
- Full mouth plaque and/or bleeding scores
- Saliva quantity and quality
- Prevalence of residual pockets

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Restoration quality in relation to the state of oral disease.

1. consider my patient's overall risk profile
2. look for key risk markers of oral disease
3. look out for pathogenic conditions or detect risk markers of a progressive oral disease

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Step 3: Pathogenic conditions and risk markers of progressive oral disease

- Inflammatory periodontal parameters and their persistence
- Caries and caries location
- Presence of ecological niches with difficult access such as furcations
- Presence of iatrogenic factors such as restoration discrepancies

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Stepwise risk assessment

1. Overall risk profile
2. Key risk markers of oral disease
3. Pathogenic conditions and risk markers of progressive oral disease
4. **It is not until this stage that concern about the technical excellence of a particular restoration should be addressed in context with the estimate of possible risk for disease progression at a particular tooth site.**

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USPHS – **Caries** (Cvar & Ryge, 1973)

Test: Visual inspection, with explorer and mirror if needed

Alfa: No evidence of caries contiguous with the margin

Bravo: Explorer catch or resist removal after insertion with moderate to firm pressure, and evidence of softness. Alternatively, opacity of the margin, as evidence of undermining or demineralization, or etching or a white spot as evidence of demineralization.

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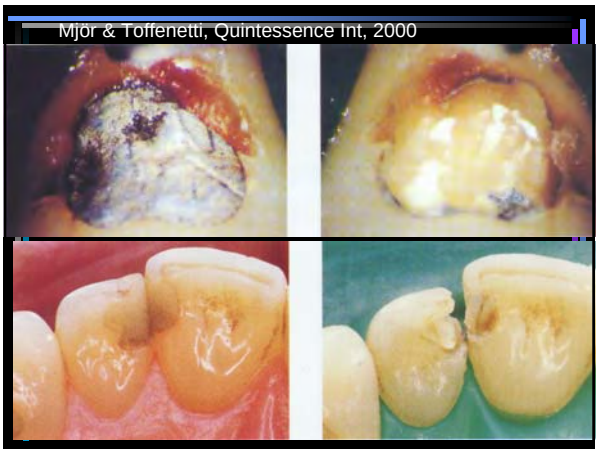

USPHS- Margin adaptation

Test: Lightly draw a sharp explorer back and forth across the margin. If catch, inspect for crevice with mirror if needed

Alfa: Explorer does not catch. No visible evidence of crevice.
Bravo: Explorer catches, and there is visible evidence of a crevice into which the explorer will penetrate. Dentin or base is not visible.
Charlie: Explorer penetrates into crevice that is of such depth that dentin or base is exposed
Delta: Restoration is fractured, mobile, or missing

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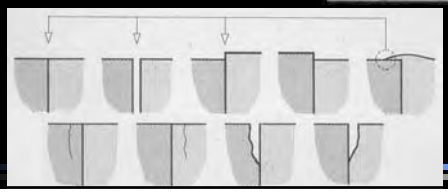
Inlays/onlays - margins

Gold: 25-50 um
Composite inlays: 50-200 um
Ceramic inlays: 50-200 um



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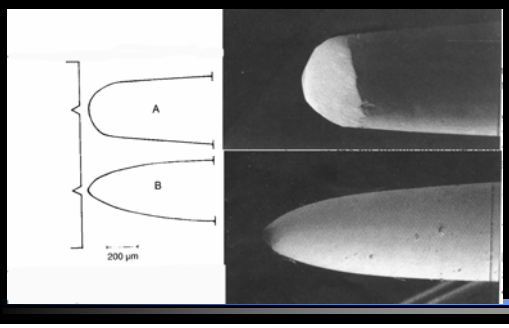
Probe as a diagnostic tool?



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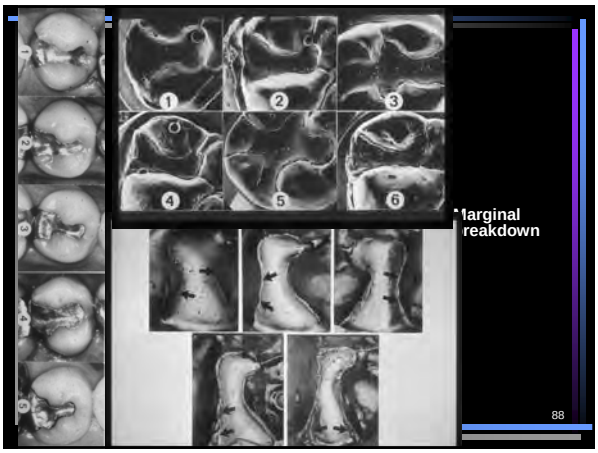
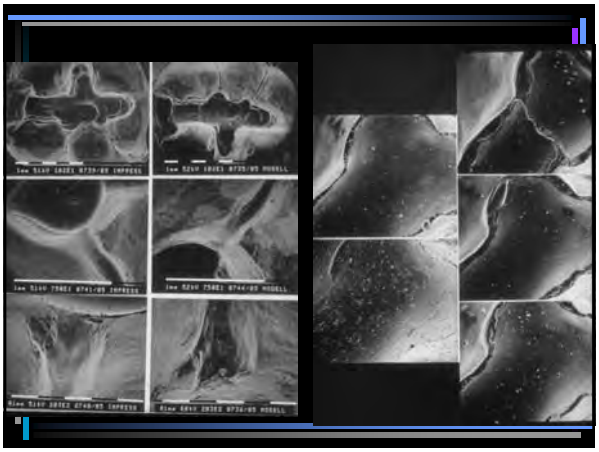
New and old

87





Study	External indications of secondary caries		Validation method and criteria	Relation between external indication and validation criteria
	Marginal integrity	Discolouration		
Kidd & O'Hara, 1990	+		Histopathological examination Presence or absence of outer and wall lesion	No
Kidd et al., 1994		+	Stereomicroscopic examination Enamel-dentine junction colour Enamel-dentine junction consistency	No
Rudolphy et al., 1995	+	+	Microradiographic examination Presence of radiolucent or radiopaque areas at the enamel-dentine junction	No
Pimenta et al., 1995	+		Histopathological examination Presence or absence of outer and wall lesion	No
Rudolphy et al., 1996		+	Microradiographic examination Presence of radiolucent or radiopaque areas at the enamel-dentine junction	No

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What is the situation in 2006?

- The oral diseases are the same
- The need for high technical excellence remains unchanged
- better understanding of etiological mechanisms of oral diseases
- documented effectiveness of a range of prophylactic interventions to avoid or arrest oral diseases
- aggressive promotion of oral health care products through advertising
- majority of the population have topical fluoride treatments 365x2 per year

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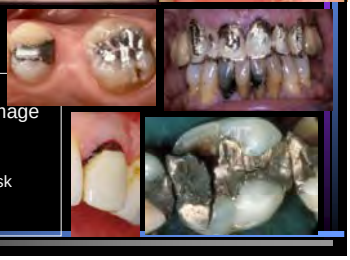
Dental restorations and prognosis

a. Observe?
or
b. Repair?
or
c. Replace?

Pain
Tissue damage
Integrity
- Pulp
- Caries risk
- Function

Replicate



a. Observe?
or
b. Repair?
or
c. Replace?

Pain:
Tissue damage:

Integrity: Pulp - Caries risk – Function – Replicate ✓

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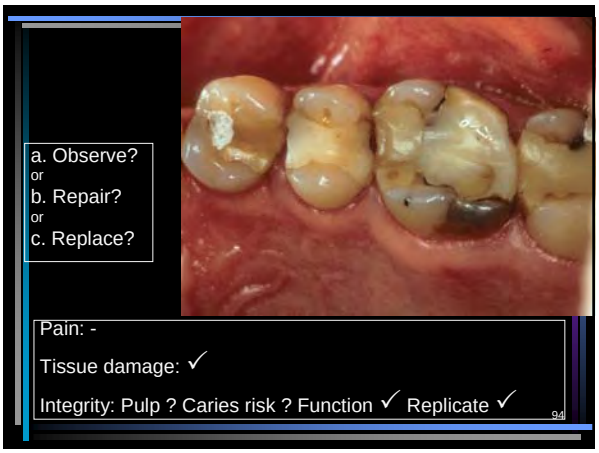
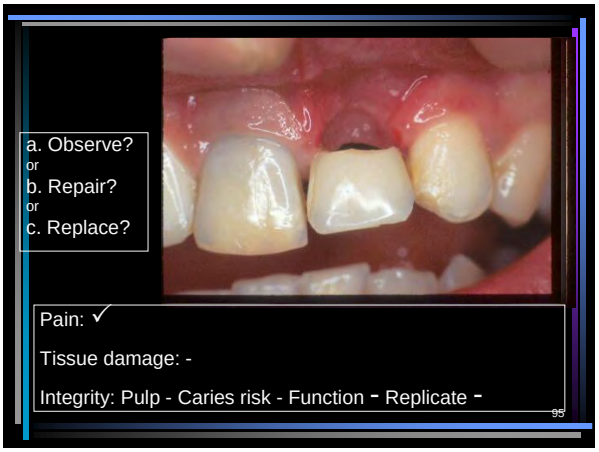
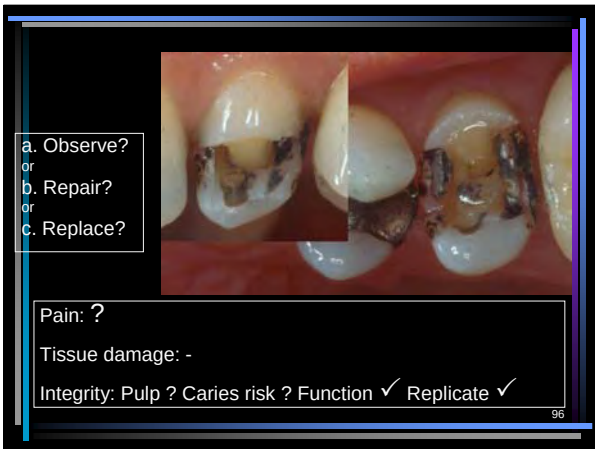
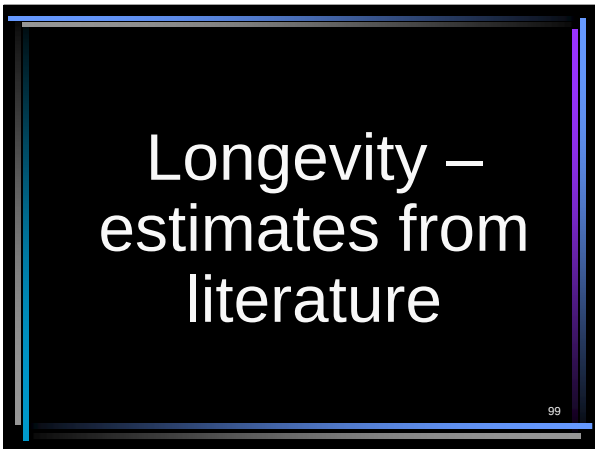

a. Observe?
or
b. Repair?
or
c. Replace?
Pain: -
Tissue damage: ✓
Integrity: Pulp ? Caries risk ? Function ✓ Replicate ✓
94


a. Observe?
or
b. Repair?
or
c. Replace?
Pain: ✓
Tissue damage: -
Integrity: Pulp - Caries risk - Function - Replicate -
95


a. Observe?
or
b. Repair?
or
c. Replace?
Pain: ?
Tissue damage: -
Integrity: Pulp ? Caries risk ? Function ✓ Replicate ✓
96


a. Observe?
or
b. Repair?
or
c. Replace?
Pain: -
Tissue damage: -
Integrity: Pulp - Caries risk ? Function - Replicate ✓
97


a. Observe?
or
b. Repair?
or
c. Replace?
Pain: -
Tissue damage: -
Integrity: Pulp - Caries risk ? Function - Replicate ?
98


Longevity – estimates from literature
99

Patient Information

1. Which biological/technical factors can affect the prognosis before, under and after therapy?
2. What can happen?

100

Survival

- Technical defects?
  - can be repaired?
  - cannot be repaired?
- Biological defects?
  - can be repaired?
  - cannot be repaired?

- Construction?
- Part-Construction?
- Tooth?
- Mucosa?

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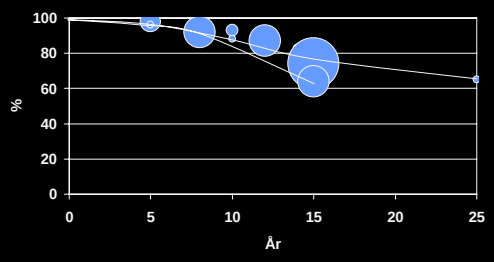
FPDs



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FPDs – what happens

	Randow et al , 86	Walton et al. 86	Valderhaug et al, 97	Karlsson, 86
Caries	25	21	18	24
Endodontic complications	12	21	14	3
Periodontal complications	10	5	10	5
Biologic complications:	**47**	**47**	**45**	**32**
Retention	3-14*	13	15	17
Fracture of restoration**	2-8*	16	-	22
Marginal defects	-	9	-	-
Fracture of tooth	3-6*		4	4
Wear	-	1	-	7
Technical complications:	**31**	**43**	**55**	**67*** **
Esthetics	12	0	-	6

- N.a.
* Variation
** Fracture also part-fracture of crown (ceram) = FDP fracture
*** inclusive other technical complications

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FPD - variables

- Patient factors
  - Age, smoking, bruxism, xerostomia
  - Intraoral localisation
  - Previous restoration of tooth
- Material factors
  - Alloy --- ceram
  - Cement type
- Selection factors
  - Vitality
- Construction factors
  - Preparation
  - Post type
  - Extension
- Follow up and hygiene

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Patient age

No clear conclusions

- Increased risk med alder
  - x4 Kerschbaum et al., 1991
- No increased risk with age
  - Glantz et al., 1984, Karlsson, 1989, Leempoel et al., 1995

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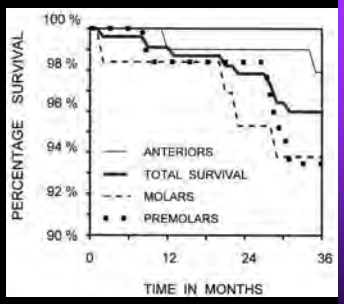
Intraoral localisation



McLaren & White. J Prosthet Dent 2000
n=408 / 107 pas.

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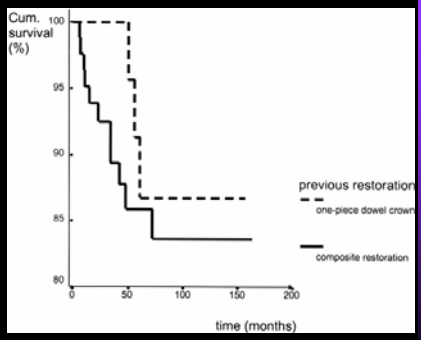
Previous treatment



Napancangas et al. J Oral Rehabil, 2000107

Material factors - alloy

- No differences between alloys
  - Morris HF et al. J Prosthet Dent 1989; 1990; 1993 10y
  - Bessing C, et al. Acta Odontol Scand 1988; 1990 3y
- Titan & conventional alloy equivalent
  - Walter M, et al. J Oral Rehabil 1999 6y
  - Bergman B, et al. Int J Prosthodont 1999 2y
- Conventional alloy & sintered guld equivalent regarding gingiva
  - Setz & Diehl. Prosthet Dent 1994 2m

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Selection factors - vitality

- Increased risk with root-filled teeth having cantilever extension
  - Randow et al., 1986; Dahl et al., 1987; Karlsson, 1989
- Uncertain/weak risk with root-filled teeth
  - Leempoel et al., 1995
- No increased risk with root-filled teeth
  - Valderhaug et al., 1997

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Construction factors - extension

- Increased risk with extensions
  - Glantz et al., 1984, Randow et al., 1986; Karlsson, 1989,
- No increased risk with extensions
  - Leempoel et al., 1995

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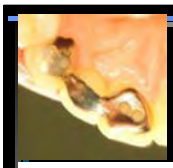
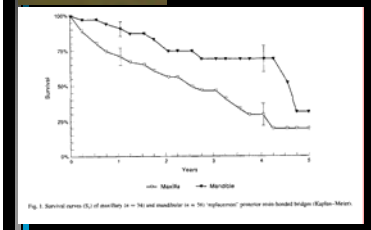


Etch bridges

1. cement
2. Prepareration
3. Size



Operator
Alloy
Etch method
Intra-oral localisation

Creugers et al. J Dent 2001

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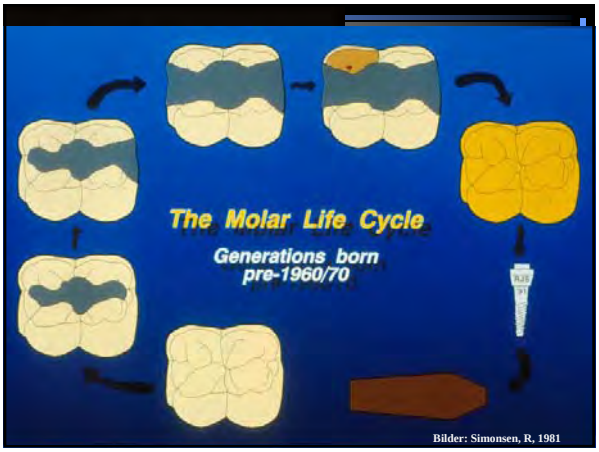
Why restorative therapy?

Protect from further damage



Principles for modern restorative care

1. Remove all infected caries
2. Remove as little as possible non-carious hard tissue
3. Evaluate which material is optimal for the given circumstance
4. Adjust preparation according to selected material to replace the lost hard tissue

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