THE OHIO STATE UNIVERSITY
COLLEGE OF DENTISTRY

Managing teeth for a lifetime

Why we crown teeth

High Performance ceramics

Will they replace metal ?

Cementation techniques

Cracked Teeth: A Review of the Literature

ERINNE B. LUBISICH, DMD*
THOMAS J. HILTON, DMD, MS†
JACK FERRACANE, PhD‡
ON BEHALF OF NORTHWEST PRECEDENT

ABSTRACT
Although cracked teeth are a common problem for patients and dentists, there is a dearth of evidence-based guidelines on how to prevent, diagnose, and treat cracks in teeth. The purpose of this article is to review the literature to establish what evidence exists regarding the risk factors for cracked teeth and their prevention, diagnosis, and treatment.

(*J Esthet Restor Dent* 22:158–167, 2010)

Northwest PRECEDENT
Practice-based REsearch Collaborative in Evidence-based DENTistry

Role of dentin in tooth Fracture

- Dentin becomes more brittle with age
- Lower fatigue resistance

THE MECHANICAL PROPERTIES OF HUMAN DENTIN: A CRITICAL REVIEW AND RE-EVALUATION OF THE DENTAL LITERATURE

J.H. Kinney*
S.J. Marshall
G.W. Marshall

Crit Rev Oral Biol Med 14(1):13-29 (2003)

Division of Biomaterials and Bioengineering, Department of Preventive and Restorative Dental Sciences, Mail Stop 0758, University of California, San Francisco, San Francisco, CA 94143-0758; *corresponding author, ktinney3@itsa.ucsf.edu

Cusp Fractures
Prevalence/Incidence

Usually associated with intracoronal restorations

slightly more often in women than men

The highest prevalence rate in patients over 40

Effects of aging on the mechanical behavior of human dentin ☆

D. Arola*, R.K. Reprogel

Department of Mechanical Engineering, University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, USA

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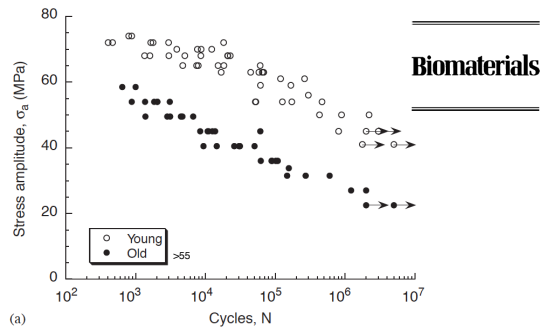


Cusp Fractures
Prevalence/Incidence

5 teeth /100 adults /year (all-teeth)

4.4 teeth/100 adults / year (posteriors)

3.1 molars / 1.3 premolars

4.4/1600=0.27%/year

Cusp Fractures
Prevalence/Incidence

48% Mandibular Molars

28% Maxillary Molars

16% Maxillary Premolars

6% Mandibular Premolars

Cusp Fractures
Prevalence/Incidence

15% of fractures result in pulpal involvement or extraction

Prevalence of fractures in unrestored teeth is higher than once thought (5-35%)

Prevalence of cusp fractures in teeth restored with amalgam and with resin-based composite

MICHAEL J. WAHL, D.D.S.; MARGARET M. SCHMITT, D.M.D.; DONALD A. OVERTON, Ph.D.; M. KATHLEEN GORDON, Ph.D.

TABLE 2

INFLUENCE OF RESTORATION MATERIAL AND NUMBER OF RESTORED SURFACES ON CUSP FRACTURE RATE.

TEETH BY RESTORATION STATUS	PERCENTAGE OF FRACTURED CUSPS, BY AGE GROUP AND TYPE OF RESTORATION*			
	Younger Patients (Aged 18-54 Years)		Older Patients (Aged 55-96 Years)	
	Amalgam	Composite	Amalgam	Composite
Teeth Restored on One Surface, Including Only Teeth Without Caries	0.52 (19/3,658)	1.26 (4/318)	1.91 (12/628)	5.56 (2/36)
Teeth Restored on Two or More Surfaces, Including Only Teeth Without Caries	1.62 (67/4,136)	1.37 (5/365)	2.91 (47/1,615)	7.58 (5/66)
Teeth Restored on One Surface, Including Teeth With Caries	0.87 (32/3,671)	1.26 (4/318)	1.91 (12/628)	5.56 (2/36)
Teeth Restored on Two or More Surfaces, Including Teeth With Caries	2.09 (87/4,156)	1.64 (6/366)	3.63 (59/1,627)	8.96 (6/67)

* For each subgroup, the table shows the percentage of fractured cusps (number of fractured cusps/number of teeth).

Survival of Dicor Glass-Ceramic Dental Restorations Over 20 Years: Part IV. The Effects of Combinations of Variables

Kenneth A. Malament, DDS, MScD[a]/Sigmund S. Socransky, DDS[b]

Table 4 Evaluation of Failures Using Proportional Hazards Analysis

	Hazard ratio	SE	95% CI	P*
Molar (vs single-rooted)	3.37	0.71	2.23–5.08	< .001
Dentin core (vs gold core)	2.65	0.82	1.44–4.87	.002
Men (vs women)	2.35	0.48	1.58–3.51	< .001
Glass ionomer (vs resin)	1.72	0.36	1.13–2.60	.011

SE = standard error.
*Overall *P* value < .00001.

What we have learned

Cast metal and Metal-Ceramic

J Dent Educ. 1986 Oct;50(10):594-600.
Longevity of restorations in a dental school clinic.
Bentley C, Drake CW.
Metal and Metal-Ceramic Posterior Teeth

10 year survival 91%

J Dent Educ. 2006 Oct;70(10):1098-104.
Survival analysis of complete veneer crowns vs. multisurface restorations: a dental school patient population.
Jarus CE1, Unger JW, Best AM (VCU).
Metal and Metal-Ceramic Posterior Teeth

10 year survival ranged from 89% to 68%

Cast inlays/Onlays/Partial Crowns

Clin Oral Investig. 1999 Jun;3(2):100-4.
Longevity of cast gold inlays and partial crowns--a retrospective study at a dental school clinic.
Stoll R1, Steweke M, Pieper K, Stachniss V, Schulte A. (German Dental School)
3518 cast gold restorations

10 year survival rate of partial crowns 86.1%

J Oral Rehabil. 2000 Jun;27(6):461-72.
Long-term survival estimates of cast gold inlays and onlays with their analysis of failures.
Studer SP1, Wettstein F, Lehner C, Zullo TG, Schärer P (University of Zurich)
Cast gold inlays and inlays

10 year survival of 96.1%

20 year survival of 87%
30 year survival of 73%

Clin Oral Investig. 2003 Jun;7(2):80-5. Epub 2003 May 13.
Long-term clinical performance and longevity of gold alloy vs ceramic partial crowns.
Wagner J1, Hiller KA, Schmalz G.
41 cast metal 3/4 crowns

7 year survival 96%

13 year survival 72%

Cast Metal Crowns

J Oral Rehabil. 1989 Jul;16(4):387-94.
Survival studies of dental restorations: criteria, methods and analyses.
Leempoel PJ1, Van't Hof MA, de Haan AF.
German reference (Kreshbaum 1985) 2734 crowns

9 year survival 96% (PFMs 92%)

J Oral Rehabil. 2013 Aug;40(8):609-17. doi: 10.1111/joor.12075. Epub 2013 Jun 8.
Five-year results of a prospective randomised controlled clinical trial of posterior computer-aided design-computer-aided manufacturing ZrSiO4 -ceramic crowns.
Passia N1, Stampf S, Strub JR
100 gold crowns as control

5 year survival 92.3 %

All-ceramic or metal-ceramic tooth-supported fixed dental prostheses (FDPs)? A systematic review of the survival and complication rates. Part I: Single crowns (SCs)☆

31:2015

Irena Sailer[a,*], *Nikolay Alexandrovich Makarov*[a], *Daniel Stefan Thoma*[b], *Marcel Zwahlen*[c], *Bjarni Elvar Pjetursson*[d]

[a] *Division for Fixed Prosthodontics and Biomaterials, Center of Dental Medicine, University of Geneva, Geneva, Switzerland*
[b] *Department of Fixed and Removable Prosthodontics and Dental Material Science, University of Zurich, Switzerland*
[c] *Department of Social and Preventive Medicine, University of Berne, Berne, Switzerland*
[d] *Department of Reconstructive Dentistry, Faculty of Odontology, University of Iceland, Reykjavik, Iceland*

Methods. Medline (PubMed), Embase, Cochrane Central Register of Controlled Trials (CENTRAL) searches (2006–2013) were performed for clinical studies focusing on tooth-supported fixed dental prostheses (FDPs) with a mean follow-up of at least 5 years. This was complimented by an additional hand search and the inclusion of 34 studies from a previous systematic review [1,2]. Survival and complication rates were analyzed using robust Poisson's regression models to obtain summary estimates of 5-year proportions.

TECHNICAL COMPLICATIONS (Sailer et al. 2015)

	PFM	LDS		PFZ	
Caries on abutment	1.00 (Ref.)	0.52 (0.18–1.55)	$p=0.243$	0.45 (0.20–0.98)	$p=0.045$
Loss due to caries	1.00 (Ref.)	0.10 (0.01–0.99)	$p=0.049$	0.27 (0.03–2.17)	$p=0.217$
Loss by abutment fracture	1.00 (Ref.)	0.20 (0.06–0.67)	$p=0.009$	0.12 (0.02–0.75)	$p=0.024$
Loss of tooth vitality	1.00 (Ref.)	0.41 (0.21–0.77)	$p=0.006$	n.a	n.a
Framework fracture	1.00 (Ref.)	92.38 (8.24–1035.29)	$p<0.0001$	17.20 (1.26–234.31)	$p=0.033$
Ceramic fracture	1.00 (Ref.)	4.06 (1.99–8.28)	$p<0.0001$	11.36 (6.09–21.18)	$p<0.0001$
Ceramic chipping	1.00 (Ref.)	0.56 (0.25–1.24)	$p=0.154$	1.19 (0.56–2.54)	$p=0.650$
Retention loss	1.00 (Ref.)	1.64 (0.62–4.33)	$p=0.315$	7.85 (2.67–23.04)	$p<0.0001$
Esthetics	1.00 (Ref.)	0	$p<0.0001$	0	$p<0.0001$

THE JOURNAL OF PROSTHETIC DENTISTRY

RESEARCH AND EDUCATION

Fracture rate of monolithic zirconia restorations up to 5 years: A dental laboratory survey

Taiseer A. Sulaiman, BDS, PhD,[a] Aous A. Abdulmajeed, BDS, PhD,[b] Terence E. Donovan, DDS,[c] Lyndon F. Cooper, DDS, PhD,[d] and Ricardo Walter, DDS, MS[e]

No clinical data available yet

Dental Laboratory data provides some positive short term data

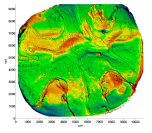
Table 1. Total number of monolithic zirconia restorations according to their location, placed over 5 years

Location	Restorations Placed	Restorations Fractured	Fracture Rate (%)
Anterior restorations	3731	77	2.06
Posterior restorations	36 096	357	0.99
Total	39 827	434	1.09

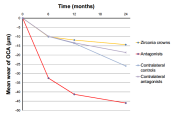
Table 2. Fracture rates of monolithic zirconia restorations according to type of restoration placed over 5 years

	Anterior			Posterior			
Type of Restoration	Restorations Placed	Restorations Fractured	Fracture Rate (%)	Restorations Placed	Restorations Fractured	Fracture Rate (%)	Total Fracture Rate (%)
Single crowns	1952	19	0.97	29 808	205	0.69	0.71
Multiple-unit fixed dental prosthesis	1779	58	3.26*	6288	152	2.42*	2.60*

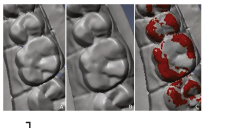
*Statistical differences between types of restoration: $P<.001$.



Lava Plus



Xenostar Trans



Lava

Wear

Antagonist wear of **monolithic zirconia crowns after 2 years**.
Lohbauer U, Reich S.
Clin Oral Investig. 2016 Jun 9.

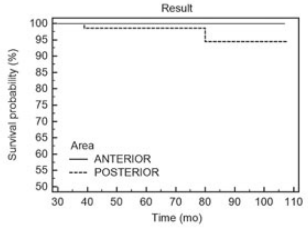
Clinical assessment of enamel wear caused by monolithic zirconia crowns.
Stober T, Bermejo JL, Schwindling FS, Schmitter M.
J Oral Rehabil. 2016 Aug;43(8):621-9.

Clinical study to evaluate the wear of natural enamel antagonist to zirconia and metal ceramic crowns.
Mundhe K, Jain V, Pruthi G, Shah N.
J Prosthet Dent. 2015 Sep;114(3):358-63.

Retrospective survival analysis of 110 lithium disilicate crowns with feather-edge marginal preparation

Marco Valenti, DDS
Private Practice, Active member of AIOP

Alessandro Valenti, DDS, MSc
Private Practice



Anteriors n = 39
9 year survival @ 100%

Posterior n = 71
9 year survival @ 94.5%

Translucent Zirconia

Making yttria-stabilized tetragonal zirconia translucent

DENTAL MATERIALS 30 (2014) 1195–1203

*Yu Zhang**

Acta Biomaterialia 16 (2015) 215–222

Highly-translucent, strong and aging-resistant 3Y-TZP ceramics for dental restoration by grain boundary segregation

Fei Zhang[a,*], Kim Vanmeensel[a], Maria Batuk[b], Joke Hadermann[b], Masanao Inokoshi[c], Bart Van Meerbeek[c], Ignace Naert[c], Jef Vleugels[a]