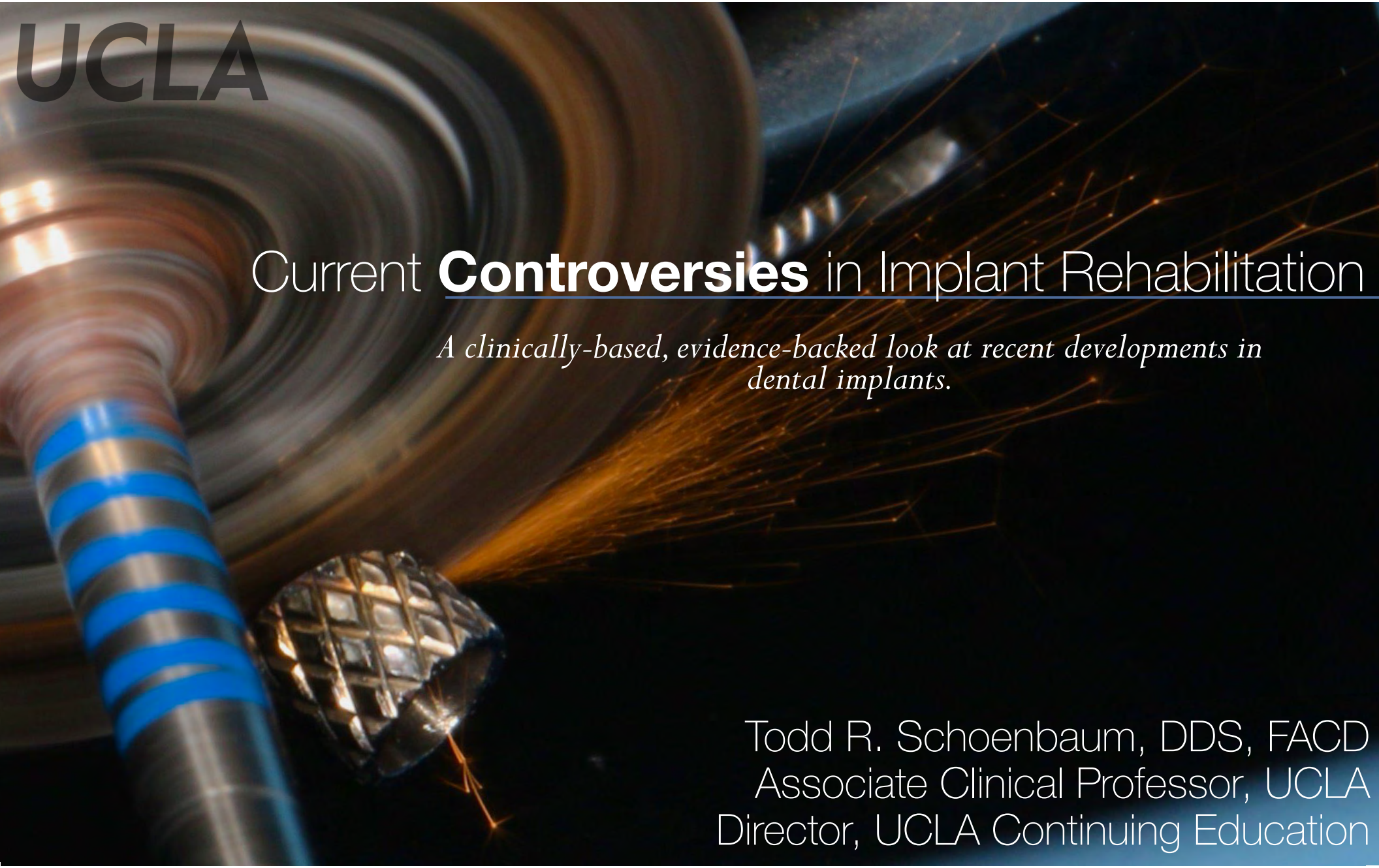


UCLA

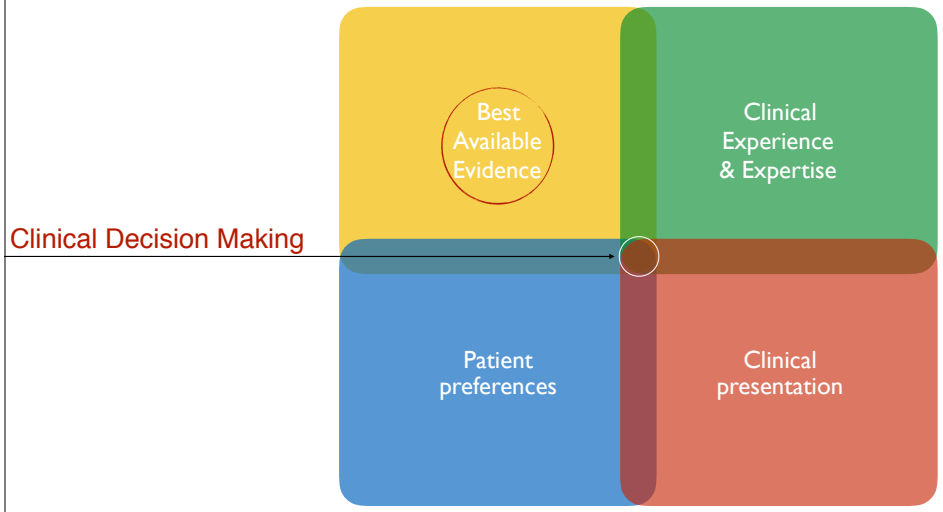
Current **Controversies** in Implant Rehabilitation

A clinically-based, evidence-backed look at recent developments in dental implants.

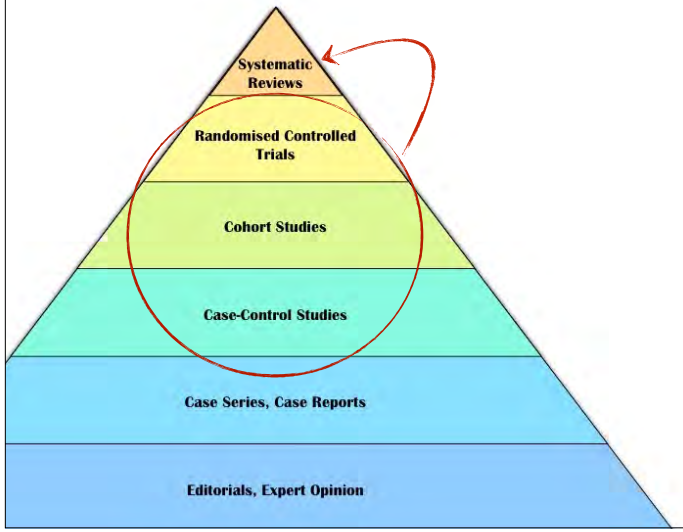
Todd R. Schoenbaum, DDS, FACD
Associate Clinical Professor, UCLA
Director, UCLA Continuing Education

Controversy…

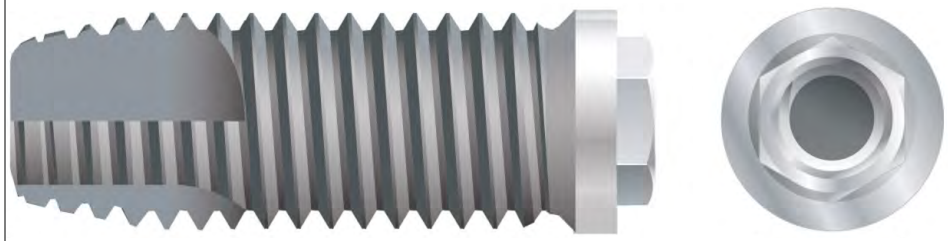
How do we decide?



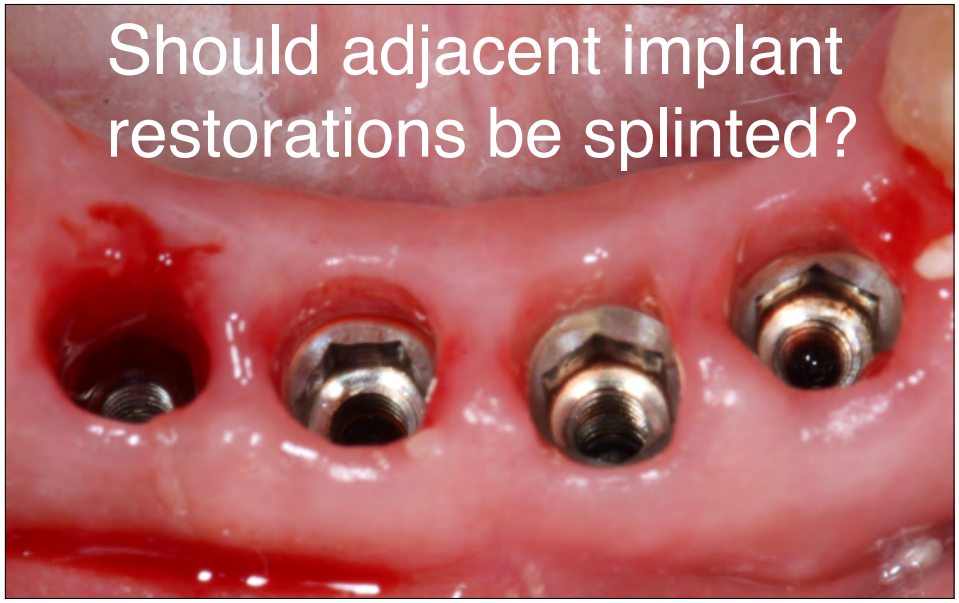
Hierarchy of Evidence



Implants have evolved…



… so have the data, the guidelines, and the rules


Should adjacent implant restorations be splinted?


Splinted


non-splinted


Rational for **splinting** implants:
/ reduce or “share” stress?
/ reduce implant loss?
/ reduce screw loosening?
/ ease of delivery?

Effects of Prosthesis Materials and Prosthesis Splinting on Peri-implant Bone Stress Around Implants in Poor-Quality Bone: A Numeric Analysis

Wang 2002

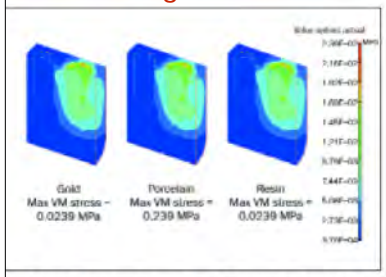
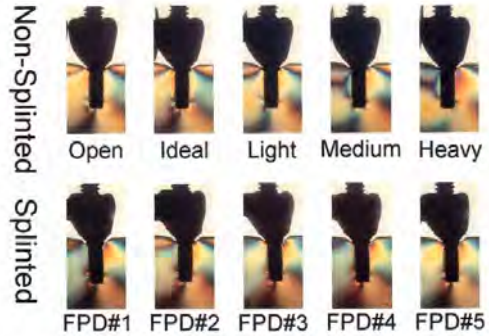


Fig 3a VM stress distribution in the peri-implant bone of the nonsplinted crown models under 1 N vertical load.

Effect of splinting and interproximal contact tightness on load transfer by implant restorations

David L. Guichet, DDS,[a] Diane Yoshinobu, DDS,[b] and Angelo A. Caputo, PhD[c]
School of Dentistry, University of California, Los Angeles, Calif.

Guichet 2002



Better "load sharing" for splinted implant restorations

…but does this result in real life changes in bone levels over time?

Comparison of Strains for Splinted and Nonsplinted Screw-Retained Prostheses on Short Implants

Burak Yilmaz, DDS, PhD[1]/Jeremy D. Seidt, BS, MS[2]/
Edwin A. McGlumphy, DDS, MS[3]/Nancy L. Clelland, DMD, MS[3]

Yilmaz 2011

CONCLUSION

The results of this study suggest that splinting short implants may provide a more even distribution of strains during the off-axis loading that occurs clinically.

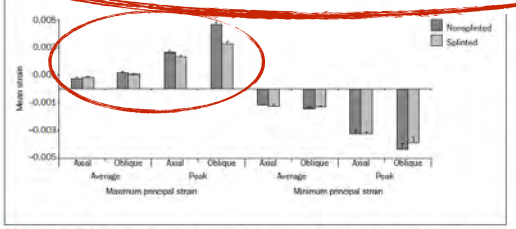


Fig 7 Mean average and peak strains for splinted and nonsplinted screw-retained restorations under axial and oblique (20 degrees off-axis) loading.

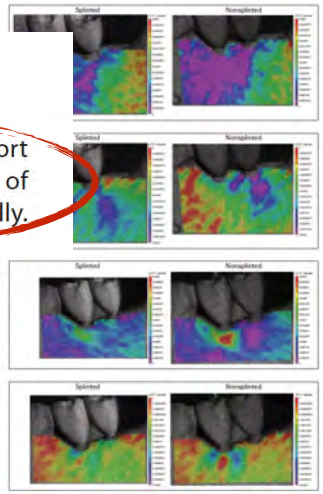


Fig 5 Patterns of maximum principal strain for oblique loading on screw-retained prostheses.

Fig 6 Patterns of minimum principal strain for oblique loading on screw-retained prostheses.

Split-Mouth Comparison of Splinted and Nonsplinted Prostheses on Short Implants: 3-Year Results

Nancy Clelland, DMD, MS[1]/Jahanzeb Chaudhry, DDS, MDS[2]/
Robert G. Rashid, DDS, MS[3]/Edwin McGlumphy, DDS, MS[1]

Clelland 2016
3yr *in-vivo* data

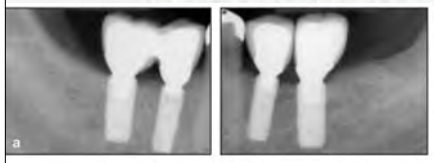


Table 2 Mean Bone Levels Measured Below Machined Bevel Surface of All Implants (Including All Lengths) and Standard Deviations

Type	Time (mo)	Mean distance (mm)	SD (mm)
Nonsplinted	0	0.75	0.92
	12	0.66	0.79
	24	0.47	0.74
	36	0.44	0.58
Splinted	0	0.76	0.80
	12	0.67	0.80
	24	0.61	0.72
	36	0.68	0.82

CONCLUSIONS

According to the results of this prospective 3-year study of splinted ipsilateral and nonsplinted contralateral implants in 15 patients: *(1)* peri-implant bone levels around splinted and nonsplinted implants were not statistically different for implants greater than 6 mm in length; *(2)* nonsplinted 6-mm implants revealed a gain in bone at 24 and 36 months compared with baseline; *(3)* all screw loosening only occurred on the nonsplinted side for 5 of 15 patients; and *(4)* implant loss after loading occurred for one 6-mm nonsplinted implant.

Multiple Single-Tooth Implant Restorations in the Posterior Jaws: Maintenance of Marginal Bone Levels with Reference to the Implant-Abutment Microgap

Michael R. Norton, BDS[1]

Norton 2006

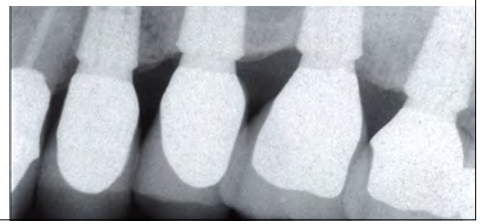
Maxilla	
First premolar	19
Second premolar	28
First molar	28
Second molar	8
Mandible	
First premolar	9
Second premolar	31
First molar	37
Second molar	21

Table 2 Marginal Bone Loss

	n	Bone loss (mm) Min	Median	Max	Mean	SD	P
Jaw							
Mandible	34	0.1	0.54	2.7	0.70	0.63	.812
Maxilla	24	0.0	0.46	1.4	0.56	0.38	
Gender							
Female	34	0.1	0.52	2.7	0.72	0.59	.370
Male	20	0.0	0.48	1.4	0.53	0.35	
All	54	0.0	0.51	2.7	0.65	0.52	
Smoking status							
No	47	0.0	0.50	2.7	0.63	0.52	.425
Yes	7	0.1	0.84	1.6	0.77	0.52	
All	54	0.0	0.51	2.7	0.65	0.52	
Surface							
Mesial	54	0.0	0.35	2.6	0.53	0.49	< .001
Distal	54	0.0	0.64	2.8	0.76	0.59	
Difference M-D	54	−1.2	-0.21	0.3	-0.23	0.31	

Average of 39 months
137 posterior implants
non-splinted

1 failure
Average bone loss 0.65mm

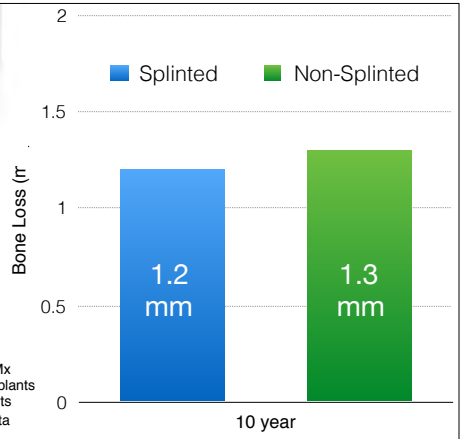


Clinical Evaluation of Marginal Bone Level Change Around Multiple Adjacent Implants Restored with Splinted and Nonsplinted Restorations: A 10-Year Randomized Controlled Trial

Paolo Vigolo, DMD, MScD[1]/Sabrina Mutinelli, DMD[2]/ Massimiliano Zaccaria, DMD[3]/Edoardo Stellini, DMD[4]

Vigolo et al

Vigolo 2015

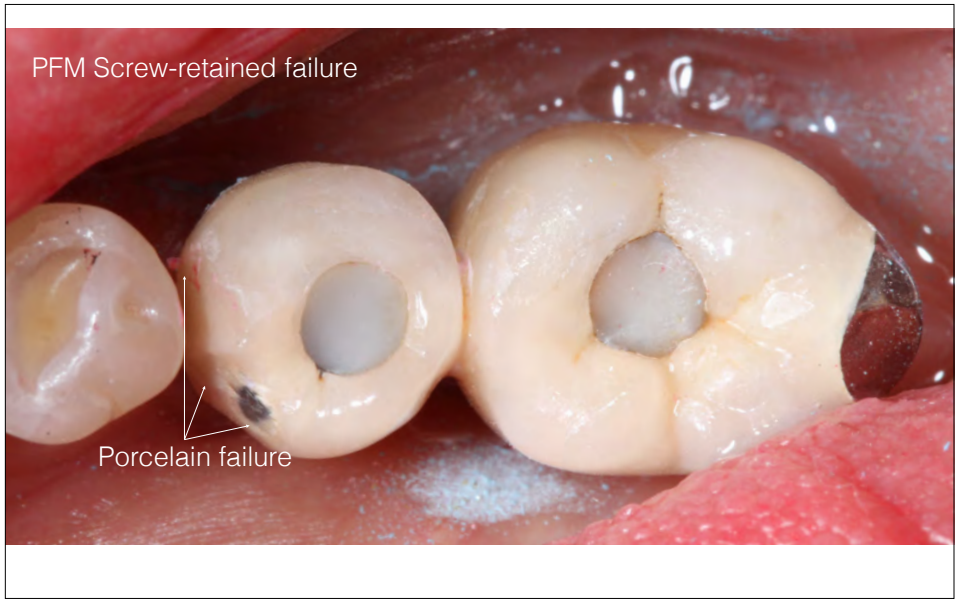


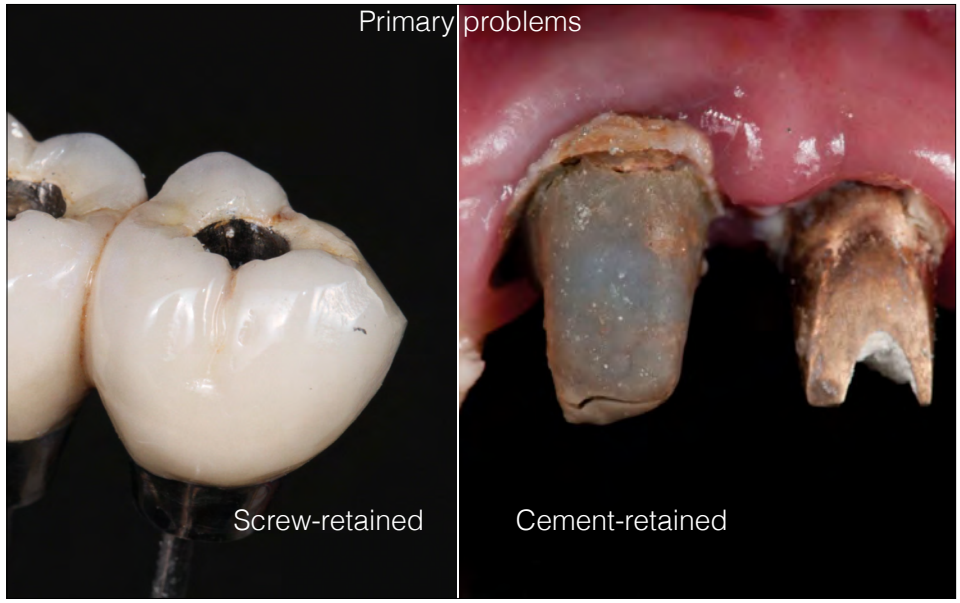
Posterior Mx
Ext hex implants
132 implants
10 year data

Conclusion:
A significant difference in bone loss was seen between the two groups (splinted vs. non-splinted). However, the difference of 0.1mm was not considered clinically meaningful.

Cement vs. Screw retained single unit crowns

	Screw Retained 	Cement Retained 
Advantages	- ease of retrievability / maintenance - no risk of retained cement - easier to manage pontics and immediate loading - can be used when occlusal clearance is as low as 4mm - porcelain can be carried to the head of the implant	- can be used with significantly angled implants - familiar delivery protocol - reinforced porcelain options (Zirconia, e.Max)
Disadvantages	- highest, but unknown cost (variable alloy costs) - requires highly trained technician - cannot easily resolve angulation issues - generally unaesthetic obturation - increased risk of porcelain fracture - some evidence of increased gingival recession	**- risk of cement retention and associated peri-implantitis** **- more difficult to remove if needed**





How Common are these failures?

Long-Term Outcome of Cemented Versus Screw-Retained Implant-Supported Partial Restorations

Joseph Nissan, DMD[1]/Demitri Narobai, DMD[2]/Ora Gross, DMD[2]/
Oded Ghelfan, DMD[2]/Gavriel Chaushu, DMD, MSc[3]

Table 1 Comparison of Complications and Clinical Parameters of Screw-Retained and Cemented Implant-Supported Partial Restorations

Complications/clinical parameters	Screw-retained restoration	Cemented restoration	P
Ceramic fracture	38% ± 0.3%	4% ± 0.1%	< .001
Abutment screw loosening	32% ± 0.3%	9% ± 0.2%	.001
Metal frame fracture	0	0	NS
Mean Gingival Index	0.48 ± 0.5	0.09 ± 0.3	< .001
Mean marginal bone loss (mm)	1.4 ± 0.6	0.69 ± 0.5	< .001

marginal bone loss was statistically significantly higher (P < .001) for screw-retained (1.4 ± 0.6 mm) than for cemented (0.69 ± 0.5 mm) restorations. ***Conclusion:*** *The long-term outcome of cemented implant-supported restorations was superior to that of screw-retained restorations, both clinically and biologically.* Int J Oral Maxillofac Implants 2011;26:1102–1107

Journal of Oral Rehabilitation

Journal of Oral Rehabilitation 2011 **38**; 697–711

The 32 final included studies were further classified as following

- 17 long-term studies ≥ 5 years
- 15 short-term studies < 5 years

Review Article 2011

Prosthetic outcome of cement-retained implant-supported fixed dental restorations: a systematic review

M. S. CHAAR, W. ATT & J. R. STRUB *Department of Prosthodontics, School of Dentistry, Albert-Ludwigs University, Freiburg, Germany*

Conclusions

It may be stated that despite the questionable retrievability of cement-retained implant-supported fixed restorations, this treatment modality is a reliable and effective option in fixed implant prosthodontics, especially for implant-supported SCs and short-span FDPs. However, it is not advocated for long-span FDPs, full-

Effects of Implant Diameter and Prosthesis Retention System on the Reliability of Single Crowns

Estevam A. Bonfante, DDS, MS, PhD[1]/Erika O. Almeida, DDS, MS, PhD[2]/
Fabio C. Lorenzoni, DDS, MS, PhD[1]/Paulo G. Coelho, DDS, BS, MS, MSMRE, PhD[4]

Purpose: *The probability of survival of implant-supported prostheses may be affected by the interplay between different implant diameters supporting screwed or cemented crowns. The purpose of this study was to investigate the effect of implant diameter and prosthesis retention system on the reliability and failure modes of single crowns.* ***Materials and Methods:*** *Internal-hexagon implants were divided into six groups (n = 21 each) according to implant diameter (3.3, 4.0, or 5.0 mm) and crown retention system (screwed or cemented). Abutments were torqued to the implants, and crowns were then fixed and subjected to step-stress accelerated life testing in water. Use-level probability Weibull curves and reliability for missions of 50,000 cycles at 100, 150, and 200 N were calculated. Failure analysis was performed.* ***Results:*** *Cemented systems presented higher reliability than screwed ones, except between 3.3-mm-diameter cemented and screwed systems at a load of 100 or 150 N. Failure modes were restricted to the abutment screw and varied with implant diameter only in the cement-retained groups.* ***Conclusion:*** *Higher reliability was observed for cemented retained crowns and implants of larger diameter compared to screw-retained and smaller diameter. Failure modes differed between groups.* Int J Oral Maxillofac Implants 2015;30:95–101. doi: 10.11607/jomi.3545

Table 1 Calculated Reliability for a Given Mission of 50,000 Cycles According to Load

	C3		S3		C4		S4		C5		S5	
Result	100 N	150 N	100 N	150 N	100 N	200 N	100 N	200 N	100 N	200 N	100 N	200 N
Upper bound	0.98	0.57	0.87	0.61	1	0.6	0.97	0.23	1	0.99	0.99	0.6
Reliability	0.89	0.35	0.80	0.72	0.99	0.67	0.92	0.11	1	0.89	0.93	0.07
Lower bound	0.79	0.13	0.65	0.29	0.99	0.49	0.79	0.03	0.99	0.97	0.99	0.50
β	0.60		0.26		1.64		0.58		2.74		1.39	

2015

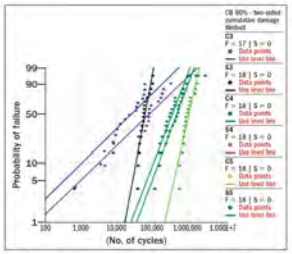


Fig 1a Use-level probability Weibull showing probability of failure as a function of time.

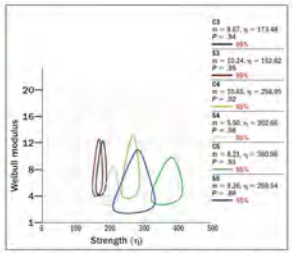


Fig 1b Contour plot (Weibull modulus vs characteristic strength (η, in N)) for group comparisons. Note that there is no statistical difference where contour plots overlap.

S = Screw retained
C = Cement retained

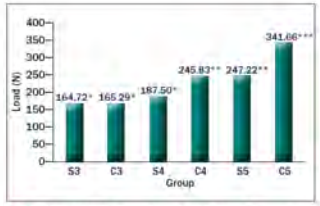


Fig 2 Mean load to failure values of each group. Different numbers of asterisks represent statistically significant differences in between-group comparisons.

Influence of Prosthesis Type and Retention Mechanism on Complications with Fixed Implant-Supported Prostheses: A Systematic Review Applying Multivariate Analyses

Christopher Millen, BDS, MFDS, MClinDent, MPros[1]/
Urs Brägger, DMD, Dr Med Dent[2]/Julia-Gabriela Wittneben, DMD, Dr Med Dent, MMSc[3]

Int J Oral Maxillofac Implants 2015;30:110–124.

Single Crown Data

The complication rates of each prosthesis type in the current review revealed a variety of different outcomes. There was a tendency toward more technical complications with screw-retained SCs, without statistical significance. More specifically, there were significantly more instances of abutment loosening with screw-retained crowns, which was in accordance with the results of the systematic review of Sailer et al.[1] More framework fractures occurred with cemented SCs; however, this could not be compared to Sailer et al, as data on framework fracture were not presented in their published article. No statistically significant differences were identified for biologic complications relative to retention type for single implant–supported crowns, whereas in the previous review from Sailer et al,[1] more soft tissue complications were documented with screw-retained SCs. This difference may have resulted because of esthetic complications that, while not considered by Sailer et al, contributed to the overall biologic complications in the current review. Esthetic complications may be of particular importance to patients.[87]

Table 4 Technical Complications with SCs

Complication	Retention	No. of studies	No. of prostheses	Exposure time (y)	No. of complications	Complication rate* (95% CI)	P
Loss of retention	Cement	22	1,193	6,155	23	0.55 (0.25–1.23)	.634
	Screw	6	309	1,198	10	0.47 (0.12–1.79)	
Exposure of access hole	Cement	0	0	–	–	– (–)	N/A
	Screw	8	309	1,198	1	0.08 (0.01–0.59)	
Fracture and/or chipping	Cement	22	1,126	5,770	23	0.41 (0.26–0.65)	.523
	Screw	7	355	1,426	4	0.28 (0.10–0.79)	
Loosening of occlusal screw	Cement	0	0	–	–	– (–)	N/A
	Screw	8	373	1,606	13	0.80 (0.20–4.00)	
Loosening of abutment	Cement	22	1,126	5,770	18	0.33 (0.18–0.71)	.003
	Screw	6	309	1,194	29	2.07 (0.85–6.58)	
Fracture of abutment	Cement	22	1,126	5,770	0	0 (–)	> .999
	Screw	8	309	1,198	1	0.08 (0.01–0.58)	
Fracture of framework	Cement	2	109	521	14	2.69 (1.59–4.54)	< .001
	Screw	7	355	1,426	1	0.07 (0.01–0.66)	
Fracture of implant	Cement	22	1,126	5,770	0	0 (–)	N/A
	Screw	6	309	1,198	0	0 (–)	
Screw fracture	Cement	22	1,126	5,770	0	0 (–)	> .999
	Screw	7	355	1,426	4	0.31 (0.07–1.32)	
Resin chipping and/or fracture	Cement	1	12	36	0	0 (–)	N/A
	Screw	8	309	1,198	0	0 (–)	
Other	Cement	20	958	4,611	33	0.60 (0.19–1.86)	.145
	Screw	7	327	1,376	7	0.30 (0.08–1.14)	
Summary of all complications except "resin chipping and/or fracture"	Cement	24	1,246	6,485	111	1.91 (1.25–2.94)	.071
	Screw	8	373	1,606	64	3.12 (1.79–5.43)	

*Estimated complication rate per 100 years (95% confidence interval).

Table 9 Biologic Complications with SCs

Complication	Retention	No. of studies	No. of prostheses	Exposure time (y)	No. of complications	Complication rate* (95% CI)	P
Bone loss (> 2 mm)	Cement	20	1,111	6,028	34	0.41 (0.19–0.88)	.213
	Screw	7	327	1,376	1	0.08 (0.01–0.34)	
Peri-implantitis	Cement	19	1,022	4,390	13	0.24 (0.08–0.71)	.999
	Screw	8	309	1,198	0	0 (–)	
Presence of fistula, suppuration	Cement	20	1,044	5,633	20	0.41 (0.18–0.93)	.567
	Screw	7	327	1,376	2	0.24 (0.04–1.49)	
Peri-implant mucositis	Cement	18	967	4,040	69	1.71 (0.82–6.57)	.687
	Screw	6	309	1,198	2	1.16 (0.14–9.98)	
Recession	Cement	18	882	3,946	6	0.19 (0.05–0.69)	.704
	Screw	7	327	1,376	1	0.12 (0.01–1.55)	
Loss of implant	Cement	20	1,075	5,565	15	0.27 (0.16–0.47)	.738
	Screw	7	355	1,426	3	0.22 (0.07–0.72)	
Any esthetic problem	Cement	20	1,117	5,900	10	0.19 (0.06–0.58)	.010
	Screw	6	309	1,198	14	1.09 (0.30–4.02)	
Other	Cement	20	1,142	5,960	43	1.22 (0.43–3.65)	.698
	Screw	6	309	1,198	14	0.82 (0.28–3.11)	
Summary of all complications except "loss of implant"	Cement	22	1,195	6,260	187	3.40 (1.98–5.82)	.425
	Screw	8	373	1,606	34	4.46 (2.07–9.58)	

*Estimated complication rate per 100 years (95% confidence interval).

Cement vs. Screw retained single unit crowns

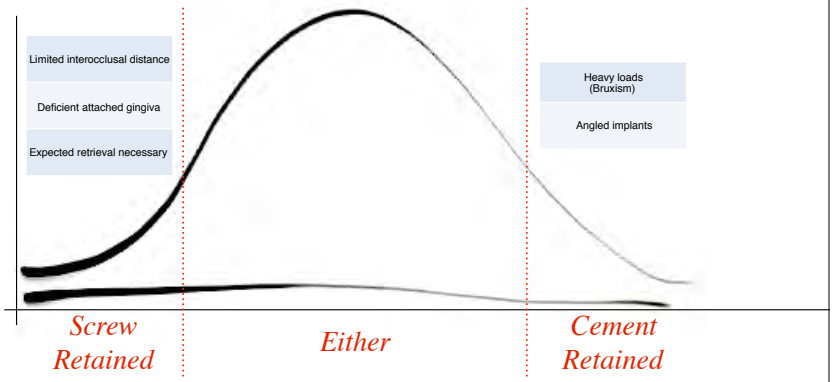
Based on RECENT peer-reviewed literature:

No consistent or clear difference in success for single crowns.

CEMENTretained
- risk of residual cement
- more difficult to retrieve

SCREWretained
- more loose screws
- more porcelain fracture

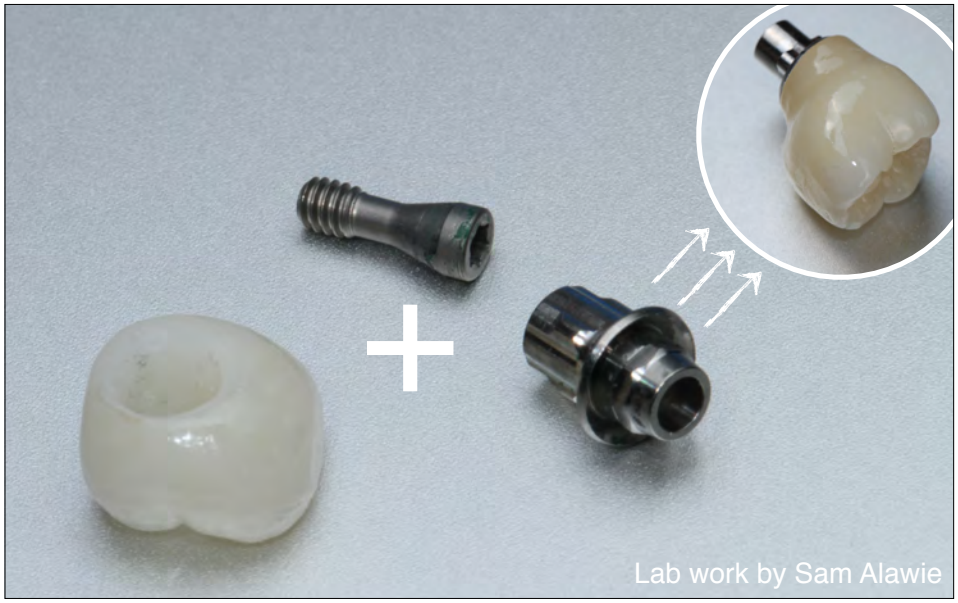
Ideal restoration for Single crowns

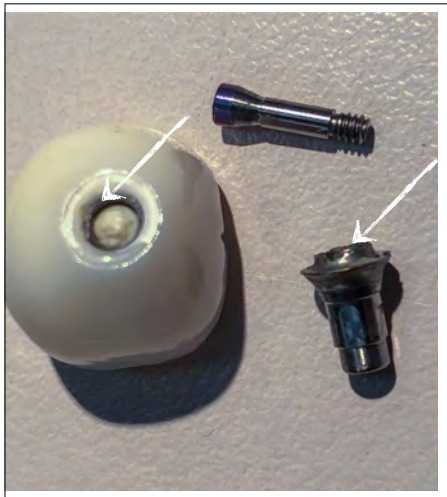


What about "screwmentable" crowns?
What about screw-retained full-Zr?
What about screw-retained Zr/TiBase?

What about screw retained Zr / Ti Base?

- Did your lab use an abutment with an appropriate height?
- Did your lab use the manufacturer's abutment?
- Did your lab properly prep the Zr and Ti?
- Did your lab properly cement it?



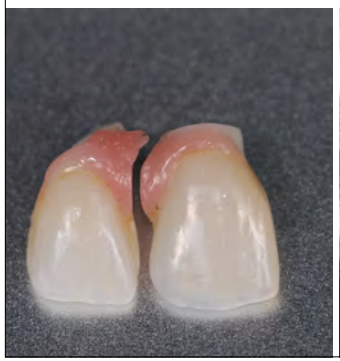


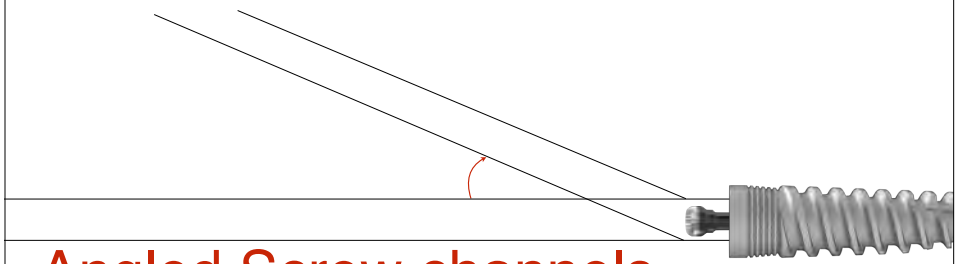
What about "screwmentable" crowns?
What about screw retained Zr?

Currently undergoing *beta* testing…

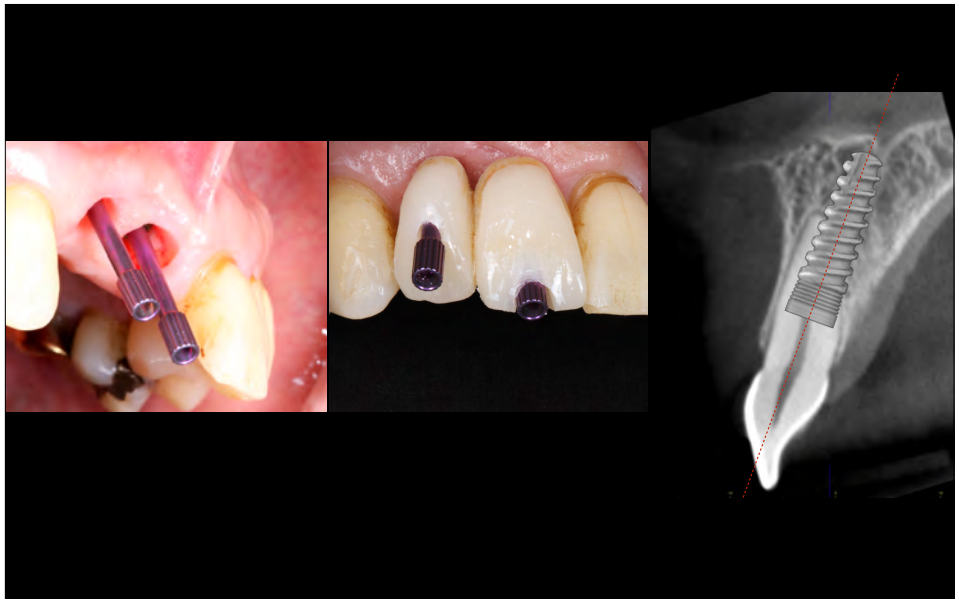
Possible complications with Zr / Ti Base?

- cement failure at the Zr / Ti interface
- failure of any overlying porcelain
- failure of the Zr frame work
- overload of implant or bone or abutment screws



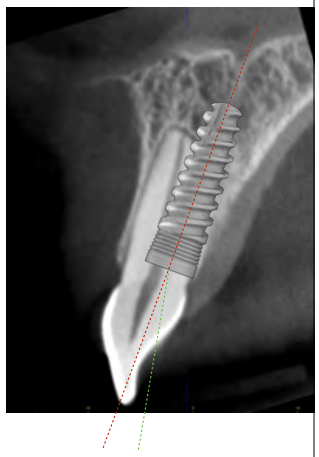


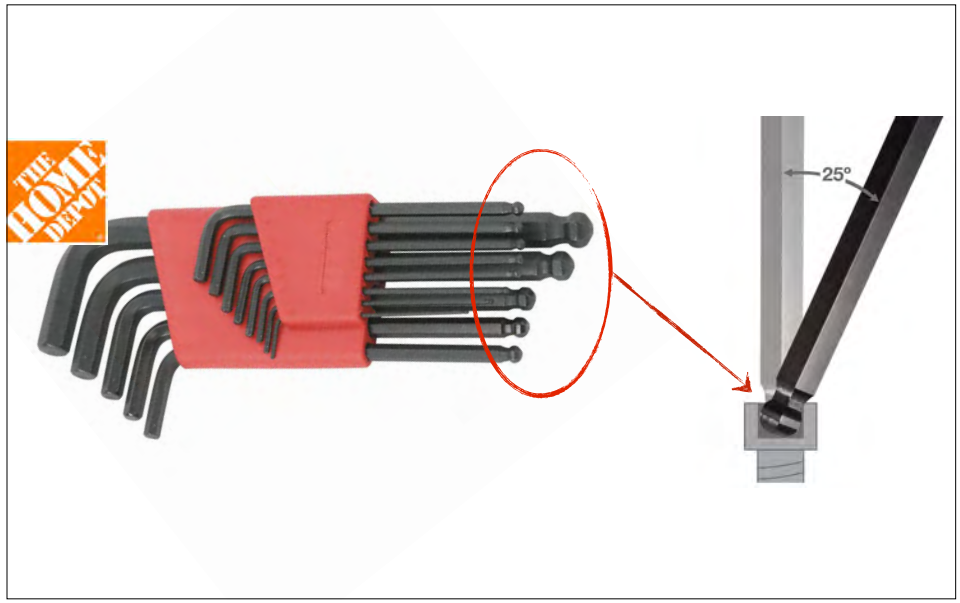
Angled Screw channels

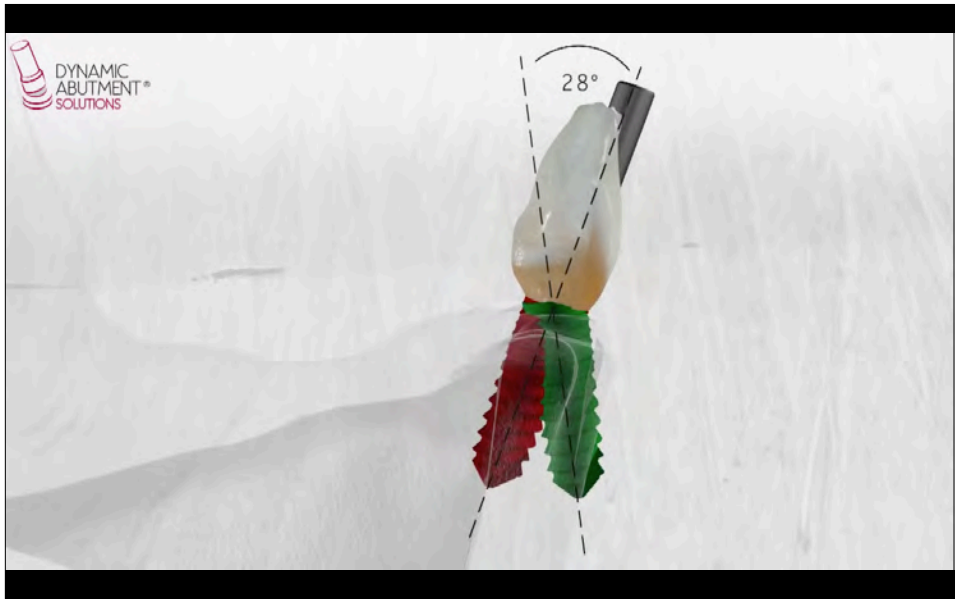


Angled Screw channels

- Allows for screw retained restorations with palatal access channels
- Only available with a few manufacturers or 3rd party parts
- Can correct 20-30 degrees
- Some are only for Cr-Co, some for PFM, some for solid Zr, some for Zr/TiBase

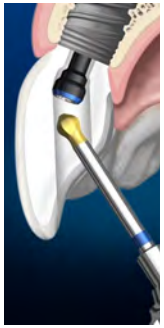






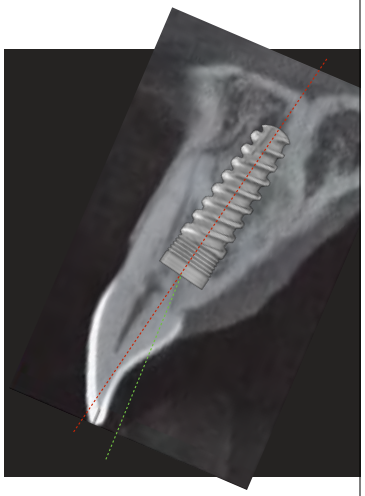
Angled Screw Channel (ASC) from Nobel

- TiBase is compressed between Zr and implant
- no cement
- Screw is torqued against the Zr
- Corrects up to 25 degrees



Potential issues:

- Zr fracture
- leakage
- screw breakage
- Zr —> Ti wear rates



Best available, existing research

Technique

- Berroeta E, Zabalegui I, Donovan T, Chee W. Dynamic Abutment: A method of redirecting screw access for implant-supported restorations: Technical details and a clinical report. The Journal of prosthetic dentistry. 2015 Jun 1;113(6): 516-9.

Case study

- Gjelvold B, Sohrabi MM, Chrcanovic BR. Angled Screw Channel: An Alternative to Cemented Single-Implant Restorations--Three Clinical Examples. The International journal of prosthodontics. 2016;29(1):74-6.

Prospective trial, 4% complication up to 2 years (n=81) →

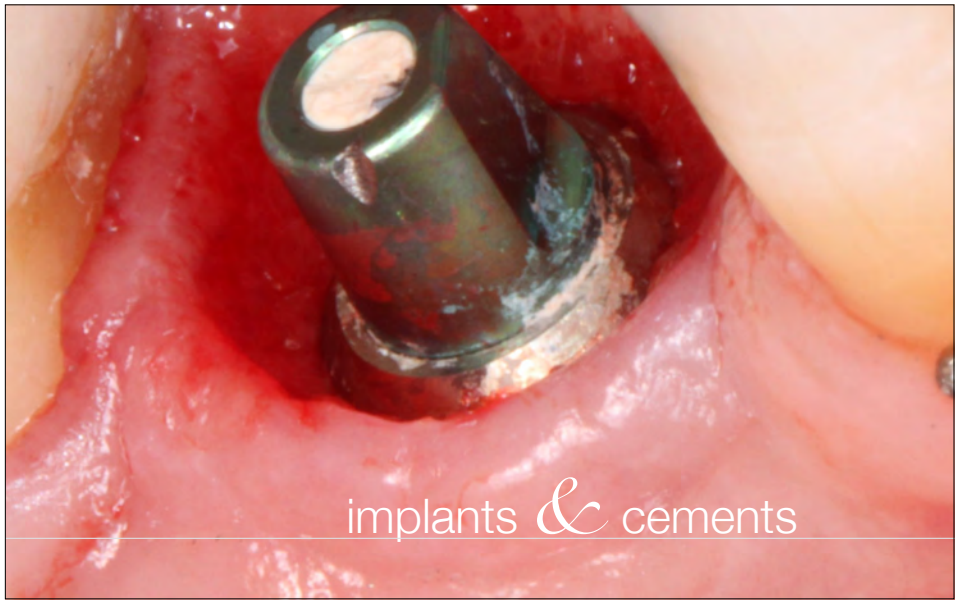
- Greer AC, Hoyle PJ, Vere JW, Wragg PF. Mechanical Complications Associated with Angled Screw Channel Restorations. International Journal of Prosthodontics. 2017 May 1;30(3).

RCT, up to 2 yrs (n=110) no difference in complications compared to straight screw channels →

- Anitua E, Flores C, Piñas L, Alkhraisat M. Frequency of technical complications in fixed implant prosthesis: the effect of prosthesis screw emergence correction by CAD-CAM. Journal of Oral Implantology. 2018 Jun 5.

in-vitro F.E.A. c: screws should work up to 40Ncm @ 30° →

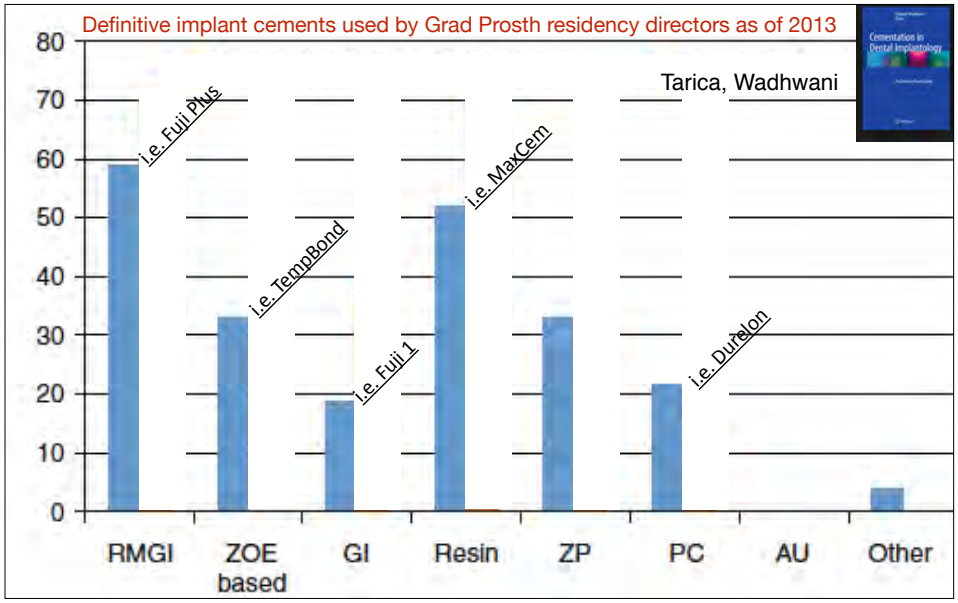
- Farré-Berga O, Cercadillo-Ibarguren I, Sánchez-Torres A, Domènech-Mestres C, Gil FJ, Escuin T, Berástegui E. NOVEL BALL HEAD SCREW AND SCREWDRIVER DESIGN FOR IMPLANT-SUPPORTED PROSTHESES WITH ANGLED CHANNELS. A FINITE ELEMENT ANALYSIS. Journal of Oral Implantology. 2018 Jul 16.



Considerations:

- retention strength — *Does the crown fall off prematurely?*
- solubility — *Will excess cement dissolve over time?*
- radiopacity — *Can excess be detected radiographically?*
- bactericidal effects — *Can the cement inhibit bacterial growth?*
- retrievability? — *Can we remove the crown if desired? Is this necessary?*

What is the "*gold standard*" ?



What about Durelon?

☞ Instructions for Use should not be discarded fo

Fields of Application

- Cementation of inlays, onlays, crowns, and bridge metal-ceramics or veneered with composite
- Cementation of inlays, onlays, crowns, and bridges made from composite or ceramics provided these are suitable for conventional cementing
- Cementation of pins and screws provided these are suitable for conventional cementing
- Cementation of orthodontic bands
- Linings

Durelon Maxicap is **not suitable for cementation from/to titanium-based restorations, since cement discoloration can occur on the points which come into contact with titanium**.

Precautionary Measures

3M MSDSs can be obtained from www.mmm.com or contact your local subsidiary.

Preparation

Cement removal from restorations luted to titanium abutments with simulated subgingival margins

John R. Agar, DDS, MA,[a] Stephen M. Cameron, DDS,[b] James C. Hughbanks, DMD,[c] and M. Harry Parker, MS, DDS[d]
The School of Dental Medicine, University of Connecticut Health Center, Farmington, Conn.; The U.S. Army Dental Activity, Fort Gordon, Ga.; and Hanau Dental Clinic Command, Hanau, Germany

Statement of problem. The process of removing excess cement from subgingival margins after cementation of restorations to implant abutments may lead to scratching of the abutments or incomplete cement removal.
Purpose. The purpose of this study was to investigate and to compare the surfaces of abutments after the removal of three cements (glass ionomer, resin, and zinc phosphate) by use of three instruments (gold coated scaler, rigid plastic scaler, and stainless steel explorer).
Material and methods. Six investigators removed zinc phosphate, glass ionomer, and resin cements with explorers, gold coated scalers, and rigid plastic scalers with a model simulating clinical conditions. The surface of Brånemark abutments with cemented restorations were examined with a microscope at 20× for scratches and cement remnants.
Results. Statistical analysis of the results were inconclusive about which combination of instrument and cement worked most effectively.
Conclusion. A surprising amount of cement remnants and scratching of abutments was observed. Although the six investigators were experienced in prosthodontic and implant procedures, there was variation in the results of their cement removal. (J Prosthet Dent 1997;78:43-7.)

CLINICAL IMPLICATIONS

The scratching of abutments and quantity of cement remnants seen in this study should sensitize dentists concerning potential problems when cementing implant restorations.

Resin cement should be avoided with implant crowns (unless all margins are highly accessible and gingiva is robust)

Fig. 4. Measurements of area of resin cement remnants on surface of abutment and crown as recorded with computer (original magnification 20×). Green characters are for identification of each area measured. Instrument used for cement removal was explorer.

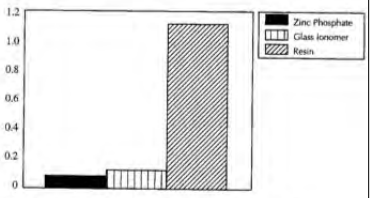


Fig. 5. Mean area in mm² of cement remnants per quadrant by cement type.

Effects of a Cementing Technique in Addition to Luting Agent on the Uniaxial Retention Force of a Single-Tooth Implant-Supported Restoration: An In Vitro Study

2010

Robert E. Santosa, BDS, MDSc[1]/William Martin, DMD, MS[2]/Dean Morton, BDS, MS, FACP[3]

Purpose: *Excess residual cement around the implant margin has been shown to be detrimental to the peri-implant tissue. This in vitro study examines the retentive strengths of two different cementing techniques and two different luting agents on a machined titanium abutment and solid screw implants. The amount of reduction of excess cement weight between the two cementation techniques was assessed.* ***Materials and Methods:*** *Forty gold castings were fabricated for 4.1 mm in diameter and 10 mm in length solid screw dental implants paired with 5.5-mm machined titanium abutments. Twenty implants received a provisional cement, and 20 implants received a definitive cement. Each group was further divided into two groups. In the control group, cement was applied and the castings seated over the implant-abutment assembly. The excess cement was then removed. In the study group, a "practice abutment" was used to express excess cement prior to cementation. The weight of the implant-casting assembly was measured and the residual weight of cement was calculated. The samples were then stored for 24 hours at 100% humidity prior to tensile strength testing.* ***Results:*** *Statistical analysis revealed significant differences in tensile strength across the groups. Further Tukey tests showed no significant difference in tensile strength between the practice abutment technique and the conventional technique for both definitive and provisional cements. There was a significant reduction in residual cement weight, irrespective of the type of cement, when the practice abutment was used prior to cementation.* ***Conclusions:*** *Cementation of implant restorations on a machined abutment using practice abutment technique and definitive cement may provide similar uniaxial retention force and significantly reduced residual cement weight compared to the conventional technique of cement rem*

Int J Oral Maxillofac Implants 2010;25:1145–1152

A, Fill intaglio of restoration with VPS material using smaller diameter tip. B, Compare and contrast abutment to VPS copy; in particular, irregularities should e noted as additional cement should be added to compensate for voids.

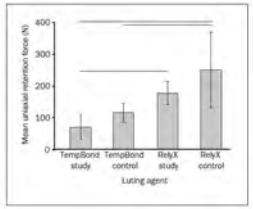
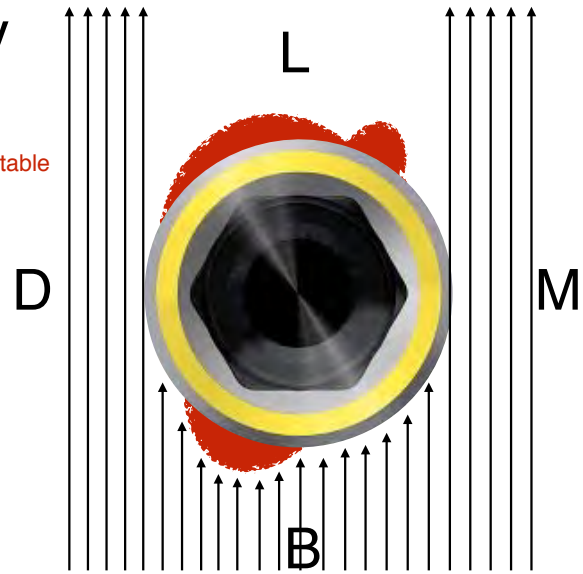


Fig 2 Uniaxial retention force/tensile strength (N) of the different cement groups. Horizontal lines indicate significant differences ($\alpha < .05$).

Wadhwani 2012

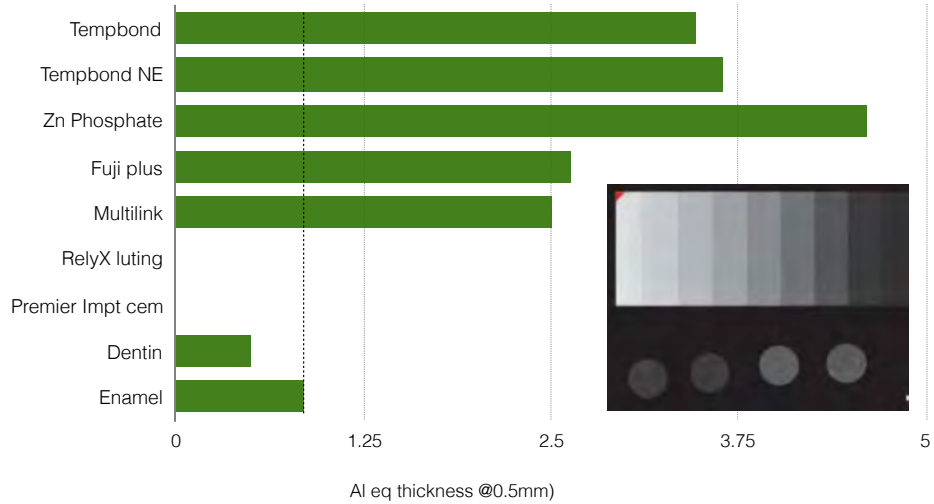
Radiopacity

Undetectable cement

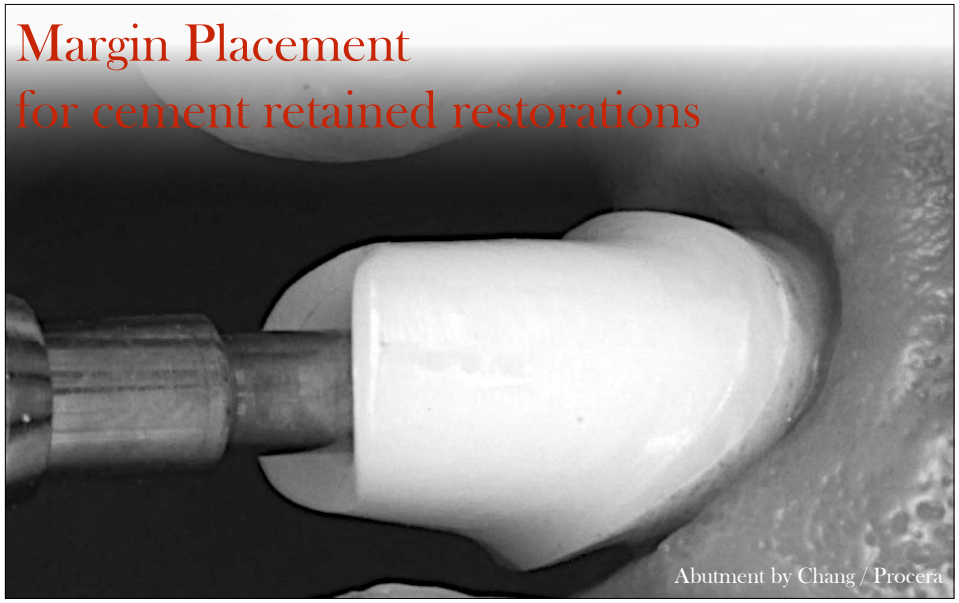


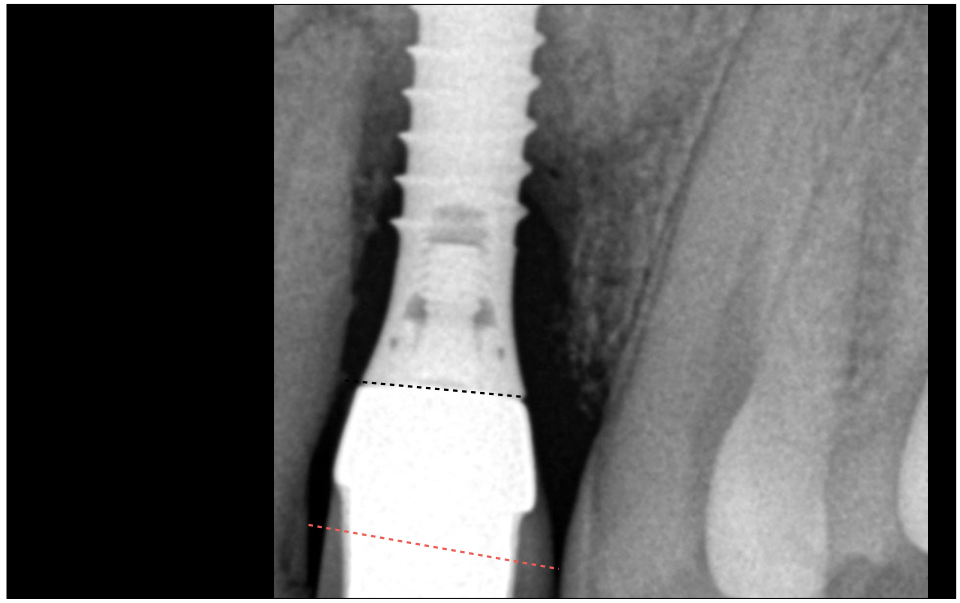
Radiopacity

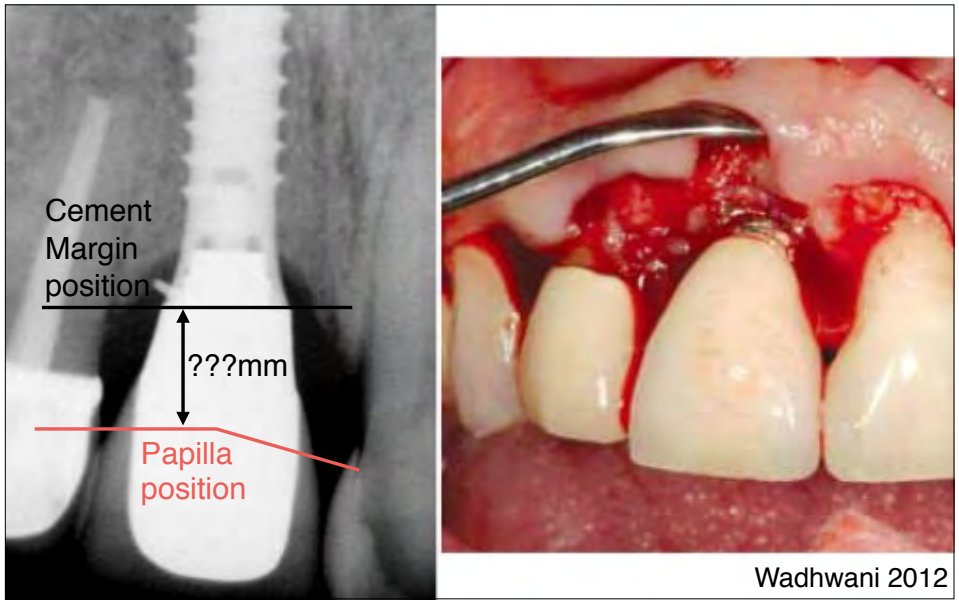
Pette GA, Ganeles J, Norkin FJ. Radiographic appearance of commonly used cements in implant dentistry. Int J perio rest Dent. 2013;33:61-8.

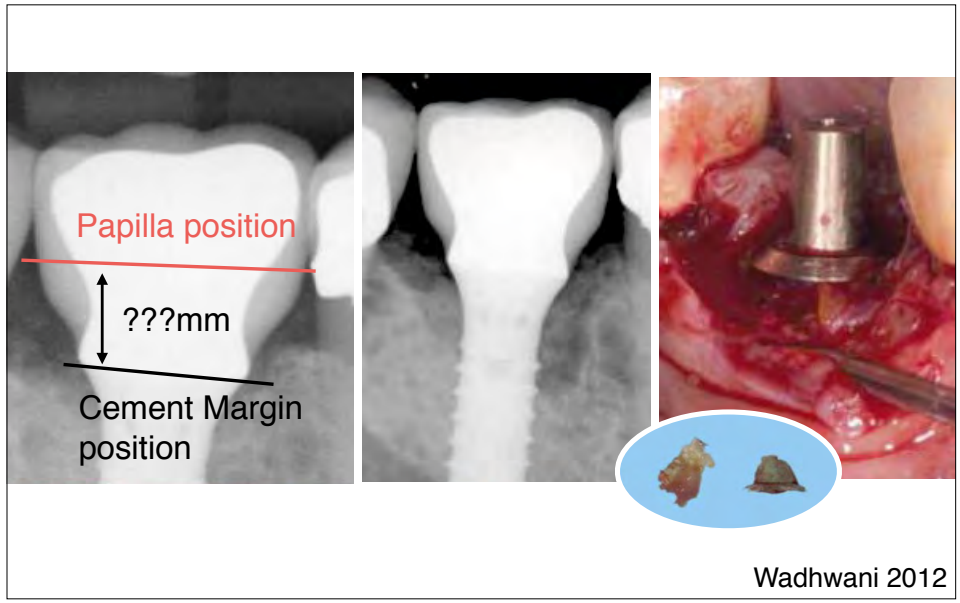


Margin Placement
for cement retained restorations









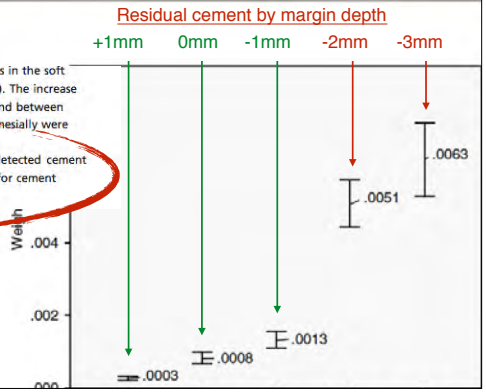
CLINICAL ORAL IMPLANTS RESEARCH

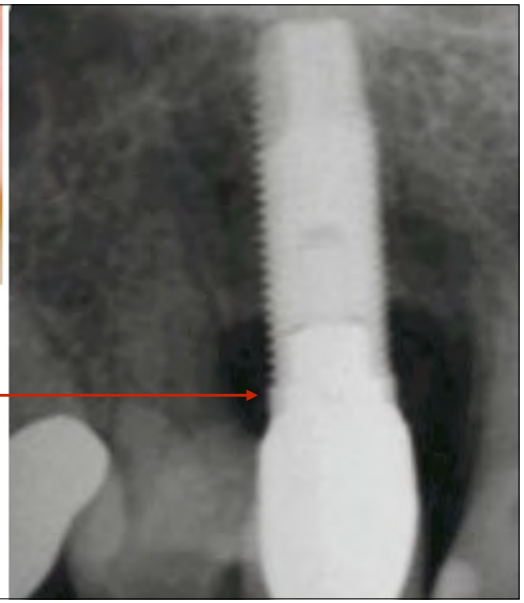
Tomas Linkevicius
Egle Vindasiute
Algirdas Puisys
Laura Linkeviciene
Natalja Maslova
Alina Puriene

The influence of the cementation margin position on the amount of undetected cement. A prospective clinical study

($P = 0.000$), significant difference was found among all groups ($P \leq 0.05$). Remnants in the soft tissue groups: 1 (0.014 ± 0.006); 2 (0.052 ± 0.011); 3 (0.057 ± 0.009); 4 (0.071 ± 0.012). The increase of the remnants was statistically reliable ($P = 0.0045$), significant difference was found between group 1 and 2 ($P \leq 0.05$). Radiographic evaluation showed that cement remnants mesially were visible in four cases of 53 or 7.5%, and in six cases of 53 distally (11.3%).

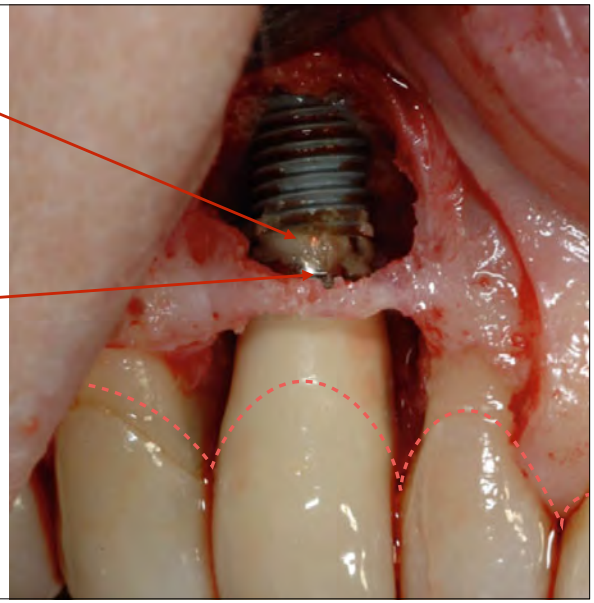
Conclusions: The deeper the position of the margin, the greater amount of undetected cement was discovered. Dental radiographs should not be considered as a reliable method for cement excess evaluation.





No cement visible

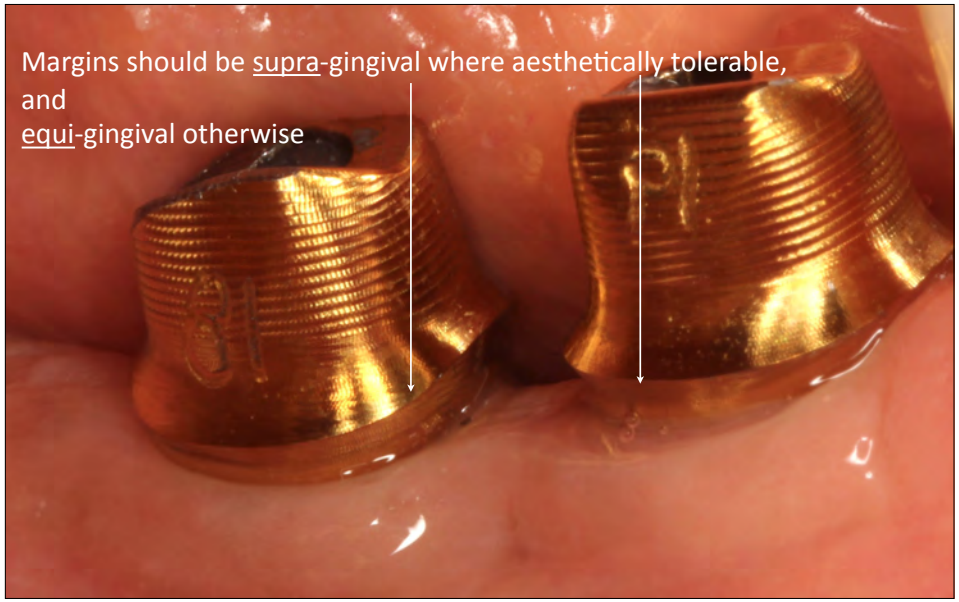
Wadhwani et al.



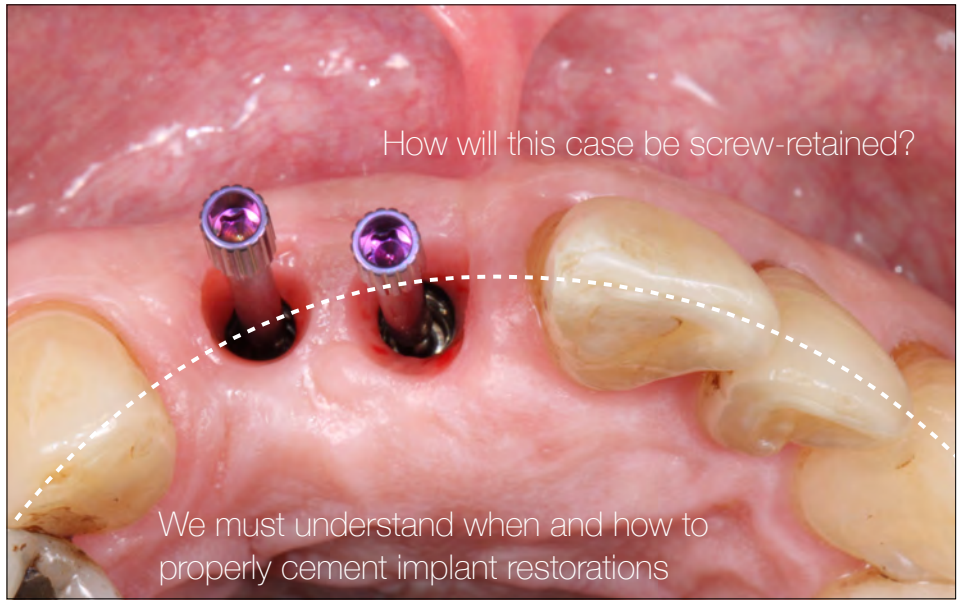
cement?

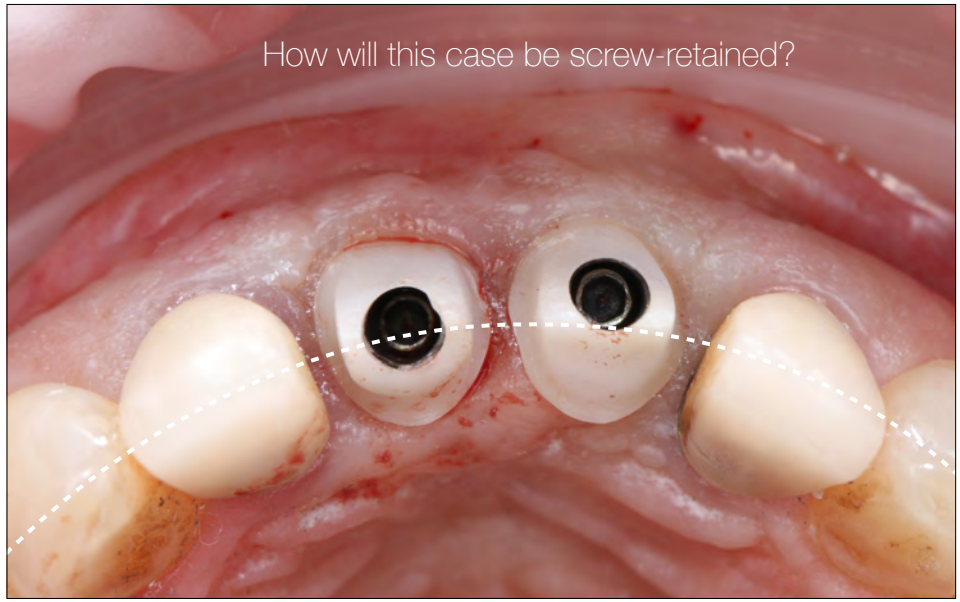
margins below the bone!
4-7mm subgingival!

Wadhwani et al.

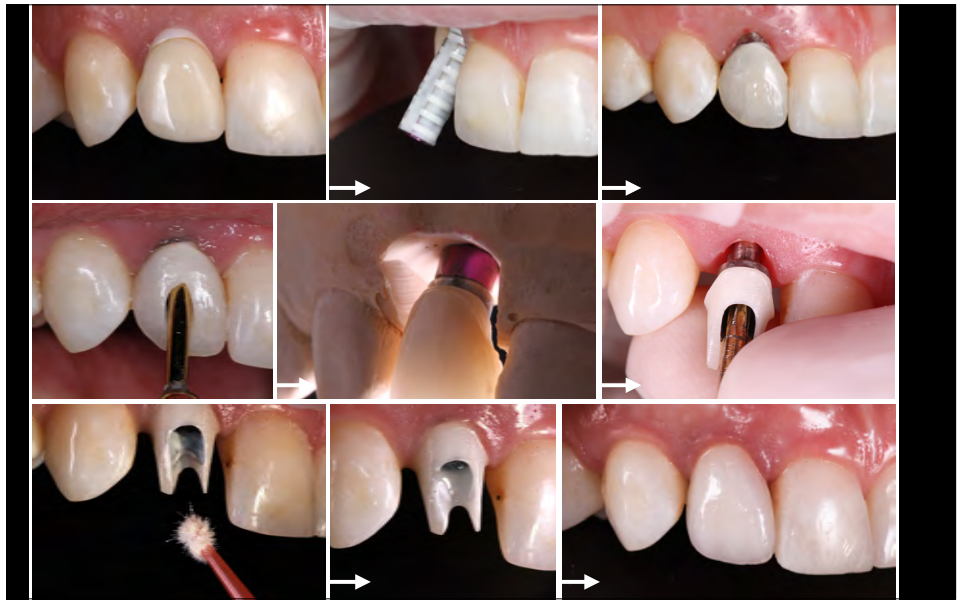


"I only do screw-retained…"



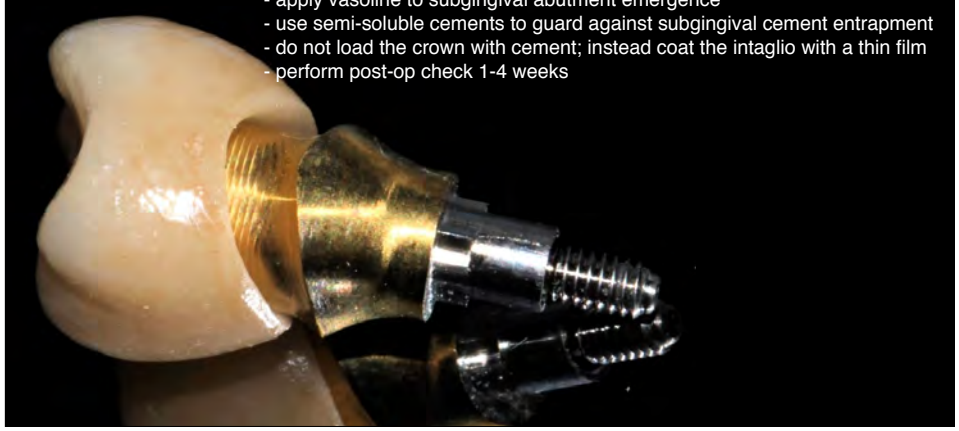

How will this case be screw-retained?


How will this case be
screw-retained?

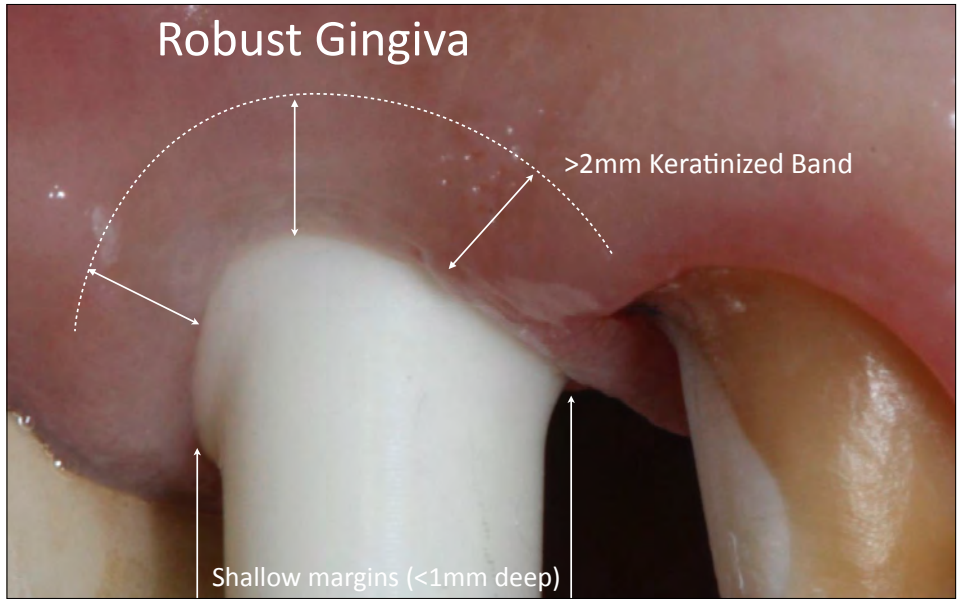


Implant Crown Cementation

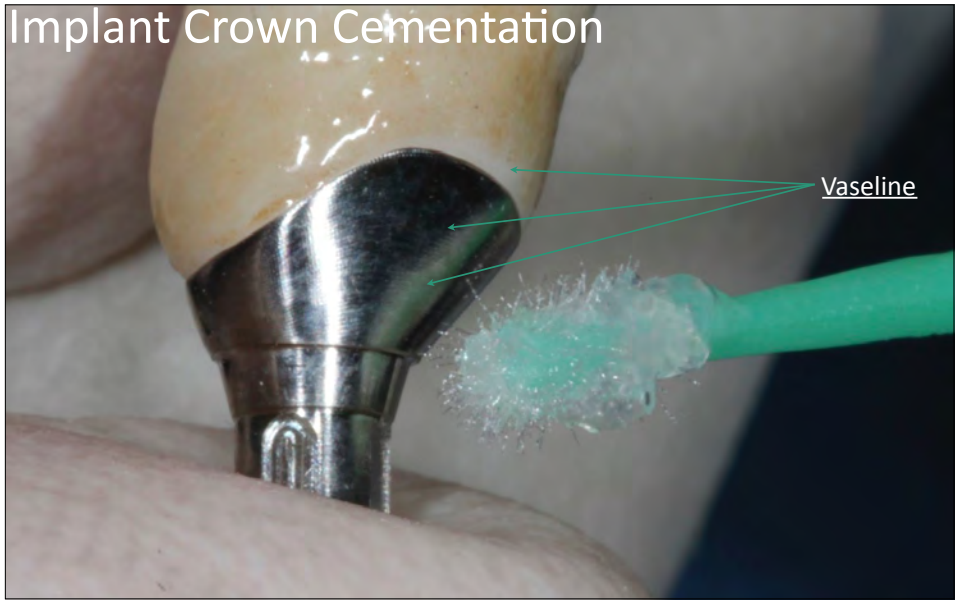
Strategies for Success:
- margins no more than 1mm subgingival
- custom designed abutments facilitate ideal margins
- only cement in mature gingiva over 2mm wide
- apply vasoline to subgingival abutment emergence
- use semi-soluble cements to guard against subgingival cement entrapment
- do not load the crown with cement; instead coat the intaglio with a thin film
- perform post-op check 1-4 weeks



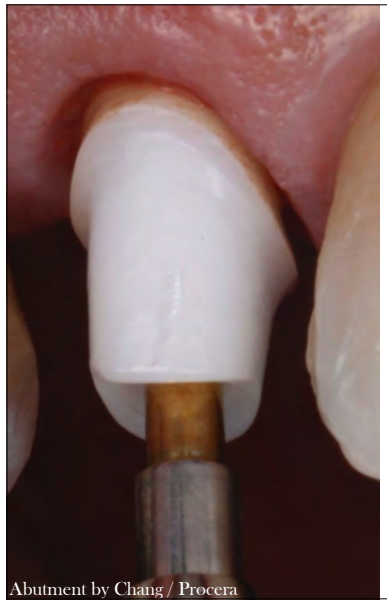
Robust Gingiva



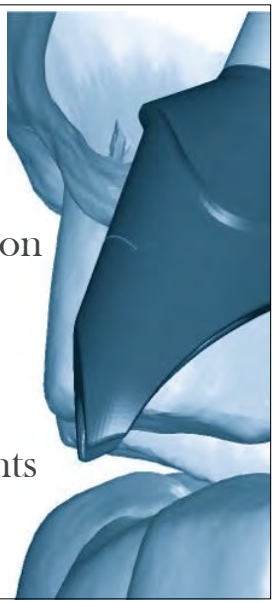
Implant Crown Cementation



What about tempbond?



Abutment Selection
&
Design
for partially
edentulous patients



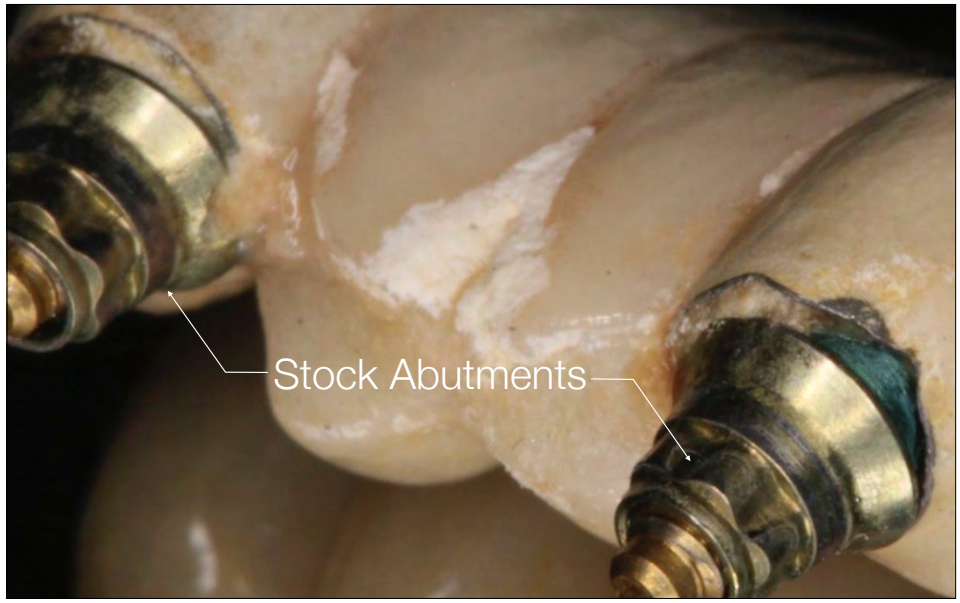
Custom abutment options

Titanium

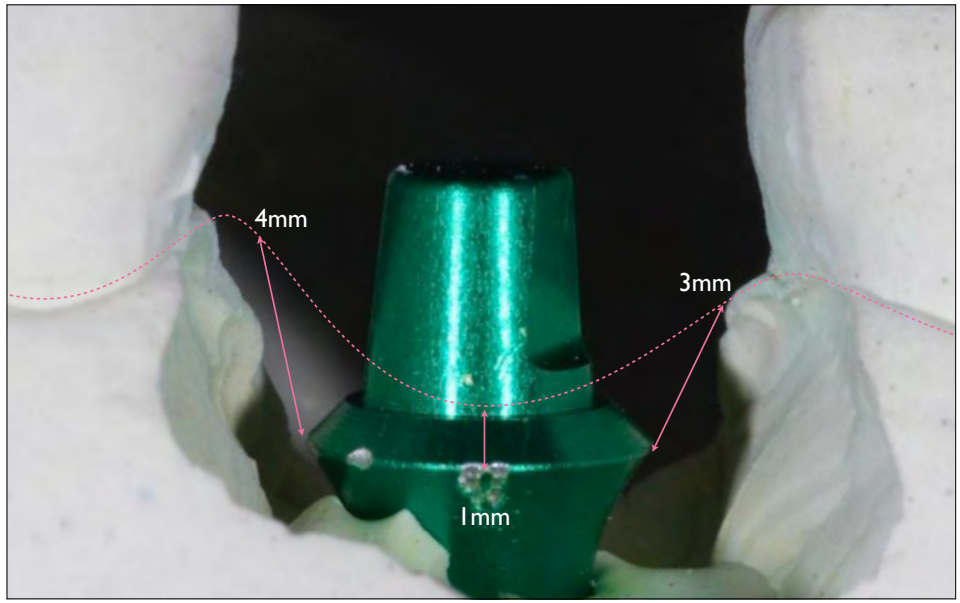
Ti-Nitride

Full Zr

Zr - TiBase



Stock Abutments



Custom Milled Titanium Abutments

Advantages:
- custom made based on user specified margin position, emergence, and definitive tooth form
- can be TiN (gold color) coated to minimize “graying” of gingiva
- minimizes amount of gold in PFM frameworks
- allows for greatest degree of angulation correction

Disadvantages:
- higher cost
- longer fabrication time

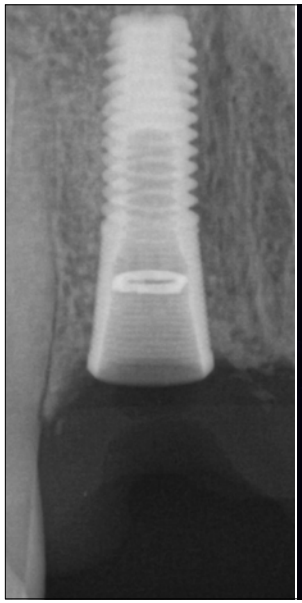
Good for:
- posterior cemented crowns / bridges
- anterior cemented prostheses under heavy loads

Custom Milled Zirconia Abutments

Advantages:
- custom made based on user specified margin position, emergence, and definitive tooth form
- can be tinted to better replicate root surface color
- less graying of gingiva
- will not “gray out” porcelain crowns
- allows for greatest degree of angulation correction

Disadvantages:
- higher cost
- longer fabrication time
- more fragile compared to Ti abutments
- needs thicker walls compared to Ti abutments

Good for:
- cemented crowns / bridges in the aesthetic zone
- posterior cemented prostheses under lighter loads



Rescue Tx by
David Wagner and Dan Pinar

Kelly 2016

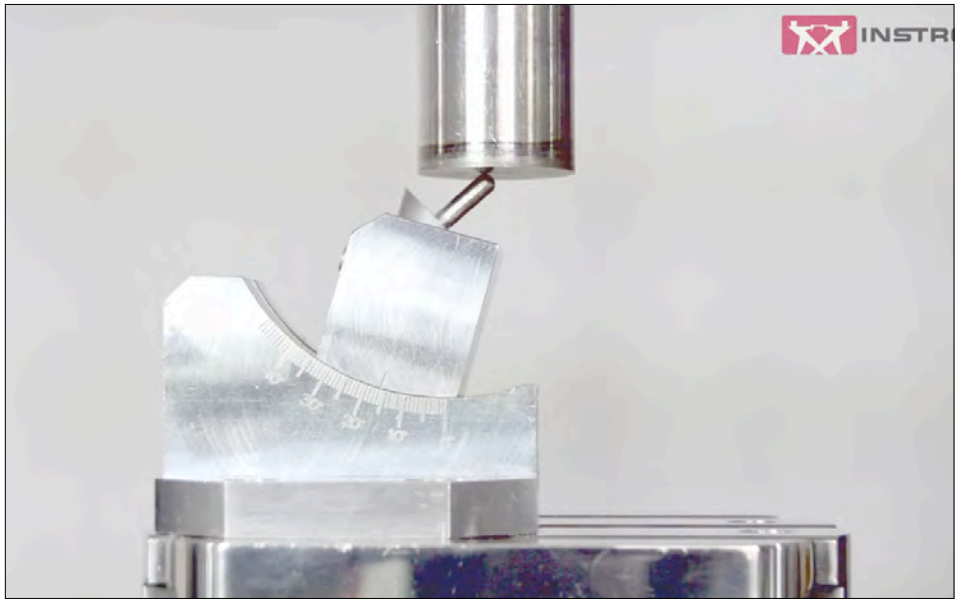
Comparison of fracture strength of 4 Zr abutments from 4 manufacturers

Straumann

Glidewell

Atlantis (Dentsply)

Nobel Procera



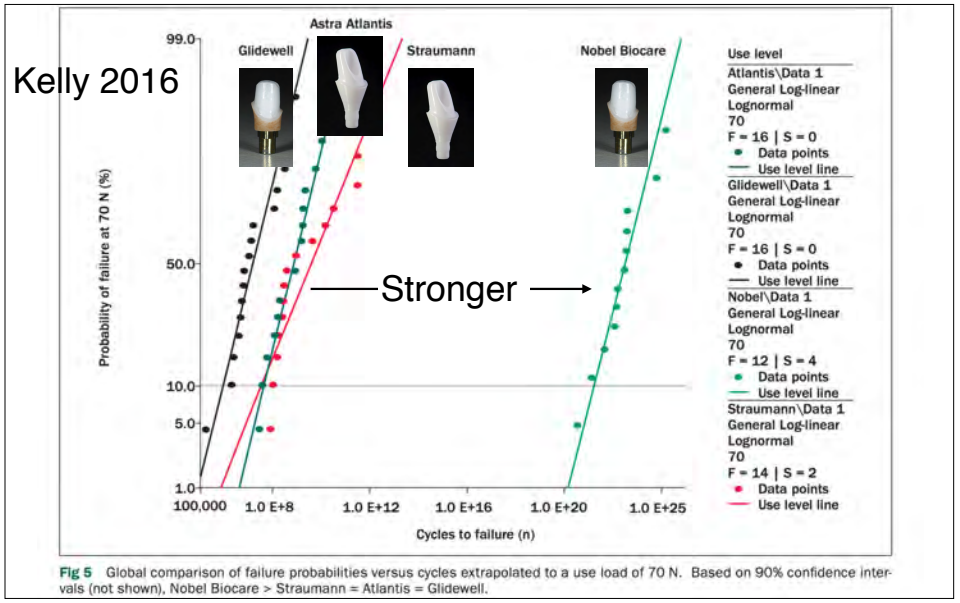


Fig 5 Global comparison of failure probabilities versus cycles extrapolated to a use load of 70 N. Based on 90% confidence intervals (not shown), Nobel Biocare > Straumann = Atlantis = Glidewell.

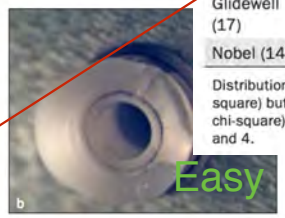
Fatigue Behavior of Computer-Aided Design/ Computer-Assisted Manufacture Ceramic Abutments as a Function of Design and Ceramics Processing

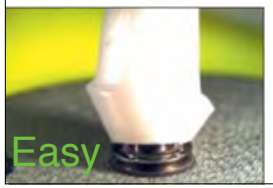
J. Robert Kelly, ODS, MS, DMedSc[1]/Patchnee Rungruanganunt, DMD, MSD[2]

Failure mode

	Internal	Screw seat	Debond and fracture	Tube tear	Runout
Atlantis (16)	8	8	–	–	–
Straumann (17)	3	13	–	–	1
Glidewell (17)	–	–	4	13	–
Nobel (14)	–	–	8	5	1

Distributions were similar for Atlantis and Straumann ($P > .1$, chi-square) but differed between Glidewell and Nobel Biocare ($P < .001$, chi-square). Examples of each failure mode can be seen in Figs 3 and 4.





The mucosal attachment at different abutments

An experimental study in dogs

Abrahamsson I, Berglundh T, Glantz P.-O, Lindhe J. The mucosal attachment at different abutments. An experimental study in dogs. J Clin Periodontol 1998; 25: 721–727. © Munksgaard, 1998.

Gold abutments resulted in 1-2mm lower gingival position compared to titanium and alumina

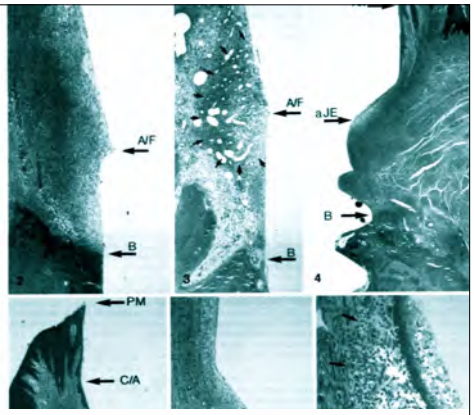
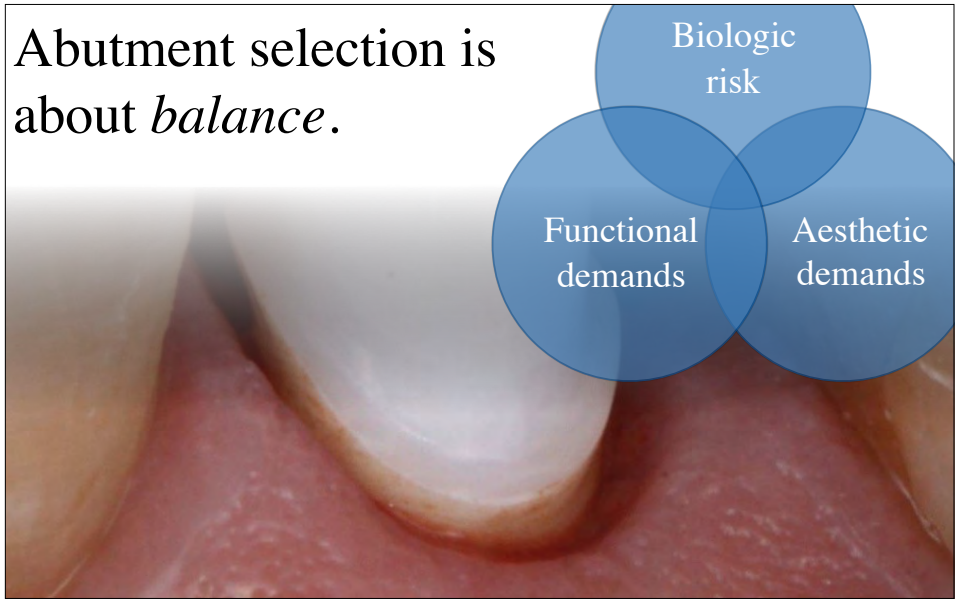


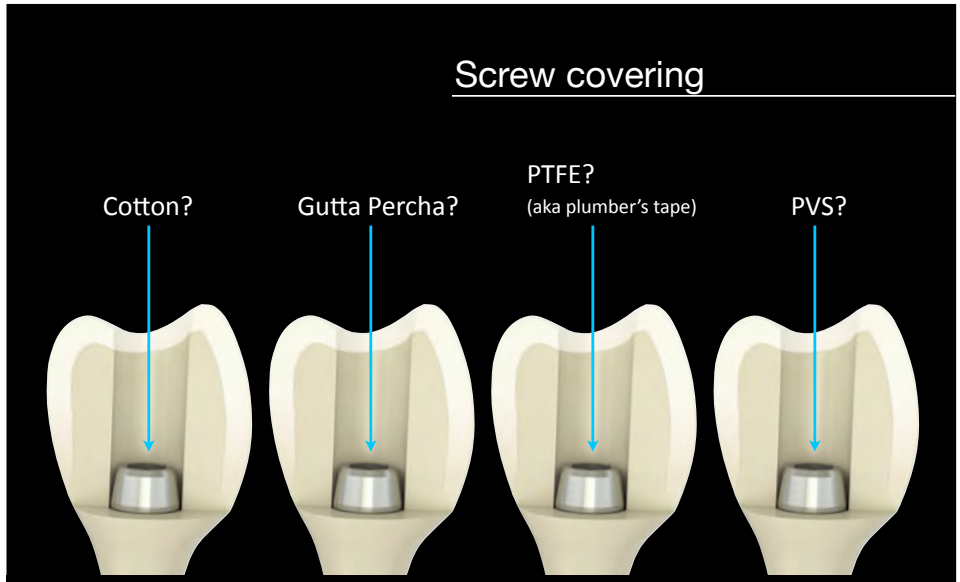
Table 1. Vertical dimensions (mm) of the peri-implant soft tissue components

	PM-B		PM-aJE		aJE-B		PM-A/F		A/F-B	
(mm)	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
control	3.32	0.24	2.04	0.22	1.28	0.11	2.54	0.35	0.78	0.17
ceramic	3.36	0.26	2.01	0.44	1.34	0.33	2.56	0.22	0.80	0.16
gold	2.55*	0.28	1.75	0.20	0.79	0.31*	0.75*	0.44	1.80*	0.21
short titanium	2.99	0.31	1.81	0.36	1.19	0.38	1.73*	0.43	1.26*	0.31

Abutment selection is about *balance*.



Screw covering



Schoenbaum TR, Wadhwani C, Stevenson RG. Covering the implant prosthesis screw access hole: a biological approach to material selection and technique. J Oral Imp. 2017.

Covering the Implant Prosthesis Screw Access Hole: A Biological Approach to Material Selection and Technique

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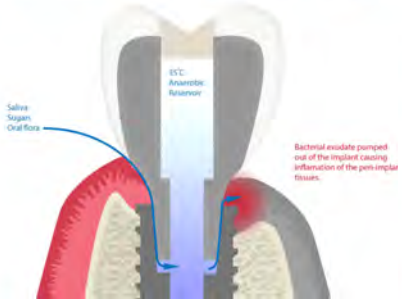


The "septic pump"

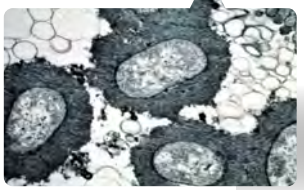
Occlusal loads here…

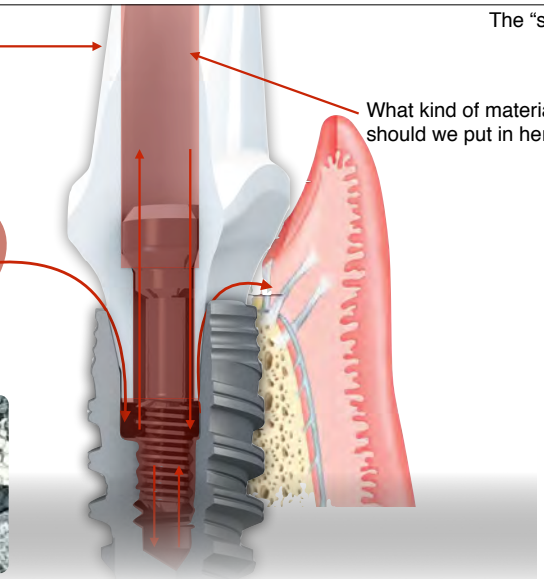
What kind of material should we put in here???

…cause micro leakage here.

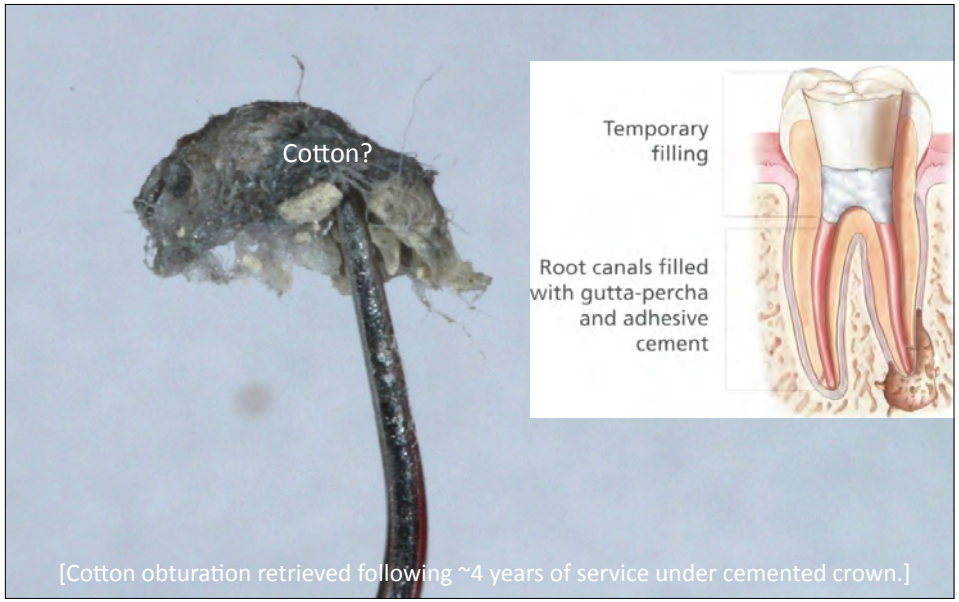
Saliva + *Bacteria*, *P gingivalis*, *T forsythia*, *T denticola*, *P intermedia*, *P micros*, *F nucleatum*, *C rectus*, *E corrodens* + Sugars

Canullo 2015



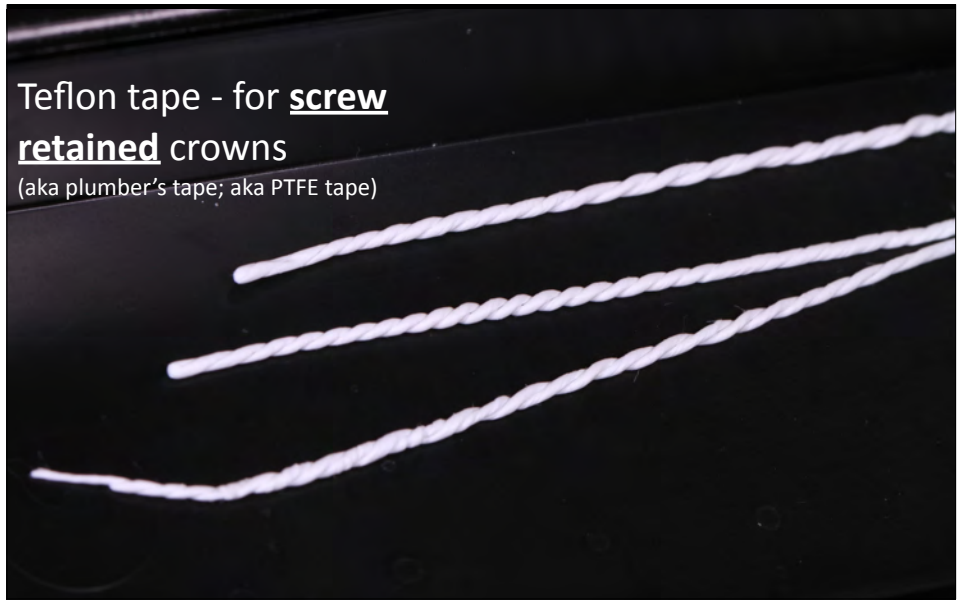


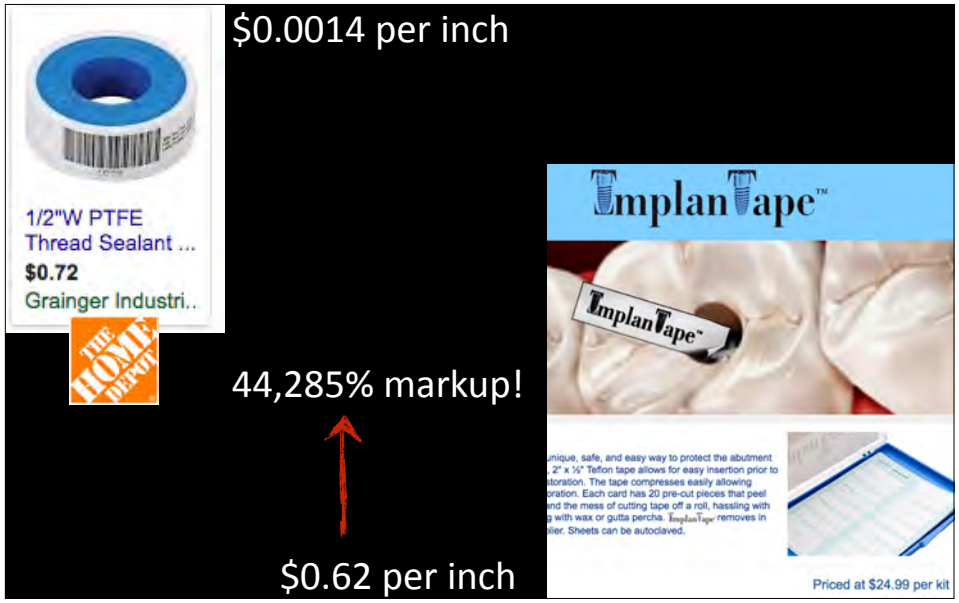
Schoenbaum T, Wadhwani C, Stevenson R. Covering the implant prosthesis screw access hole: A biological approach to material selection and technique. J Oral Implant. 2016 Nov 21.

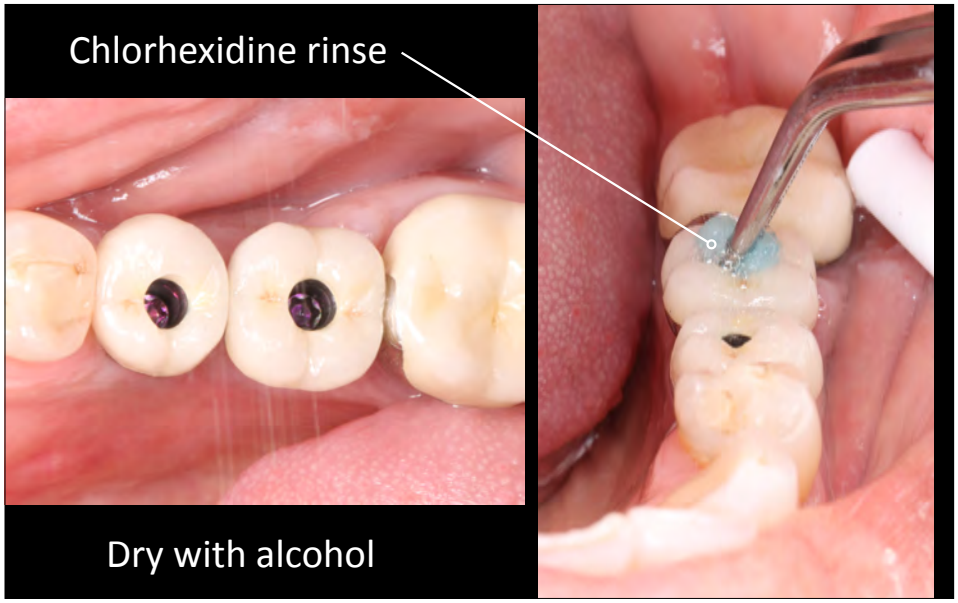


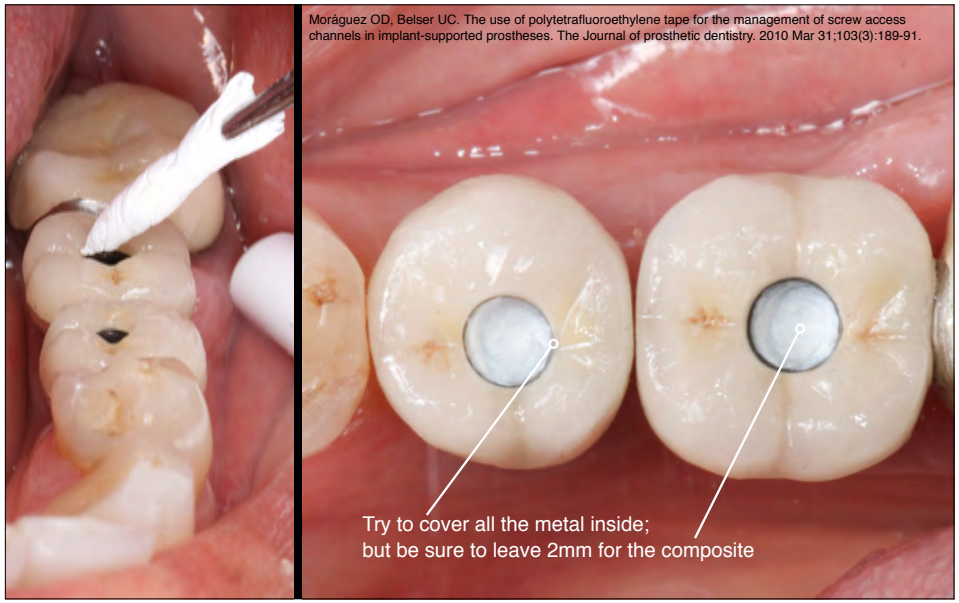
Screw covering materials — Tarica, Wadhwani

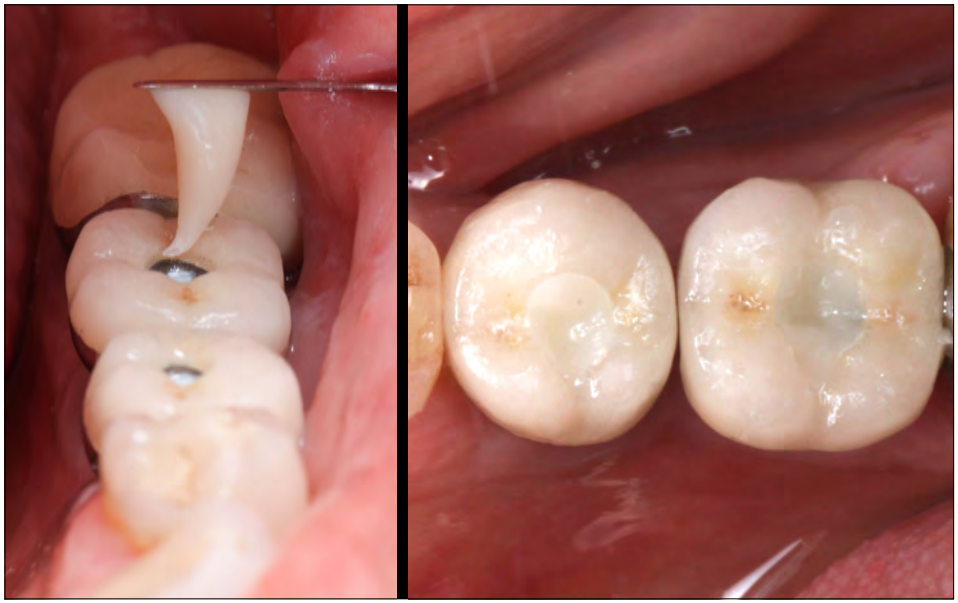
Material	Prosthodontic residency directors 2008	Prosthodontic residency directors 2013
Cotton Pellet	17 (59 %)	16 (59 %)
PTFE	0	14 (52 %)
Gutta-percha	9 (31 %)	6 (22 %)
Light-cured temp.	8 (28 %)	17 (63 %)
Composite	18 (62 %)	22 (81 %)
Acrylic	0	3 (11 %)
Rubber material	12 (41 %)	17 (63 %)
Amalgam	1 (3 %)	4 (15 %)
Glass ionomer	1 (3 %)	0
Cavit	1 (3 %)	3 (11 %)
IRM	0	0
Other	4 (14 %)	3 (11 %)




$0.0014 per inch
1/2"W PTFE
Thread Sealant ...
$0.72
Grainger Industri..
THE HOME DEPOT
44,285% markup!
$0.62 per inch
ImplanTape™
ImplanTape™
Priced at $24.99 per kit


Chlorhexidine rinse
Dry with alcohol


Moráguez OD, Belser UC. The use of polytetrafluoroethylene tape for the management of screw access channels in implant-supported prostheses. The Journal of prosthetic dentistry. 2010 Mar 31;103(3):189-91.
Try to cover all the metal inside;
but be sure to leave 2mm for the composite

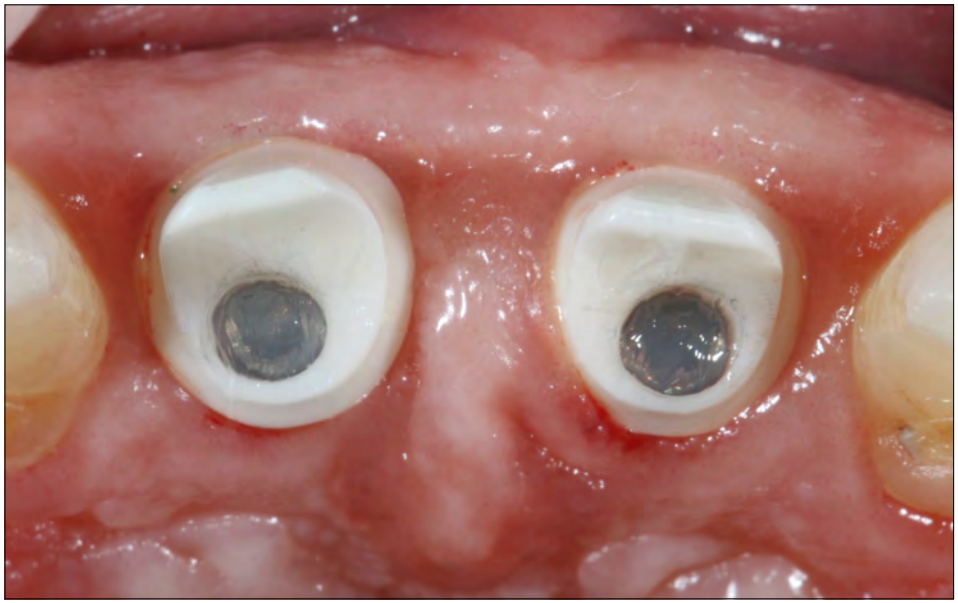


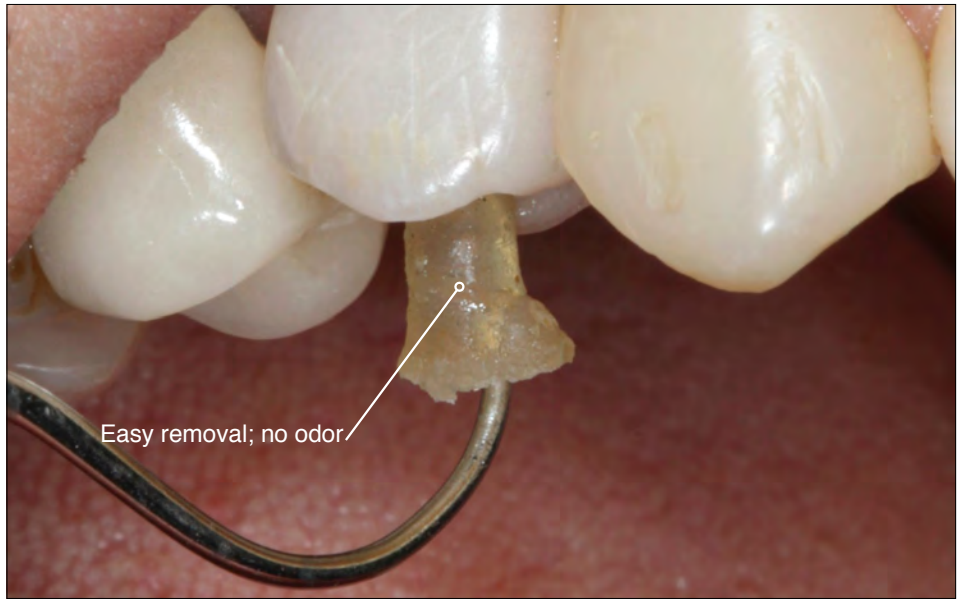
PVS screw cover for **cemented crowns**

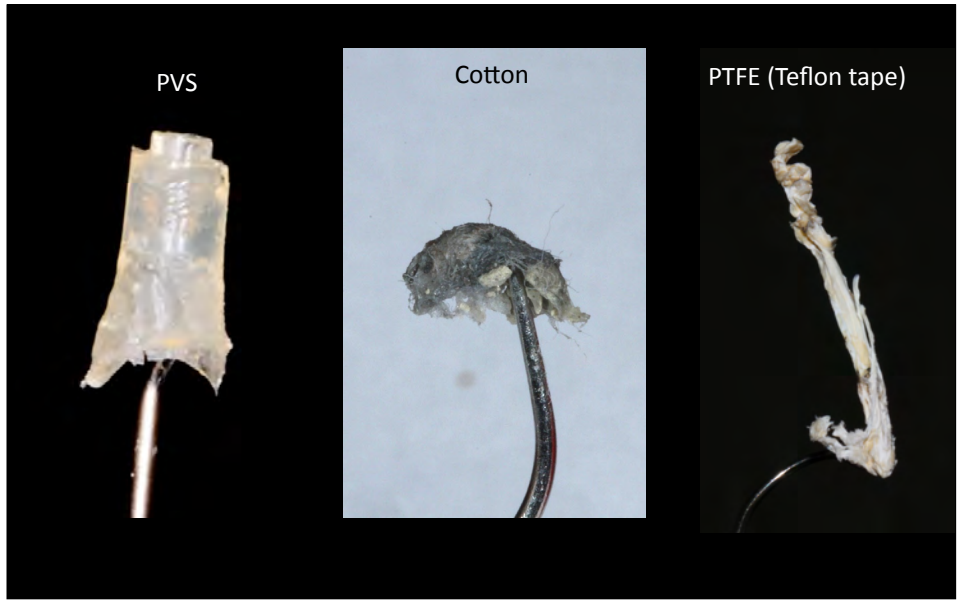
Protocol:

1. 2% Chlorhexidine
2. Isopropol alcohol
3. Backfill with Clear or white PVS

Clear PVS or White PVS




Easy removal; no odor


PVS
Cotton
PTFE (Teflon tape)


Schoenbaum Ed.
Implants in the Aesthetic Zone
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