

# Knowledge and attitude of dentists toward implant retained restorations in Saudi Arabia

Vohra F, Habib R

Department of Prosthetic Dental Science, College of Dentistry, King Saud University, Riyadh 11545, Kingdom of Saudi Arabia

## Abstract

**Objectives:** The aim was to assess the knowledge and attitudes of specialists (SP) and general dental practitioners (GDP) toward cement-retained restoration (CRR), screw-retained restoration (SRR) and implant restorations in Saudi Arabia.

**Materials and Methods:** Self-designed-structured questionnaires were distributed between SP and GDP by hand and through E-mails. Opinion of dentists regarding factors vital in selection of CRR and SRR was enquired. Factors included esthetics, retrievability, retention, passive fit, fracture resistance, tissue health, cost-effectiveness, fabrication ease, and required expertise. Participants also graded significance of treatment-planning factors for implant-retained prosthesis. Analysis of comparative response frequencies and significance grades was done using the Chi-square and independent *t*-test.

**Results:** Of 552 respondents, 64% were SP and 36% were GDP with overall response rate of 67%. About 75% of SP and 80% of GDP used SRR in <50% and <25% of their implant practice respectively. The opinion of GDP and SP was significantly different with regards to esthetics, fabrication ease, retrievability, retention and cost-effectiveness between CRR and SRR ( $P < 0.05$ ). Overall, CRR were considered better in terms of esthetics, passive fit, fabrication ease, required expertise and fracture resistance. However, SRR were regarded as having better retention, retrievability, soft tissue health and cost-effectiveness. The average significance scores were significantly higher for SP as compared to GDP for six out of nine factors.

**Conclusions:** Knowledge of SP and GDP for selection of implant-retained restorations was broadly in line with standard evidence. The clinical use of CRR was greater in comparison to SRR.

**Key words:** Cement-retained, implants retained restorations, knowledge, screw-retained

**Date of Acceptance:** 13-Sep-2014

## Introduction

Improved survival rates of osseointegrated dental implants have led to their increased utilization in oral rehabilitation.<sup>[1]</sup> Many factors influence clinical success and longevity of implants and implant restorations including, systemic patient health, implant site, type of supra-structure, biomechanical considerations and occlusal loads, and oral hygiene maintenance.<sup>[2-5]</sup> One of the vital decisions to be made in the treatment-planning of implant based oral therapy is the method of retention of the restoration

to the implant, that is, cement or screw-retained. The choice between cement-retained restoration (CRR) and screw-retained restoration (SRR) is influenced by multiple factors, which include esthetic outcomes, mechanical and biological complications, financial implications and ease of maintenance.<sup>[6,7]</sup>

Both SRR and CRR are extensively being used in clinical practice for prosthetic rehabilitations. Although, reports have shown comparable survival results for CRR and

### Address for correspondence:

Dr. F Vohra,  
Assistant Professor, Department of Prosthetic Dental Science,  
College of Dentistry, King Saud University, P.O. Box 60169,  
Riyadh 11545, Kingdom of Saudi Arabia.  
E-mail: fahimvohra@yahoo.com

### Access this article online

#### Quick Response Code:

Website: [www.njcponline.com](http://www.njcponline.com)

DOI: \*\*\*

PMID: \*\*\*\*\*

SRR,<sup>[8]</sup> both these prosthesis types offer evident advantages making them suitable for distinct clinical scenarios. For SRR, maintenance and replacement is made easy through retrievability;<sup>[9]</sup> also lack of luting cement minimizes biologic complications and allows for uninterrupted healing for immediately restored implants.<sup>[10]</sup> A further advantage of screw-retained prosthesis is their ability to be used in cases with minimal inter-arch space (<4 mm) and malpositioned implants due to direct screw engagement. However in terms of their limitations, SRR require increased skill on part of the technicians along with high cost. In addition, presence of screw access channel could result in unsupported weak ceramic and undesirable esthetic.<sup>[11-14]</sup> Conversely, cement-retained prosthesis provide the benefits of excellent esthetics and desirable occlusal contacts.<sup>[11]</sup> In addition, CRR allow for flexibility in positioning of implants, permit passivity of fit and have low overall cost.<sup>[15-17]</sup> However CRR are not without problems, difficulty during retrieval and incomplete removal of cement are major concerns.<sup>[18-20]</sup> Presence of residual cement in the peri-implant tissue has shown to result in biological complications, including soft tissue inflammation and bone loss.<sup>[21]</sup>

In a recent long-term clinical trial on comparing SRR and CRR implant restorations, no difference was found in the survival of these restorations by patient and clinician assessed success factors.<sup>[8]</sup> Hence the choice between CRR and SRR is based on the patient based clinical findings and clinicians' preference. Since implant dentistry has revolutionized the modern dental practice and increased numbers of general dental practitioners (GDP's) are involved in the provision of implant-retained restorations,<sup>[22]</sup> it is hypothesized that the knowledge of GDP's and specialist (SP) regarding implant-retained restorations is comparable. Therefore, the aim of this study was to evaluate the knowledge and attitude of SP and GDP regarding factors effecting decision-making between CRR and SRR implant restorations.

## Materials and Methods

The study population in this cross-sectional study was a sample of dentists in Saudi Arabia divided into two distinct strata SP and GDP. GDP included in the study were graduate dentist who had completed minimum 1-year internship; for SP, those who had completed a postgraduate SP program in dental prosthetics and/or restorative dentistry. The contact details of the clinicians were obtained from the office of Saudi Dental Society (SDS). The Ethical Committee of College of Dentistry Research Center, King Saud University approved the study protocol (Ref No. 0019) and the study was conducted from December 2013 to April 2014.

A self-designed-structured anonymous questionnaire in English language was used as the instrument for data collection. The questionnaire comprised of three sections.

Section one had four questions however sections two and three had nine questions each. This resulted in a total of twenty two questions. Questions included in the questionnaire were finalized after a pilot distribution of thirty primary survey forms within the College of Dentistry, King Saud University. The first part of the definitive questionnaire enquired about the respondent's category of practice, specialty, years of experience and use of implant-retained restorations. The second section had nine questions enquiring which implant restoration (CRR or SRR) better provides the properties desired in these restorations. These desired factors included esthetics outcome, cost-effectiveness, ease of fabrication, expertise required for provision, retrievability, and retention, passivity of fit, fracture resistance and surrounding tissue health. In the last part of the questionnaire, participants were asked to grade factors considered important in selection of implant-retained prosthesis according to their clinical significance. The significance level scores ranged from one to five, one being very insignificant and five being very significant (0–1: Very insignificant 1–2: Insignificant 2–3: Neutral 3–4: Significant 4–5: Very significant).

Six hundred questionnaires along with a cover letter stating the instructions, rationale and purpose of the survey, were randomly distributed between SP and GDP in the major cities of Saudi Arabia. With the foresight of nonresponding participants, 150 questionnaires were E-mailed on addresses obtained from the SDS. Descriptive statistics and analysis of the collected data was performed using Statistical Package for Social Sciences (SPSS) version 21 (SPSS, Chicago, Illinois, USA). Chi-square test was used for the comparison of responses collected for each question between SP and GDP. Comparative analysis of the significance grades related to decision-making factors was made by using independent sample t-test, considering  $P < 0.05$  to be statistically significant.

## Results

502 responses were completed out of the 600 hand distributed questionnaires (response rate 83.6%). However, SP and GDP completed only 50 out of 100 online (E-mailed) questionnaires (response rate 50%). A total of 552 complete responses were received, which were assessed and compared between SP and GDP. 64% ( $n = 354$ ) of the respondents were SP and 36% ( $n = 198$ ) were GDP. Among the total respondents, 60% ( $n = 330$ ) had <5 years clinical experience, 27% ( $n = 150$ ) had 5–10 years and 13% ( $n = 72$ ) had >10 years experience [Table 1]. Almost 32% ( $n = 176$ ) of participants were working in a private practice, 48% ( $n = 265$ ) belonged to teaching hospitals and 20% ( $n = 111$ ) practiced at both places. More than 80% ( $n = 163$ ) of GDP used SRR in <25% of implant restoration cases. However, almost 41% ( $n = 145$ ) (majority

**Table 1: Category and experience of participating dentists**

Participants	Years of experience								P
	<5 years		5-10 years		>10 years		Total		
	n	%	n	%	n	%	n	%	
SP	210	38.0	108	19.5	36	6.52	354	64.1	0.179
GDP	120	21.7	42	7.6	36	6.52	198	35.9	
Total	330	59.7	150	27.2	72	13	552	100	

SP=Specialists; GDP=General dental practitioners

group) of SP used SRR in a range of >25% <50% of implant cases treated.

Out of nine questions in relation to ideal properties desired in CRR, SRR and implant restorations; opinions of GDP and SP were significantly different on five occasions (55.5%) [Table 2]. With regards to esthetics, ease of fabrication, and passivity of fit, both SP and GDP considered CRR to be superior to SRR. In relation to esthetics and ease of fabrication the opinions of SP and GDP were significantly different ( $P > 0.05$ ), for both factors > 25% ( $n = 99$ ) of SP considered both CRR and SRR to be similar. In addition, 22.3% ( $n = 79$ ) of SP and 29.7% ( $n = 59$ ) of GDP considered both CRR and SRR to have similar passivity of fit. Without any significant difference between SP and GDP, delivery of SRR, was considered to require high level of expertise (SP 58% [ $n = 205$ ] and GDP 52% [ $n = 103$ ]) and is also less likely to disrupt soft tissue health (SP 11% [ $n = 39$ ] and GDP 18.6% [ $n = 37$ ]). Majority of participants also considered SRR, easy to retrieve as compared with CRR.

Although the majority of total respondents mentioned SRR as having better retention, 43.9% ( $n = 87$ ) (majority group) of GDP selected CRR as more retentive restoration compared to SRR. CRR was considered to possess better fracture resistance by SP [51.1% ( $n = 181$ )], however 44.4% ( $n = 88$ ) (majority group) of GDP regarded both restorations to have comparable fracture resistance. Significant difference was found between SP and GDP opinions regarding the cost of implant restorations. Most of the SP (50.8% [ $n = 180$ ]) considered both SRR and CRR to be equally cost-effective, however, 59.7% ( $n = 118$ ) of GDP chose SRR to be more economical.

The average significance for factors influencing selection between CRR and SRR is presented in Table 3. Factors including, esthetics, soft tissue health, retention, level of expertise and fracture resistance were regarded as "very significant" by SP (average significance weightage [ASW]  $\geq 4$ ). For the GDP group only "esthetics" was considered "very significant." However, all other the factors were considered "significant" (ASW in excess of >3<4) for both SP and GDP. Six of the nine planning factors for implant-retained restorations, showed

statistically significant difference in their ASW between SP and GDP [Table 3].

## Discussion

The study presents a unique data comparison of knowledge and attitudes of SP (prosthodontic and restorative) and GDP towards factors that are affected by different methods of implant prosthesis retention. The response rate was 83.6% and 50.0% % for hand delivered and E-mailed questionnaires respectively. Electronic questionnaires showed a low response rate as compared to paper surveys, however, this has been reported previously.<sup>[23]</sup> Few reasons for the low response rate of electronic questionnaires are, SDS members not belonging to the specific specialty (prosthetic and restorative dentistry), inactive SDS members, and members failing to update E-mail addresses with the SDS. However for paper surveys the response rate appears similar to a previous study by Baruch and Brooks.<sup>[24]</sup> Presence of statistical similarity (SP and GDP,  $P 0.179$ ) in the level of clinical experience between SP and GDP, allowed an effective comparison of data sets.

Overall, almost 60% of respondents used SRR in <25% of their implant cases. 75% of SP and 80% of GDP used SRR in <50% and <25% of their implant practice respectively. The popular use of CRR has been reported previously, in a survey regarding practice of dental implants involving 16 countries; an overwhelming majority of clinicians reported the use of CRR as compared to SRR.<sup>[25]</sup> In the present study, factors considered most significant [Table 3] for selection of implant restorations included esthetics, expertise required for fabrication and fracture resistance of the restoration. CRR are superior to SRR in all three above mentioned properties, therefore it can be assumed that these along with other reasons could likely be the cause for the preferred use of CRR as reported in our study.

Both SP and GDP considered CRR to be esthetically superior, easier to fabricate requiring comparatively less expertise and have better passivity of fit in comparison to SRR. These opinions appear to be in line with the established standards in implant dentistry.<sup>[9,17,26-28]</sup> When implant is placed in the ideal position SRR and CRR produce the same esthetic outcome. However, in situations where anatomy or bone loss does not allow desired implant positioning, presence of screw access hole in the esthetic region of a SRR, results in an unfavorable esthetic outcome.<sup>[9,17]</sup> Moreover, a lack of passivity of fit in implant restorations is linked to mechanical and biological complications.<sup>[26,29]</sup> It is popular belief that CRR are more likely to achieve a passive fit,<sup>[27,30,31]</sup> however, studies comparing CRR and SRR for passive fit have shown no difference.<sup>[30,32]</sup> It is assumed that the luting cement for CRR acts as a shock absorber and results in stress reduction in the prosthesis and supporting bone.<sup>[12]</sup> Conversely, in

**Table 2: Numerical summary of participant responses to survey questions**

Question	Response options	SP (n)	GDP (n)	P
Percentage of SRR among implant restorations provided	<10	16	72	0.001*
	>10<25	108	91	
	>25<50	145	35	
	>50<75	72	0	
	>75<100	13	0	
Which restoration provides better esthetics?	SRR	9	31	0.01*
	CRR	246	140	
	Both	99	27	
Which restoration is more cost-effective?	SRR	75	118	0.001*
	CRR	99	38	
	Both	180	37	
Which restoration is easy to fabricate?	SRR	27	35	0.005*
	CRR	234	145	
	Both	93	18	
Which restoration requires higher level of expertise?	SRR	205	103	0.595
	CRR	23	21	
	Both	125	74	
Which restoration is easier to retrieve?	SRR	323	157	0.024*
	CRR	22	18	
	Both	9	23	
Which restoration has better retention?	SRR	199	72	0.017*
	CRR	89	87	
	Both	64	39	
Which restoration has better passivity of fit?	SRR	66	44	0.326
	CRR	209	94	
	Both	79	59	
Which restoration has better fracture resistance?	SRR	68	38	0.077
	CRR	181	71	
	Both	104	88	
Which restoration is likely to disrupt tissue health?	SRR	39	37	0.193
	CRR	225	100	
	Both	88	61	

\*Significant difference. CRR=Cement-retained restoration; SRR=Screw-retained restoration; GDP=General dental practitioner; SP=Specialists

case of SRR without a precise fit stresses are created at the prosthesis-implant-bone complex likely to result in complications.<sup>[17]</sup> Furthermore, fabrication of CRR is similar to conventional tooth supported crowns, however, SRR requires increase expertise and extra components resulting in a comparatively costly and challenging restorative process.<sup>[28]</sup>

Most of the SP and GDP agreed with the fact that CRR cause more peri-implant tissue inflammation than SRR (SP 63.8% and GDP 50.8%), and SRR are easier to retrieve (SP 91.4% and GDP 79.1%) in comparison to CRR. Presence of residual cement is a common limitation of CRR, which could lead to peri-implant mucositis and in case of no treatment results in peri-implantitis.<sup>[33,34]</sup> Lack of cement in the use of SRR allows better peri-implant soft tissue attachment. However, loosening of abutment or prosthetic screw causes

**Table 3: Comparison of average significance scores for factors influencing selection of implant restorations**

Factors	Expertise	n	ASW	SD	SEM	P
Aesthetic	SP	119	4.55	0.756	0.069	0.008*
	GDP	67	4.15	1.270	0.155	
Cost	SP	119	3.78	0.940	0.086	0.204
	GDP	67	3.58	1.157	0.141	
Ease of fabrication	SP	119	3.89	0.757	0.069	0.000*
	GDP	67	3.18	1.072	0.131	
Retrievability	SP	119	3.93	0.722	0.066	0.792
	GDP	67	3.97	1.206	0.147	
Clinical expertise	SP	119	4.10	0.960	0.088	0.007*
	GDP	67	3.69	1.033	0.126	
Passivity of fit	SP	119	3.89	0.811	0.074	0.801
	GDP	67	3.85	1.351	0.165	
Retention	SP	119	4.18	0.936	0.086	0.003*
	GDP	67	3.73	1.024	0.125	
Soft tissue health	SP	118	4.31	0.929	0.086	0.002*
	GDP	66	3.80	1.255	0.155	
Fracture resistance	SP	118	4.03	0.978	0.090	0.008*
	GDP	67	3.61	1.100	0.134	

\*Significant difference. ASW=Average significance weightage; SP=Specialist; GDP=General dental practitioner; SD=Standard deviation; SEM=Standard error of the mean

micro-gap formation resulting in plaque accumulation and granulation tissue formation.<sup>[35]</sup> Moreover, retrievability of implant restorations is critical for the long-term maintenance and survival of these restorations. The presence of screw access hole in case of SRR allows for retrieval of these restorations without much challenge and complications.<sup>[16]</sup> In comparison, CRR cemented to implant abutments have to be removed in a way similar to tooth supported restorations resulting in undesired stresses and in some cases destruction of restoration. Multiple methods are proposed to allow for easy retrievability of CRR including use of temporary cement, retrieval screws, abutment inserts and techniques on locating the screw access opening.<sup>[36-38]</sup>

Retention for CRR is achieved through abutment surface area, height, taper and surface roughness.<sup>[39,40]</sup> In addition, the type of cement considerably influences their long-term retention.<sup>[41]</sup> However in cases of limited inter-occlusal space (<4 mm) or malpositioned implants, SRR are indicated due to direct engagement of screw. In the present study, overall, SRR was considered to have better retention; a considerable number of GDP (43.9%) preferred CRR to SRR. A possible explanation in this regard could be; although SRR with regards to retention are versatile, reports have shown increased incidence of screw loosening (65%), however the rate of de-cementation for CRR have been reported to be <5%.<sup>[15,42,43]</sup> Moreover, implant crowns withstand higher occlusal loads due to lack of proprioception. Furthermore, the presence of unsupported ceramic due screw access hole in SRR accounts



for their increased incidence of fractures.<sup>[14,44]</sup> Therefore, in the present study the perception of majority of GDP that both CRR and SRR have similar fracture resistance (44.8%) is in contrast to available evidence.

All factors assessed for their significance level in selection of implant restorations were regarded as significant (ASW of  $\geq 3 < 4$ ) or very significant (ASW of  $\geq 4$ ) by both GDP and SP. This reflects the improved awareness and knowledge of participants in relation to these factors. In addition, the average significance scores were significantly higher for SP as compared to GDP in six out of nine factors, suggesting the increased comparative emphasis placed on planning of these restorations by SP as compared to GDP.

A limitation of the present study was that data was categorized and correlated on the basis of knowledge and attitude of GDP's and SP in relation to implant-retained restorations (SRR and CRR) however further studies are needed to investigate the influence of duration of clinical experience of GDP's and SP towards the knowledge and attitude of implant-retained restorations.

## Conclusions

Within the limitations of the study, the results show that the knowledge of SP and GDP with regards to factors important in selection of implant-retained restorations was broadly in line with current standards. The use of cement-retained prosthesis for restoration of implants was significantly higher than SRR in both SP and general dental practice.

## Acknowledgments

The authors would like to thank the College of Dentistry Research Center and Deanship of Scientific Research, King Saud University, Saudi Arabia for funding this research project (RefNo. 0019). The authors would also like to thank Saudi Dental Society for their assistance in questionnaire administration.

## References

- Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg* 1981;10:387-416.
- Diz P, Scully C, Sanz M. Dental implants in the medically compromised patient. *J Dent* 2013;41:195-206.
- Papaspzydakis P, Chen CJ, Chuang SK, Weber HP. Implant loading protocols for edentulous patients with fixed prostheses: A systematic review and meta-analysis. *Int J Oral Maxillofac Implants* 2014;29 Suppl: 256-70.
- Geckili O, Bilhan H, Geckili E, Cilingir A, Mumcu E, Bural C. Evaluation of possible prognostic factors for the success, survival, and failure of dental implants. *Implant Dent* 2014;23:44-50.
- Misje K, Bjørnland T, Saxegaard E, Jensen JL. Treatment outcome of dental implants in the esthetic zone: A 12-to 15-year retrospective study. *Int J Prosthodont* 2013;26:365-9.
- De Boever AL, Keersmaekers K, Vanmaele G, Kerschbaum T, Theuniers G,

- De Boever JA. Prosthetic complications in fixed endosseous implant-borne reconstructions after an observations period of at least 40 months. *J Oral Rehabil* 2006;33:833-9.
- Lee A, Okayasu K, Wang HL. Screw-versus cement-retained implant restorations: Current concepts. *Implant Dent* 2010;19:8-15.
- Sherif S, Susarla SM, Hwang JW, Weber HP, Wright RF. Clinician-and patient-reported long-term evaluation of screw-and cement-retained implant restorations: A 5-year prospective study. *Clin Oral Invest* 2011;15:993-9.
- Michalakis KX, Hirayama H, Garefis PD. Cement-retained versus screw-retained implant restorations: A critical review. *Int J Oral Maxillofac Implants* 2003;18:719-28.
- Korsch M, Obst U, Walther W. Cement-associated peri-implantitis: A retrospective clinical observational study of fixed implant-supported restorations using a methacrylate cement. *Clin Oral Implants Res* 2014;25:797-802.
- Hebel KS, Gajjar RC. Cement-retained versus screw-retained implant restorations: Achieving optimal occlusion and esthetics in implant dentistry. *J Prosthet Dent* 1997;77:28-35.
- Pietrabisia R, Gionso L, Quaglini V, Di Martino E, Simion M. An *in vitro* study on compensation of mismatch of screw versus cement-retained implant supported fixed prostheses. *Clin Oral Implants Res* 2000;11:448-57.
- McGlumphy EA, Mendel DA, Holloway JA. Implant screw mechanics. *Dent Clin North Am* 1998;42:71-89.
- Zarone F, Sorrentino R, Traini T, Di Iorio D, Caputi S. Fracture resistance of implant-supported screw-versus cement-retained porcelain fused to metal single crowns: SEM fractographic analysis. *Dent Mater* 2007;23:296-301.
- Misch CE. Screw-retained versus cement-retained implant-supported prostheses. *Pract Periodontics Aesthet Dent* 1995;7:15-8.
- Guichet DL, Caputo AA, Choi H, Sorensen JA. Passivity of fit and marginal opening in screw-or cement-retained implant fixed partial denture designs. *Int J Oral Maxillofac Implants* 2000;15:239-46.
- Taylor TD, Agar JR. Twenty years of progress in implant prosthodontics. *J Prosthet Dent* 2002;88:89-95.
- Chiche GJ, Pinault A. Considerations for fabrication of implant-supported posterior restorations. *Int J Prosthodont* 1991;4:37-44.
- Strong SM. What's your choice: Cement-or screw-retained implant restorations? *Gen Dent* 2008;56:15-8.
- Chee WW, Duncan J, Afshar M, Moshaverinia A. Evaluation of the amount of excess cement around the margins of cement-retained dental implant restorations: The effect of the cement application method. *J Prosthet Dent* 2013;109:216-21.
- Agar JR, Cameron SM, Hughbanks JC, Parker MH. Cement removal from restorations luted to titanium abutments with simulated subgingival margins. *J Prosthet Dent* 1997;78:43-7.
- Lang-Hua BH, Lang NP, Lo EC, McGrath CP. Attitudes of general dental practitioners towards implant dentistry in an environment with widespread provision of implant therapy. *Clin Oral Implants Res* 2013;24:278-84.
- Nulty D. The adequacy of response rates to online and paper surveys: What can be done. *Assess Eval High Educ* 2008;33:301-314.
- Baruch Y, Brooks BH. Survey response rate levels and trends in organizational research. *Hum Relat* 2008;61:139-60.
- Chowdhary R, Hosadattu SR, Chandrakar N. A survey on the use of techniques, materials in dental implantology practice. *Indian J Dent Res* 2012;23:297.
- Duyck J, Naert I. Influence of prosthesis fit and the effect of a luting system on the prosthetic connection preload: An *in vitro* study. *Int J Prosthodont* 2002;15:389-96.
- Chee W, Felton DA, Johnson PF, Sullivan DY. Cemented versus screw-retained implant prostheses: Which is better? *Int J Oral Maxillofac Implants* 1999;14:137-41.
- Avivi-Arber L, Zarb GA. Clinical effectiveness of implant-supported single-tooth replacement: The Toronto study. *Int J Oral Maxillofac Implants* 1996;11:311-21.
- Jemt T. *In vivo* measurements of precision of fit involving implant-supported prostheses in the edentulous jaw. *Int J Oral Maxillofac Implants* 1996;11:151-8.
- Kim WD, Jacobson Z, Nathanson D. *In vitro* stress analyses of dental implants supporting screw-retained and cement-retained prostheses. *Implant Dent* 1999;8:141-51.
- Keller W, Brägger U, Mombelli A. Peri-implant microflora of implants with

- cemented and screw retained suprastructures. Clin Oral Implants Res 1998;9:209-17.
32. Heckmann SM, Karl M, Wichmann MG, Winter W, Graef F, Taylor TD. Cement fixation and screw retention: Parameters of passive fit. An *in vitro* study of three-unit implant-supported fixed partial dentures. Clin Oral Implants Res 2004;15:466-73.
  33. Dumbrigue HB, Abanomi AA, Cheng LL. Techniques to minimize excess luting agent in cement-retained implant restorations. J Prosthet Dent 2002;87:112-4.
  34. Pauletto N, Lahiffe BJ, Walton JN. Complications associated with excess cement around crowns on osseointegrated implants: A clinical report. Int J Oral Maxillofac Implants 1999;14:865-8.
  35. Kallus T, Bessing C. Loose gold screws frequently occur in full-arch fixed prostheses supported by osseointegrated implants after 5 years. Int J Oral Maxillofac Implants 1994;9:169-78.
  36. Chee W, Jivraj S. Designing abutments for cement retained implant supported restorations. Br Dent J 2006;201:559-63.
  37. Okamoto M, Minagi S. Technique for removing a cemented superstructure from an implant abutment. J Prosthet Dent 2002;87:241-2.
  38. Schwedhelm ER, Raigrodski AJ. A technique for locating implant abutment screws of posterior cement-retained metal-ceramic restorations with ceramic occlusal surfaces. J Prosthet Dent 2006;95:165-7.
  39. Jorgensen KD. The relationship between retention and convergence angle in cemented veneer crowns. Acta Odontol Scand 1955;13:35-40.
  40. Felton DA, Kanoy BE, White JT. The effect of surface roughness of crown preparations on retention of cemented castings. J Prosthet Dent 1987;58:292-6.
  41. Breeding LC, Dixon DL, Bogacki MT, Tietge JD. Use of luting agents with an implant system: Part I. J Prosthet Dent 1992;68:737-41.
  42. Jemt T, Lindén B, Lekholm U. Failures and complications in 127 consecutively placed fixed partial prostheses supported by Brånemark implants: From prosthetic treatment to first annual checkup. Int J Oral Maxillofac Implants 1992;7:40-4.
  43. Singer A, Serfaty V. Cement-retained implant-supported fixed partial dentures: A 6-month to 3-year follow-up. Int J Oral Maxillofac Implants 1996;11:645-9.
  44. Torrado E, Ercoli C, Al Mardini M, Graser GN, Tallents RH, Cordaro L. A comparison of the porcelain fracture resistance of screw-retained and cement-retained implant-supported metal-ceramic crowns. J Prosthet Dent 2004;91:532-537.

How to cite this article: ???

Source of Support: Nil, Conflict of Interest: None declared.

Author Queries???

AQ1: Kindly provide operator

AQ2: Kindly confirm the author name.