COMPARATIVE EVALUATION OF MARGINAL BONE LOSS IN SCREW- RETAINED VERSUS CEMENT- RETAINED IMPLANT SUPPORTED RESTORATIONS- A SYSTEMATIC REVIEW AND META-ANALYSIS.

Review Article

Dr. Darshana Shah*, Dr. Chirag Chauhan**, Dr. Manushi Panchal***, Dr. Khushboo Jaiswal****, Dr. Shailin Thaker*****

ABSTRACT

Aim: The aim of this systematic review is to compare the marginal bone loss in screw versus cement retained implant prosthesis. Materials and Method: An electronic search was conducted for articles in English listed with PuBMeD, Science Direct, Ebsco host between 1966 to December 2018 and 14 studies were included based on the inclusion and exclusion criteria in which the marginal bone loss between screw and cement retained were evaluated and compared. Results: The mean marginal bone loss in cement retained restorations is 0.89 mm and the mean marginal bone loss in screw retained restorations is 0.98 mm. Conclusion: The conclusion of this review states that the mean marginal bone loss in cement retained and screw retained implant supported restorations is not statistically significant when compared and both can be used depending on the clinical situation.

Keywords: Dental implant, Implant Supported Restorations, Dental Screws, Dental Implant Cementation, Screw-retained Restorations, Cement- retained Restorations, Marginal Bone Loss

INTRODUCTION:

At present the dental implants are widely used for the oral rehabilitation of partially or fully edentulous patients in order to secure various kinds of prosthesis. There are several factors that are responsible for long term success after placing and loading implants. One of the many factors involved is regarding the type of connection between the implant and restoration.[1]

Marginal bone loss (MBL) around dental implants is a serious problem, and extensive bone loss has long been regarded as one key factor contributing to implant failure.This "standard MBL" stabilizes at approximately 12 months. The type of retention system for implant supported prostheses must be decided before the surgical stage to determine the most accurate location of implant. There are two methods of retaining a fixed implant supported restoration: screw retention and cement retention or occasionally a combination of both, eg, Cemented prosthesis with lingual or palatal fastening screws.

Screw retained prosthesis remain the treatment of choice in completely edentulous patients because of its ease of retrievability, reduced biological complications, ease of hygiene maintainence, repairs and provision for future surgical interventions if required. Restorations that use screw retention have been an accepted treatment option in patients with limited inter arch space.[4]

Advocates of cement retained restorations list improved esthetics and occlusion, simplicity of fabrication, reduced cost of components, reduced chairside time, and easier access to posterior of the mouth as distinct advantages. Biomechanically, the potential for passivity is more when a cemented restoration is placed on implants. Some in vitro studies have demonstrated that cement-retained prostheses exert less stress on other components and on bone tissue than screw-retained prostheses. As for disadvantages in cemented restorations, retrievability remains questionable. There is evidence that excess cement from cement retained restorations may end up in the soft tissues of the patient and then result in localized swelling and marginal bone loss. A number of studies have shown that the bacterial loads associated with failing dental implants are the same organisms implicated in periodontal disease and that pro-inflammatory mediators associated with soft-tissue inflammation are differentially expressed in tissues surrounding failing implants versus healthy implants.

The presence of a marginal gap located sub-gingivally has been demonstrated to influence soft-tissue health and implant survival, as the gap size can be associated with the accumulation of plaque and debris, ultimately leading to inflammation and loss of bone architecture. In light of all these factors, an essential question to ask is whether the differences in marginal gap

* Head Of Department, **Professor, ***PG Student, **** PG Student, *****PG Student

DEPARTMENT OF PROSTHODONTICS CROWN & BRIDGE,
AHMEDABAD DENTAL COLLEGE & HOSPITAL, TA. KALOL, DIST: GANDHINAGAR, GUJARAT, INDIA

ADDRESS FOR AUTHOR CORROSPONDENCE : DR. MANUSHI PANCHAL, TEL: +91 96389 77429

between screw and cement retained implant prostheses will indeed manifest themselves in the health of peri-implant soft tissues.Presently, the dental literature is unequivocal on the association of marginal bones loss (MBL) with the implant retention mechanism.[8]

Thus the purpose of present systematic review and meta-analysis is to compare and evaluate the marginal bone loss in screw versus cement retained fixed implant restorations.

SEARCH STRATERGY:-

An electronic search of dental literature in PuBMeD, Science Direct, Ebscowas performed for articles published in english between 1966 to December 2018.The key words searched were :Dental implant, implant supported restorations, dental screws, dental implant cementation, screw-retained restorations, cement- retained restorations and marginal bone loss.Manual searches of the references of all full-text articles and relevant articles also selected from the electronic search were also performed. Both abstracts and full text articles were included.

SELECTION OF STUDIES:

For the review, first the titles and abstracts of the search were initially screened by two authors for relevance and the full text of relevant abstracts were obtained and accessed. From these relevant articles, by using inclusion and exclusion criteria, relevant and suitable articles were isolated for further processing and data extraction.

INCLUSION CRITERIA:

1. Study designs such as randomized controlled trial, prospective studies and retrospective studies were included.
2. Studies reporting marginal bone loss of dental implant in implant supported restoration with retention system by both of the following:
    a. Cement retained restoration
    b. Screw retained restoration
3. Age limit between 18-81 years were selected.
4. Follow up period more than 6 months.
5. Minimum sample size : 20

EXCLUSION CRITERIA:

1. Duplicate and irrelevant studies
2. Studies that evaluated only one type of retention without a comparison group.
3. In vitro studies.
4. In vivo animal studies.
5. Studies reporting placement of implant in zygoma.

FLOW CHART FOR SEARCH TRATERGY:

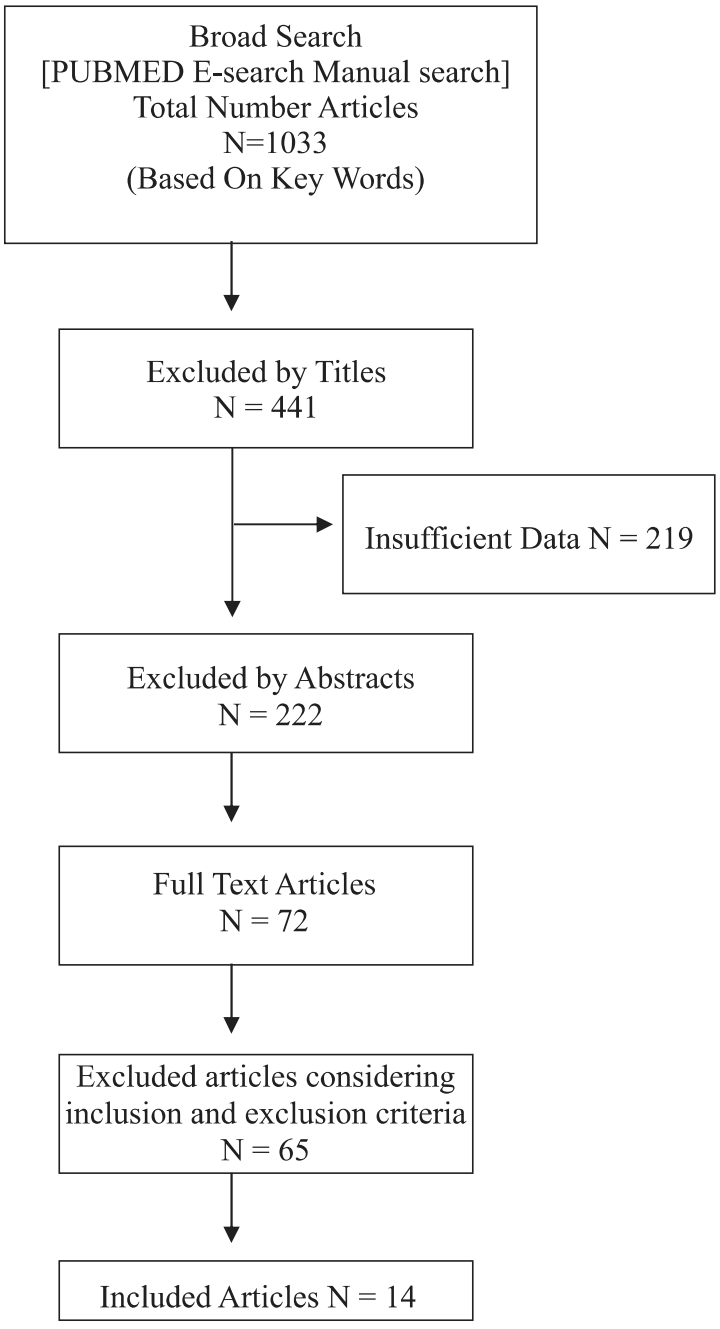

Table 1:- Evidence level of included studies

No.	Study and year	Type of the study	Evidence level
1	Hameed(2018)[9]	Retrospective	02
2	Francis(2018)[10]	Prospective	02
3	Shi(2018)[11]	Retrospective	02
4	Ferreiroa(2015)[12]	Prospective	02
5	Crespi et al.(2014)[13]	Retrospective	02
6	Cha et al.(2013)[14]	Prospective	02
7	Vigolo et al.(2012)[15]	Retrospective	02
8	Nissan et al.(2011)[16]	Retrospective	02
9	Sherif et al.(2010)[17]	Prospective	02
10	Jemt(2008)[18]	RCT	01
11	Drago and Lazzara(2006)[19]	Prospective	02
12	De Boever et al.(2006)[20]	Prospective	02
13	Vigolo et al.(2004)[21]	Prospective	02
14	Henriksson and jemt(2003)[22]	Prospective	02

Table 2:- Evaluation of marginal bone loss with cement retained restoration

No.	Study and year	No. of patients	Total No. Of implant	Mean Age (years)	Follow up in months	No. of cement retained restoration	Mean marginal bone loss (mm) cement retained restoration
1	Hameed(2018)[9]	41	104	59.8	12	58	0.86
2	Francis(2018)[10]	14	28	28.3	6	14	0.42
3	Shi(2018)[11]	176	176	46.8	30.2	82	1.97
4	Ferreiroa(2015)[12]	80	80	44.4	48	40	NR
5	Crespi et al.(2014)[13]	28	272	59.3	96	17 (full arch)	0.32
6	Cha et al.(2013)[14]	120	136	47	60	30	NR
7	Vigolo et al.(2012)[15]	16	32	33	120	16	1.11
8	Nissan et al.(2011)[16]	38	221	58	180	110	0.69
9	Sherif et al.(2010)[17]	99	193	47.3	60	90	NR
10	Jemt(2008)[18]	35	41	31.35	120	23	1.56
11	Drago and Lazzara(2006)[19]	27	151	62.4	18	15 (full arch)	NR
12	De Boever et al.(2006)[20]	105	283	59.1	40	127 (full arch)	NR
13	Vigolo et al.(2004)[21]	12	24	NR	48	12	0.8
14	Henriksson and jemt(2003)[22]	20	24	29	12	13	0.3
Overall Mean Marginal Bone loss (mm)							0.89

Table 3:- Evaluation of marginal bone loss with screw retained restoration

No.	Study and year	No. of patients	Total No. of implant	Mean Age	Followup in months	No. of screwretained restoration	Mean marginal bone loss (mm) screw retained restoration
1	Hameed(2018)[9]	41	104	59.8	12	46	0.96
2	Francis(2018)[10]	14	28	28.3	6	14	0.39
3	Shi(2018)[11]	176	176	49.6	31.4	94	1.67
4	Ferreiroa(2015)[12]	80	80	44.4	48	40	NR
5	Crespietal.(2014)[13]	28	272	59.3	96	17 (full arch)	0.48
6	Chaetal.(2013)[14]	120	136	47	60	106	NR
7	Vigoloetal.(2012)[15]	16	32	33	120	16	1.12
8	Nissanetal.(2011)[16]	38	221	58	180	111	1.4
9	Sherifetal.(2010)[17]	99	193	47.3	60	103	NR
10	Jemt(2008)[18]	35	41	31.35	120	18	1.67
11	Drago and Lazzara (2006)[19]	27	151	62.4	18	12 (full arch)	NR
12	De Boeveretal. (2006)[20]	105	283	59.1	40	45 (full arch)	NR
13	Vigoloetal. (2004)[21]	12	24	NR	48	12	0.8
14	Henriksson and jemt(2003)[22]	20	24	29	12	11	0.4
Overall Mean Marginal Bone loss (mm)							0.98

Table 4:- Evaluation of marginal bone loss with cement retained restoration and screw retained restoration

No.	Study and year	Retention system	Follow up in month	Implant Connection	Loading protocol	Opposite Occlusion	Occlusal Scheme	No. of Impant Survived (%)	Complications (n)	Mean marginal bone loss (mm)	
										Cement retained	Screw Retained restoration
1	Hameed(2018)[9]	C-58 S-46	12	IC	Conventional Loading	Natural teeth	IPO	NR	NR	0.86	0.96
2	Francis(2018)[10]	C-14 S-14	6	IC	Conventional Loading	Natural teeth	IPO	NR	NR	0.42	0.39
3	Shi(2018)[11]	C-82 S-94	C-30.2 S-31.4	IC	Conventional Loading	Natural teeth	IPO	C-98.8 S-100	C-38 S-56	1.97	1.67
4	Ferreiroa(2015)[12]	C-40 S-40	48	EX	Conventional Loading	Natural dentition	IPO	C-100 S-100	C-15 S-12	NR	NR
5	Crespi et al.(2014)[13]	C-17 (full arch) S-17 (full arch)	96	IC	Immediate Loading	Implant supported fixed arch	Group Function	C-100 S-100	C-6 S-4	0.32	0.48
6	Cha et al.(2013)[14]	C-30 S-106	60	IC	Conventional Loading	Natural dentition	MIP	C-93.1 S-90.3	NR	NR	NR
7	Vigolo et al.(2012)[15]	C-16 S-16	120	EX	Conventional Loading	Natural dentition	Group Function	C-93.75 S-93.75	C-0 S-0	1.11	1.12
8	Nissan et al.(2011)[16]	C-110 S-111	180	IC	Conventional Loading	Natural dentition	Group Function	C-100 S-100	C-10 S-42	0.69	1.4
9	Sherif et al.(2010)[17]	C-90 S-109	60	IC	Conventional Loading	NM	NM	C-97.8 S-95.2	NR	NR	NR
10	Jemt(2008)[18]	C-23 S-18	120	IC	Conventional Loading	Natural dentition	NM	C-100 S-100	C-6 S-5	1.56	1.67
11	Drago and Lazzara(2006)[19]	C-15 (full arch) S-12 (full arch)	18	IC	Immediate Loading	Artificial dentition	Even contacts	NR	C-0 S-0	NR	NR
12	De Boever et al.(2006)[20]	C-127 (full arch) S-45 (full arch)	40	IC	Conventional Loading	NM	IPO	C-100 S-100	C-29 S-26	NR	NR
13	Vigolo et al.(2004)[21]	C-12 S-12	48	IC	Conventional loading	Natural dentition	MIP	C-100 S-100	C-0 S-0	0.8	0.8
14	Henriksson and jemt(2003)[22]	C-13 S-11	12	IC	Conventional loading	Natural dentition	NM	C-100 S-100	C-0 S-0	0.3	0.4
Overall Mean marginal loss (mm)										0.89	0.98

(IC - Internal Connection
Ex - External Connection
IPO - Implant Protected Occlusion
MIP - Maximam Intercuspul Position)

Table 5:- Overall Mean marginal bone loss with cement retained restoration and screw retained restoration

Retention system	Mean marginal bone loss (mm)
Cement retained restoration	0.89
Screw retained restoration	0.98

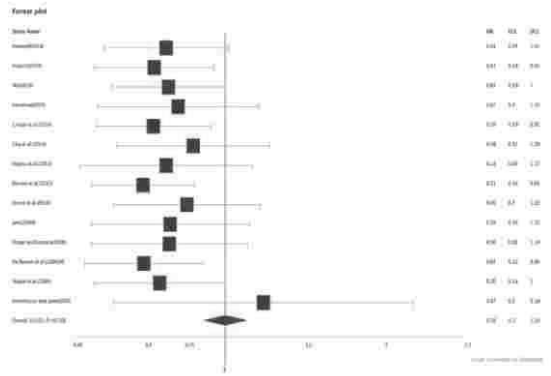

Fig. 1 Forest plot for the evaluation of marginal bone loss with cement retained restoration

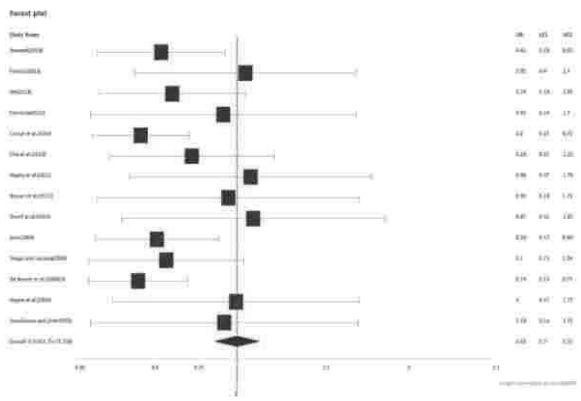

Fig. 2 Forest plot for the evaluation of marginalbone loss with screw retained restoration

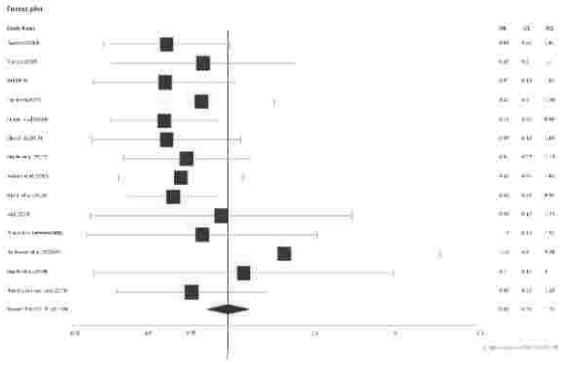

Fig. 3 Overall Mean marginal bone loss with cement retained restoration and screw retained restoration

DISCUSSION:

The main purpose of this review was to evaluate the marginal bone loss in cement- and screw retained implant fixed restorations. Along with the retention system, the included articles also assessed the follow up period, the type of implant connection, the loading protocol used, the type of opposing occlusion and the occlusal scheme.

Brandaoet et al[23] compared marginal bone loss in a systematic review of different retention systems and he observed greater loss in screw-retained prosthesis but this difference was not statistically significant. The present review, which investigated only studies with direct comparisons, also found no significant differences favouring cement-retained prostheses or screw retained prosthesis.

Jemt[18] observed higher levels of average bone loss for cemented control restorations before the final tightening, supporting the observations made by Weber and colleagues.[26]

Wannfors and Smedberg[27]indicate that single-implant restorations with wider cement margins between the crowns and abutments may experience more marginal bone loss. Residue of cement can be difficult to diagnose and remove, especially when the crown margin is placed deep in the gingival sulcus. In addition, bone may be lost when wide cement margins are present.

Ferreiroa[12], Sherif S[17], Weber[26] reported that cement-retained prostheses had greater tendency toward plaque buildup, sulcular bleeding, and gingival inflammation because of the inherent difficulty in removing excess subgingival cement. Plaque buildup may increase the risks of inflammation and, consequently, marginal bone loss.[51]

Tonella BP[28] reported that the biomechanics of the different retention systems may also affect marginal bone loss, with some studies reporting that cement-retained prostheses are better at stress distribution. Access to the screw hole may also contribute to marginal bone loss because different restorative materials can transfer occlusal loads laterally to the implant instead of axially. Furthermore, Guichet DL[29] stated that cement may be better at filling discrepancies, absorbing the strain of the deformation caused by the mismatch between the abutment and implant in the implant abutment- prosthesis structure, and helping to equalize distribution.

The longevity of the dental implants depends on the amount of crestal bone loss along the implant surface and the crestal bone remodels after loading of implants. However, the meta- analysis included only 2 studies by Crespiet et al[13] and Draggo and Lazzara[19] which have immediately loaded the implants, and stated that in both delayed and immediate loading, there is initial bone loss which stabilizes after about a month of loading.

Only one study by Nissan et al[16] in the present review reported a high marginal bone loss with screw retained restoration. This could be due to the greater preload exerted by reduced passive fit of the screw-retained framework which caused a greater tendency of abutment screw loosening. This finding was in agreement with the study conducted by Hameed[9]. A possible explanation for observing greater MBL in

screw-retained design could be the fact that the position of the access opening in the prosthetic restoration transfers occlusal loads in a non- axial manner which results in increased marginal bone loss. Studies have shown that there is minimal stress exertion on implant and crestal bone with cement-retained prostheses than with screw-retained prostheses.

The present systematic review is a basic vision of the vast field of screw retained and cement retained restorations. The results obtained from this review are clinically insignificant and state that both screw retained and cement retained implant supported fixed restorations can be used according to the clinical situation as there is negligible difference in the marginal bone loss between the two types of retention systems used.

CONCLUSION:

From the above systematic review and meta-analysis, it is concluded that, the mean marginal bone loss in cement retained implant supported restorations is 0.89 mm.

The mean marginal bone loss in screw retained implant supported restorations is 0.98 mm.

The conclusion of this review states that the mean marginal bone loss in cement retained and screw retained implant supported restorations is not statistically significant and both can be used depending on the clinical situation.

1. RolaShadid, NasrinSadaqa. A comparison between screw- and cement- retained implant prostheses. A literature review. Journal of Oral Implantology2012; 38(3):298-307.
2. Paulo Vicente Barbosa da Rocha, MirellaAguiarFreitas, and Tiago de MoraisAlves da Cunha. Influence of screw access on the retention of cement-retained implant prostheses. J Prosthet Dent 2013; 109:264-268.
3. Michalakis, Hirayama, Garefis. Cement-retained versus screw-retained implant restorations: a critical review. The International journal of Oral and Maxillofacial implants 2003; 18(5):719-28.
4. SanathShetty, AditiGarg, K. Kamalakanth Shenoy. Principles of screw-retained and cement-retained fixed implant prosthesis: A critical review. Journal of Interdisciplinary Dentistry 2014; 4(3).
5. Amilcar C, Freitas J, Estevam A. Effect of implant connection and restoration design (screwed vs. cemented) in reliability and failure modes of anterior crowns. Eur J Oral Sci 2011; 119:323–330.
6. Christian Mehl, Sonke Harder, Mona Wolfart. Retrievability of implant retained crowns following cementation. Clin. Oral Impl. Res. 2008; 1304–1311.
7. Ralf Smeets, Anders Henningsen, Ole Jung, Max Heiland, Christian Hammacher, and Jamal M Stein. Definition, etiology, prevention and treatment of peri-implantitis - a review. Head Face Med. 2014; 10:34.
8. Modi R, Mittal R, Kohli S, Singh A, Sefa I. Screw versus Cement Retained Prosthesis: A Review. Int J Adv Health Sci 2014; 1(6):26-32.
9. Muhammad-HasanHameed. Marginal bone loss around cement and screw-retained fixed implant prosthesis. J ClinExp Dent. 2018; 10(10):949-54.
10. Litty Francis. Clinical and Radiological

Evaluation of Screw-retained and Cement-retained Single-implant Restorations - A Comparative Study.Int J Oral Care Res 2018; 6(2):60-66.

11. Shi. Peri-implant conditions and marginal bone loss around cemented and screw-retained single implant crowns in posterior regions: A retrospective cohort study with up to 4 years follow-up. PLOS ONE 2018; 13(2).
12. Alberto Ferreiroa, Miguel Peñarrocha-Diago, Guillermo Pradíes, María-Fernanda Sola-Ruiz.Cemented and screw-retained implant-supported single-tooth restorations in the molar mandibular region: A retrospective comparison study after an observation period of 1 to 4 years. J ClinExpDent. 2015; 7(1):89-94.
13. Crespi R, Cappare P, Gastaldi G, Gherlone EF. Immediate occlusal loading of full-arch rehabilitations: screw-retained versus cement-retained prosthesis. An 8-year clinical evalutation. Int J Oral Maxillofac Implants. 2014; 29(6).
14. Cha, Kim. Cumulative survival rate and complication rates of single-tooth implant; focused on the coronal fracture of fixture in the internal connection implant. Journal of Oral Rehabilitation 2013; 40:595-602.
15. Paolo Vigolo, Sabrina Mutinelli, Andrea Givani, Edoardo Stellini. Cemented versus screw-retained implant-supported single-tooth crowns: a 10-year randomised controlled trial. Eur J Oral Implantol 2012; 5(4):355–364.
16. Joseph Nissan, Demitri Narobai, Oded Ghelfan. Long-Term Outcome of Cemented Versus Screw-Retained Implant-Supported Partial Restorations. Int J Oral Maxillofacial Implants 2011; 26:1102–1107.
17. Sami Sherif&Srinivas M.Clinician- and patient-reported long-term evaluation of screw- and cement-retained implant restorations: a 5-year prospective study. Clin Oral Invest 2011; 15:993-999.
18. TorstenJemt. Cemented CeraOne® and Porcelain Fused to TiAdapt™ Abutment Single-Implant Crown Restorations: A 10-Year Comparative Follow-Up Study. Clinical Implant Dentistry and Related Research 2009; 11(4).
19. Carl J. Drago. Immediate Occlusal Loading of Osseotite Implants in Mandibular Edentulous Patients: A Prospective Observational Report with 18-Month Data. J Prosthodont 2006; 15:187-194.
20. A. L. De Boever, K. Keersmaekers. Prosthetic complications in fixed endosseous implant-borne reconstructions after an observations period of at least 40 months. Journal of Oral Rehabilitation 2006; 33:833-839.
21. Paolo Vigolo, Dr Odont. Cemented Versus Screw-Retained Implant-Supported Single-Tooth Crowns: A 4-year Prospective Clinical Study. Int J Oral Maxillofacial Implants 2004; 19:260-265.
22. Kristina Henriksson, Torsten Jemt. Evaluation of Custom-Made Procera Ceramic Abutments for Single-Implant Tooth Replacement: A Prospective 1-Year Follow-up Study. Int J Prosthodont 2003; 16:626-630.
23. Brandao ML.Peri-implant bone loss in cement- and screw-retained prostheses: Systematic review and meta-analysis. J Clin Periodontol 2013; 40:287-295.
24. Charles J. Goodacre Clinical complications with implants and implant prostheses. J Prosthet Dent 2003; 90:121-32.
25. Dale E. Smith. Criteria for success of osseointegrated endosseous implants. J Prosthet Dent 1989; 62:567-72.
26. Hans P. Weber, David M. Kim. Peri-implant soft-tissue health surrounding cement- and screw retained implant restorations: a multicenter, 3-year prospective study. Clin. Oral Impl. Res. 2006; 375-379.

27. Wannfots K, Smedberg JI. A prospective clinical evalution of different singletooth restoration designs on osseointegrated implants. A 3-year follow-up of Branemark implants. Clin Oral Implants Res. 1999; 10(6):453-8.

28. Photoelastic analysis of cemented or screwed implant-supported prostheses with different prosthetic connections. J Oral Implantol. 2011;37(4):401-10.

29. David L. Guichet, Passivity of Fit and Marginal Opening in Screw- or Cement-Retained Implant Fixed Partial Denture Designs. Int J Oral Maxillofacial Implants 2000; 15:239–246.

30. Amilcar C. Freitas, Effect of implant connection and restoration design (screwed vs. cemented) in reliability and failure modes of anterior crowns. Eur J Oral Sci 2011; 119: 323–330.

31. Sagar. Implant protected occlusion: A comprehensive review. European Journal of Prosthodontics 2013; 1(2).