ISSN No:-2456-2165

A Systematic Review on the Effect of Using Titanium Material in Single Tooth Implant

Elakiya S[1]; Prabu D[2]*; Bharathwaj V V[3]; Sindhu R[3]; Dinesh Dhamodhar[4]; Sathiyapriya S[3]; Rajmohan M[4]

[1]Postgraduate Student, Department of Public Health Dentistry, SRM Dental College, Ramapuram, Chennai, India
[2]Professor and Head of the Department, Department of Public Health Dentistry, SRM Dental College, Ramapuram, Chennai, India Corresponding Author*
[3]Senior Lecturer, Department of Public Health Dentistry, SRM Dental College, Ramapuram, Chennai, India
[4]Reader, Department of Public Health Dentistry, SRM Dental College, Ramapuram, Chennai, India

Abstract:- The Aim of this systematic review was to assess the effect of single tooth implant using titanium abutment material. A systematic review was conducted based on literature search in the databases PubMed, Wiley online library, Cochrane library, Elsevier science direct, Prospero, Scopus, Ovid Medicine, Grey literature using the search keywords (single tooth implant) AND (stability) AND (titanium abutment). Randomised controlled trials investigating the effect of titanium implant and further followed by Cochrane database bias assessment was done. Four randomised controlled trials were included and after discussed, the result of p value is not significant in effect of single tooth implant using titanium abutment material. For implant-supported SCs, both metal and ceramic abutments with internal and external connections exhibited high survival rates. Moreover, implant-supported FDPs with metal abutments with internal and external connections for also showed high survival rates.

Keywords:- *Abutment Materials, Titanium, Single Tooth Implant.*

I. INTRODUCTION

The rehabilitation of missing or lost teeth by means of implant reconstructions is a predictable treatment option. The survival rates of implant-supported single crowns and fixed dental prostheses (FDPs) range between 89% and 94% at 10 years (1). Implant reconstructions are perpetually exposed to forces during function which can influence the survival and incidence of complications. Abutments from different materials, such as titanium, gold, alumina, and zirconia, proved to be biocompatible and allow for a healthy mucosal attachment (2).Consequently, the clinician can choose the appropriate abutment material in each individual situation. Metal abutments can shine through thin mucosa and compromise the esthetic outcome more often than zirconia abutments (3). Out of this reason, ceramic abutments, specifically zirconia abutments, became popular and are being frequently used.

Abutments can be connected to the implant in an internal or external way. Findings from in vitro studies showed improved stability for internally connected abutments(4). This biomechanical advantage seems clinically beneficial in terms of a lower incidence of abutment screw loosening for internally connected abutments (1.5%) compared to externally connected abutments (7.5%) (5). On the other hand, fractures were reported for internally connected zirconia abutments, especially when being out of one piece(6). In contrast, successful survival rates of 100% for externally connected zirconia abutments were observed at 12 years in function(7). A disadvantage of the externally connected abutments might be the possibility of abutment screw fractures(8).

Although the clinical performance is not differing significantly for abutments with external or internal connections, there is a shift toward internal connections across most implant systems today (9). For decision making with regard to the abutment type and material, systematic reviews are a perfect tool to provide the practitioners with recent clinical outcomes on the highest level of evidence (10). Taking developments and progress in implant dentistry into account, this information needs to be updated every once in a while. This systematic review is an update of the previously published one on ceramic and metal abutments (11).

The aim was to estimate and compare the clinical performance and 5-year survival rate of metal and ceramic abutments and the reconstructions supported by these abutments, as well as the incidence of technical, biological, and esthetic complications with specific focus on the different implant-abutment connection types, that is, the external and internal connections.

II. MATERIALS AND METHOD

A total of 120 articles were searched among those 4 articles are included in this study and this systematic review was done using effect of single tooth implant using titanium abutment material.

- *Eligibility Criteria:*
- *Inclusion Criteria*
- ✓ Studies published in English
- ✓ Articles on the effectiveness on single tooth implant using titanium material
- ✓ Full text articles

- *Exclusion Criteria:*

✓ Only abstracts available
✓ Unrelated articles
✓ Animal studies

➢ *Search Engines:*

✓ PubMed
✓ Wiley online library
✓ Cochrane library
✓ Elsevier science direct
✓ Scopus
✓ Ovid Medicine
✓ Grey literature

After the search using the appropriate mesh terms a total of 120 articles were found from the online databases. After duplicates removal of 109 articles were screened and 99 full- text articles were available. Inclusion-exclusion criteria were applied and finally 4 related articles were selected for further assessment.

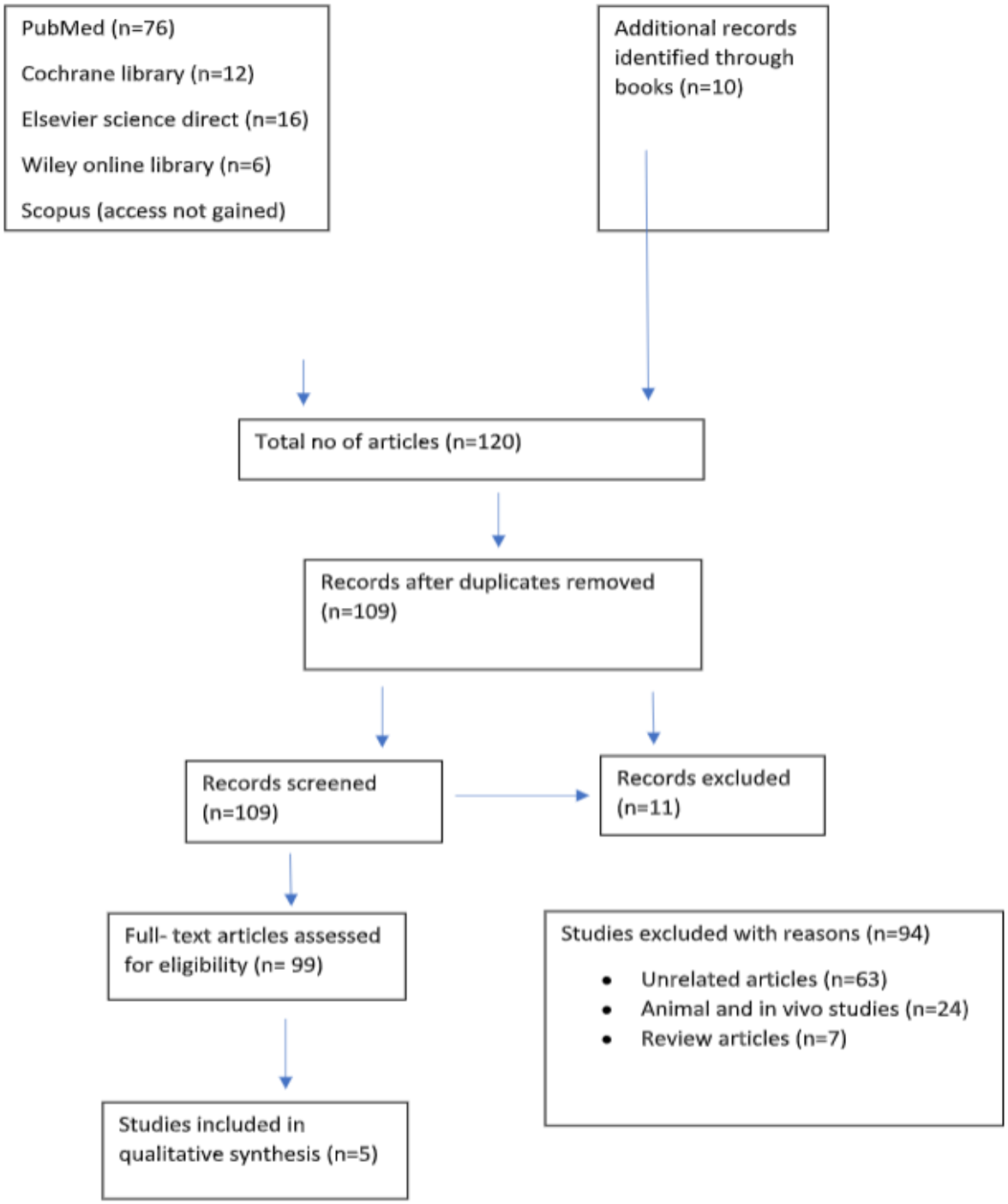

Fig 1 Flow Diagram Showing the Number of Studies Identified, Screened, Assessed For Eligibility, Excluded and Included in the Systematic Review

III. RESULTS

Table 1 Characteristics of the interventions in the included studies

AUTHOR NAME	YEAR	NO OF PATIENTS	NO OF ABUTMENTS	ABUTMENT MATERIAL	FOLLOW UP TIME	FDP MATERIAL
Andersson et al(12)	2003	32	105	Titanium	5	17
Jemt et al(13)	2003	421	70	Titanium	5	63
Romeo et al(14)	2003	38	100	Titanium Gold	4	49
Kreissl et al(15)	2007	76	159	Metal	5	66

Table 1 shows the characteristics of the intervention in the included studies. In all above the the effect of single tooth implant using titanium abutment material was reviewed.

Table 2 Outcome data as reported in included studies

AUTHOR NAME	YEAR	STUDY DESIGN	OUTCOME	RESULT
Andersson et al(12)	2003	Prospective randomized controlled clinical trial	Bone loss more than 2 mm	P=0.102 shows not statistically significant
Jemt et al(13)	2003	Prospective randomized controlled clinical trial	Loosening of the reconstruction	P=0.262 shows not statistically significant
Romeo et al(14)	2003	Prospective randomized controlled clinical trial	Soft tissue complications	P=0.383 shows not statistically significant
Kreissl et al(15)	2007	Prospective randomized controlled clinical trial	Soft tissue recession	P=0.603 shows not statistically significant

Table 2 shows an outcome and result of the effect of single tooth implant using titanium abutment material in above-mentioned studies.

Table 3 Bias analysis of included studies

AUTHOR NAME	YEAR	RANDOM SEQUENCE GENERATION	ALLOCATION CONCEALMENT	SELECTIVE REPORTING	INCOMPLETE OUTCOME DATA	BLINDING OF OUTCOME ASSESSMENT	BLINDING PARTICIPANTS AND PERSONALS
Andersson et al(12)	2003	-	-	-	++	?	?
Jemt et al(13)	2003	++	-	?	-	-	++
Romeo et al(14)	2003	-	++	++	-	-	-
Kreissl et al(15)	2007	-	-	-	-	?	++

Table 3: shows the bias analysis of all the included studies. It is categorized as high-risk bias "-", low risk bias "++" and unclear "?".

IV. DISCUSSION

The present review showed similar overall survival rates of internally and externally connected implant abutments, with no differences between ceramic and metal abutments. Yet, the review displayed that the implant-abutment connection influenced the technical and biologic outcomes of the implant abutments and the supported reconstructions. In general, the external connections were more prone to specific technical problems, while internal connections were more associated with biologic problems. At both single crowns (SCs) and multiple-unit fixed dental prostheses (FDPs), significantly more abutment screw fractures were observed at external implant-abutment connections. Furthermore, at SCs, more screw loosening was reported for abutments/crowns with external implant-abutment connections. With respect to abutment materials, the present review showed higher fracture rates of both externally and internally connected ceramic abutments, as compared to externally and internally connected metal abutments.

Hence, the implant-abutment connection plays an important role for the outcomes of the implant-supported fixed reconstructions as the present review could show. The finding that the predominant technical problem at the

external connections was abutment screw loosening and screw fracture is in accordance with previously published literature.

Andersson et al 2003, the study reveals that totally 105 abutments used, and titanium abutment materials is used. It is a Prospective randomized controlled clinical trial and the follow up time is about 5 times and 17 FPD materials used in this study. The outcome of this study reveals Bone loss more than 2 mm and the result shows that the p value is P=0.102 shows not statistically significant and there is no effect of single tooth implant using titanium abutment material(12).

Jemt et al 2003, the study reveals that totally 70 abutments used, and titanium abutment materials is used. It is a Prospective randomized controlled clinical trial and the follow up time is about 5 times and 63 FPD materials used in this study. The outcome of this study reveals that loosening of the reconstruction and the result shows that the p value is P=0.262 shows not statistically significant and there is no effect of single tooth implant using titanium abutment material(13).

Romeo et al 2003, the study reveals that totally 100 abutments used, and titanium and gold abutment materials is used. It is a Prospective randomized controlled clinical trial and the follow up time is about 4 times and 49 FPD materials used in this study. The outcome of this study reveals soft tissue complicatons and the result shows that the p value is P=0.383 shows not statistically significant and there is no effect of single tooth implant using titanium abutment material(14).

Kreissl et al 2007, the study reveals that totally 105 abutments used, and metal abutment materials is used. It is a Prospective randomized controlled clinical trial and the follow up time is about 5 times and 66 FPD materials used in this study. The outcome of this study reveals soft tissue recession and the result shows that the p value is P=0.603 shows not statistically significant and there is no effect of single tooth implant using titanium abutment material(15).

❖ *Limitation of the Study*

Many articles were excluded due to limited accessibility. The other sources should also be considered to get more relevant outcome. Only limited number of studies available and need further studies for research.

V. CONCLUSION

For implant-supported SCs, both metal and ceramic abutments with internal and external connections exhibited high survival rate as well as metal abutments with internal and external connections for implant-supported FDPs. Still, the implant-abutment connection appears to have an influence on the incidence of biological and technical complications. Externally connected abutments encountered more technical problems such as abutment or screw loosening, whereas internally connected abutments were more associated with biologic problems. Ceramic abutments, both internally and externally connected, demonstrated a significantly higher incidence of abutment fractures than metal abutments.

REFERENCES

[1]. Abrahamsson, I., Berglundh, T., Glantz, P.-O., & Lindhe, J. (1998). The mucosal attachment at different abutments.An experimental study in dogs. Journal of Clinical Periodontology, 25, 721– 727.
[2]. Akobeng, A. K. (2005). Principles of evidence-based medicine. Arch Dis Child, 90, 837– 840.
[3]. Alsahhafa, A., Spies, B. C., Vachc, K., & Kohal, R. J. (2017). Fracture resistance of zirconia-based implant abutments after artificial long-term aging. Journal of the Mechanical Behavior of Biomedical Materials, 66, 224– 232.
[4]. Atieh, M. A., Ibrahim, H. M., & Atieh, A. H. (2010). Platform switching for marginal bone preservation around dental implants: A systematic review and meta-analysis. Journal of Periodontology, 81, 1350– 1366.
[5]. Bollen, C. M., Papaioanno, W., Van Eldere, J., Schepers, E., Quirynen, M., & van Steenberghe, D. (1996). The influence of abutment surface roughness on plaque accumulation and peri-implant mucositis. Clinical Oral Implants Research, 7, 201– 211.
[6]. Butz, F., Heydecke, G., Okutan, M., & Strub, J. (2005). Survival rate, fracture strength and failure mode of ceramic implant abutments after chewing simulation. Journal of Oral Rehabilitation, 32, 838– 843.
[7]. Carrillo de Albornoz, A., Vignoletti, F., Ferrantino, L., Cardenas, E., De Sanctis, M., & Sanz, M. (2014). A randomized trial on the aesthetic outcomes of implant-supported restorations with zirconia or titanium abutments. Journal of Clinical Periodontology, 41(12), 1161– 1169.
[8]. Chrcanovic, B. R., Albrektsson, T., & Wennerberg, A. (2015). Platform switch and dental implants: A meta-analysis. Journal of Dentistry, 43(6), 629– 646.
[9]. Chun, H. J., Yeo, I. S., Lee, J. H., Kim, S. K., Heo, S. J., Koak, J. Y., … Lee, S. J. (2015). Fracture strength study of internally connected zirconia abutments reinforced with titanium inserts. International Journal of Oral and Maxillofacial Implants, 30, 346– 350.
[10]. Cosme, D. C., Baldisserotto, S. M., Canabarro, S. A., & Shinkai, R. S. (2005). Bruxism and voluntary maximal bite force in younger adults. International Journal of Prosthodontics, 18, 328– 332.
[11]. Egger, M., Smith, G. D., & Altman, D. G. (2001). Systematic reviews in health care: Meta-analysis in context. London: BMJ Publishing Group.
[12]. Andersson, B., Glauser, R., Maglione, M., & Taylor, A. (2003). Ceramic implant abutments for short-span FPDs: A prospective 5-year multicenter study. The International Journal of Prosthodontics, 16(6), 640– 646.

[13]. Jemt, T. Regeneration of gingival papillae after single-implant treatment. International Journal of Periodontics and Restorative Dentistry, 2003;17(4), 326– 333.
[14]. Eugenio Romeo,Diego Lops,Emilio Margutti,Marco Ghisolfi,Matteo Chiapasco,Giorgio Vogel. Implant-supported fixed cantilever prostheses in partially edentulous arches. A seven-year prospective study. Clinical oral implant research, 2003; 14(3): 303-311
[15]. Kreissl ME, Heydecke G, Metzger MC, Schoen R. Zygoma implant-supported prosthetic rehabilitation after partial maxillectomy using surgical navigation: a clinical report. Journal of Prosthetic Dentistry 2007; 97(3):121-128.