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RESEARCH ARTICLE

THE EFFECT OF DIFFERENT SUPERSTRUCTURE MATERIALS OF IMPLANT SUPPORTED RESTORATION. A SYSTEMATIC REVIEW.

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Abstract

Objectives: The purpose of this review was to recognize the biological complication of implant superstructure materials in comparative to alveolar bone loss around superstructure. **Methodology:** A search on the electronic database and additional a manual searching was focused to detect randomized clinical trials and other studies that gives a sign about superstructure complication. alveolar bone loss was ascribed to the amount of recession, crestal bone and loss Pocket depth. **Results:** The initial search gives a twenty-six from an initial search of 144 studies and the analyzing data were tabled rendering to output complication. Pocket probing depth were recognized in eighteen clinical studies, Pocket probing depth around all ceramic superstructure was 3.1 mm versus 3.5 mm for porcelain fused to metal superstructure. sixteen studies inspected the recession index for all ceramic and porcelain fused to metal superstructure. recession index ranged from 0.1 to 0.5 at porcelain fused to metal superstructure and 0 to 0.3 at all ceramic superstructure. alveolar bone loss around all ceramic superstructure was itemized to differ from 0.21 - 1.5 and 0.4 - 1.5 mm at porcelain fused to metal superstructure. **Conclusion:** The information described in this systematic review did not give an indication for the complication regarding all ceramic versus porcelain fused to metal superstructure. However, it can be settled that the assessment of the randomized clinical trials did not provide an absolute prime for the choice of ceramic or porcelain fused to metal as superstructure material relative to alveolar bone response.

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Introduction:-

One of the main challenges faced by dentists is re- placing missing teeth to the patient satisfactory. Implant therapy is a basic and durable option for replacing missing teeth.⁽¹⁾

Implant treatment have shown high success and survival rate in spite to its biological and technical complications that still occurs and may lead in some cases to loss of the implant. failure of implants may lead to great economic

and psychological burdens to the patients and clinicians. Implant supported restorations showed higher complication rates when compared tooth supported restorations. The long-term success of the implant is gained by both the health of the hard and soft tissues in proximity to the implant in addition to its final superstructure.⁽²⁾

Many superstructure materials were used to restore an implant supported restoration such as cobalt-chromium (Co-Cr) PFM, aurum-platinum (Au-Pt) PFM, titanium (Ti) PFM, and zirconia (Zi) all-ceramic restoration. However, Co-cr alloys are not used anymore due to their lack of biocompatibility. However, gold alloys, titanium alloys and zirconia and perfectly biocompatible with no common adverse effect.⁽³⁾

Aim of Research:-

The goal of this review was to detect the complication of different superstructure materials of implant supported restoration regarding the biological complication.

Methods:-

Criteria of studies: -

Article Types:-

All randomized controlled trials (RCTs) & cohort study estimating the effect of different types of implant abutment on the alveolar bone loss of implant supported superstructure.

The participant: -

People having implant supported restoration affected by bone loss.

The Interventions: -

All types of implant superstructure (metallic or all ceramic abutments)

Outcomes:-

1. Alveolar bone loss, signs attributing for alveolar bone loss
2. Radiographic by intraoral radiographs.
3. Pocket depth (PD).
4. Soft tissue recession (REC) .

Search methods for identification of studies:-

Electronic databases searches:-

The resulting inclusion criteria (table 1) were obligatory to: complication of implant supported restoration (biological complication), articles published in English. Case report, case study, invitro study, article in press and animal studies articles were excluded (table2).

To identify the research question, the PubMed database, the Cochrane and ovoid databases were searched electronically. Databases were searched for articles from 2000 through October 2017 using the next (MeSH) terms:

implant superstructure (b) implants crown (c) zirconia implant superstructure (d) All ceramic implant superstructure (e) metallic implant superstructure (f)titanium implant superstructure (g) periodontal loss (h) periodontal pocket (i) periodontal pocket index, (j) alveolar bone loss (k) rescission and the combinations. Other applicable non-MeSH words were used in the search to recognize articles showing periodontal inflammatory parameters. These included “yettria-stabilized zirconia abutment”

“zirconia implant superstructure” “inflammation implant superstructure” “bleeding index implant superstructure” and “peri-implant pocket” and “clinical attachment loss around implant abutment.” The studies collected after the described protocol were assessed by 3 authors (M.M, N.F, A.M). The studies full texts were read by authors (M.M, N.F and independently assessed according to the inclusion criteria. For more deep knowledge hand search was done in the reference lists studies included during primary research. The contents of some nominated journals were independently searched by 2 authors (M.M, M.R) for related studies available up to October 2017 . This was performed to detect any studies which may be lost in the earlier step. The included studies were checked among the all authors for any divergence.

Data collection and analysis:-**Study selection:-**

The 144 articles were screened independently by two reviewer (M.M, A.M) through titles and abstracts. articles that meet the inclusion criteria and that have no sufficient data to take optimum choice, the full text was gotten. The full reports that are collected from the different electronic and hand searching were checked independently by two authors (M.M, N.F) to get an absolute decision of whether these articles met the inclusion criteria or not. Disagreements were resolved among authors by open discussion; where a third review author (M.M, N.F, A.M) was a consulted and firmness was not possible, 26 studies meet the inclusion criteria, data extraction were done under constant protocol. Studies rejected at this stage or following stages were collected. A table for the excluded studies and the reasons for exclusion was reported. (table 3).

Data extraction:-

Independently using constant designed data extraction forms fourteen studies undergo data extraction by two review authors (M.M, M.R). Data extraction were shown and modified on several papers before agreement to use. Any disagreement among author were debated in open discussion and a review author (N.F) consulted was essential.

Data of disagreement were excluded until clarification was presented.

For each study, the extracted data was listed as follow (table 4).

1. Year of publication.
2. The participants (No. , Sex , Age)
3. The type of intervention (No., Types)
4. The outcomes reported. (No., Assessment method)

Missing data Protocol: -

Efforts was done to regain missing data from trials authors. and if cross-sectional data were accessible; Change data can be done, the standard deviation "SD" of the changes was to be assessed using the no. within patient correlation, which will give information to the conservative estimate of the SD for change. This technique was described by Follmann (13). To guess the standard error of the difference for split mouth studies when the proper data were not accessible and could not be found.

Heterogeneity Assessment:-

Cochran's test for heterogeneity was used to assess the significance of any differences. heterogeneity would have been considered significant if $P < 0.1$. All 14 included studies results were pooled using the random model effect as statistical heterogeneity among studies was significance where ($I^2 = 93\%$ $P < 0.00001$).

Table 1:- Inclusion criteria

• Clinical studies compare all ceramic to metallic implant superstructure
• Studies of 10 sample size at least
• Studies at least show one of the outcome.
• Studies in English

Table 2:- Exclusion criteria

UncOntrOllled randomized clinical trial
randomized clinical trial using teeth as control group
Review (systematic or ordinary)
experimental (animal) studies
case-reports
unpublished articles

Table 3:- Studies excluded from this review

Brandenberg etal. 2017	Veneering outcome of superstruchure
Esposito etl,2017	different Zirconia superstructure designs
Chen etal,2017	Mechanical failure of superstructure

Bomiche et al, 2017	survival rate between one piece and 2-piece implant systems
Heinemann et al, 2016	Occluding versus non-occluding superstructure
Luongo et al, 2015	Superstructure, abutment loading period
Linkevicius 2017	Case report
Patil et al, 2014	Effect of different abutment design
Vandewwghe et al 2013	Compares immediate versus delayed implant loading
Papaspyridakos and lai, 2013	Mechanical failure of zirconia superstructure
Delben et al, 2013	Literature review
Sherif et al, 2011	screw retained versus cement retained implant crowns
Nissan et al, 2011	Superstructure different designs
Nothudurft and pospiech, 2010	Zirconia abutments
Sailer et al, 2009	Systematic review
Jemet 2009	failure of cemented and screw retained superstructure
Kollar et al, 2008	Case report
Blanes et al, 2007	Different superstructure height
Hall et al, 2007	Provisional versus conventional superstructure survival rate in immediate loading
YaYc et al, 2005	Mechanical failure of superstructure
Vigolo et al, 2004	Cemented versus screw retained superstructure
Goodacre et al, 2003	Literature review
Andersson et al, 2003	Implant abutments

Table 4:- The effect of different superstructure material on the crestal bone loss

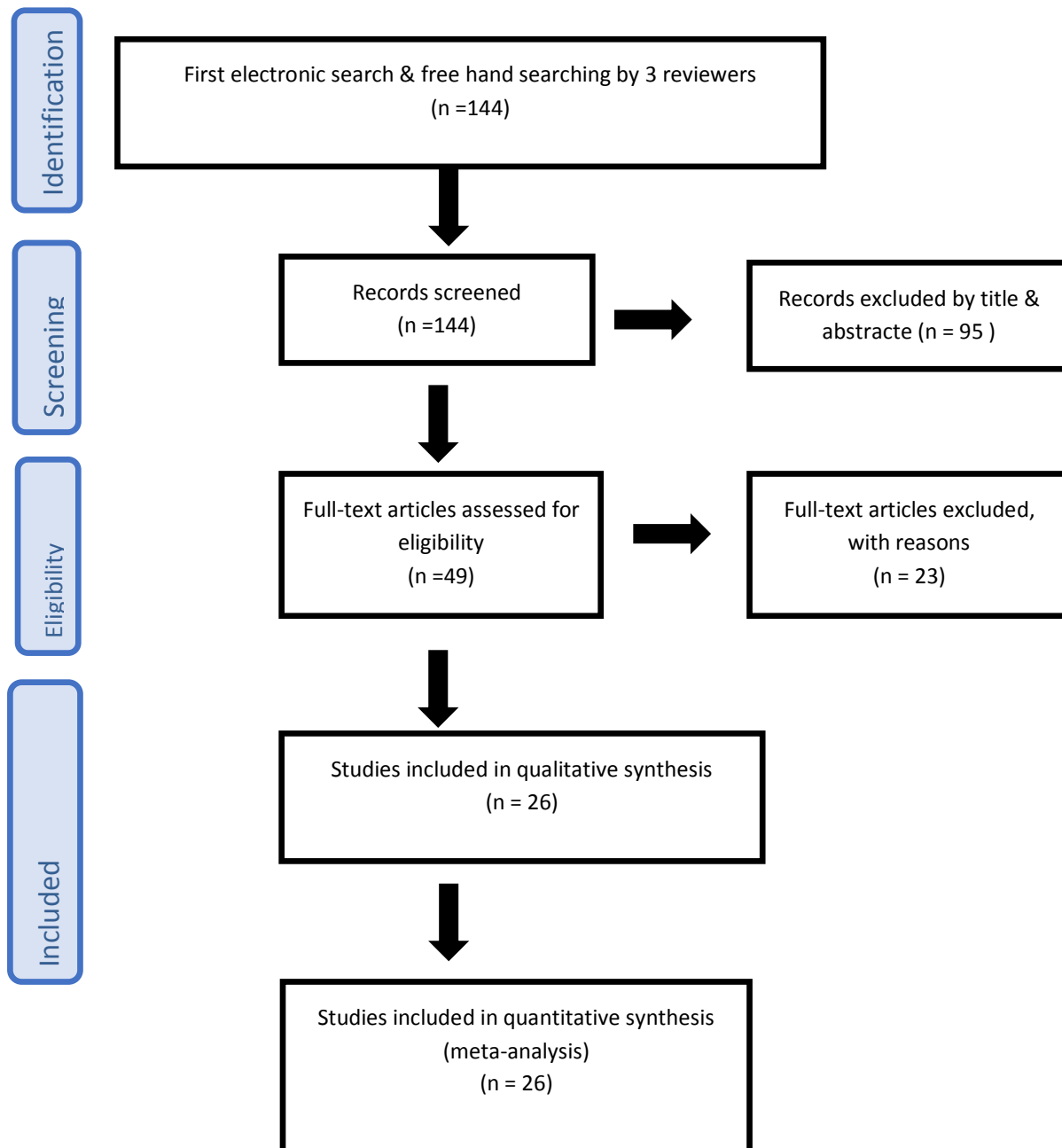
Study	year	Study design	No. of patient	Follow up	No. of superstructure	PFM	All ceramic abutment	“bone loss mean mm”
Shu-Juan Yu et al	2017	RCT	196	1y	100	50	46	1.22-0.99
A. G. TEURK et al	2013	RCT	23	1y	42	22	20	0.670
Anja et al	2012	RCT	22	5y	40	20	20	ZrO ₂ 3.3 ± 0.6 mm, Ti 3.6 ± 1.1 mm
Mandana et al	2011	RCT	36	1y	75	37	38	AC: 0.08 mm, SD 0.25; MC: 0.10 mm, SD 0.17
Gallucci et al	2011	RCT	20	2y	20	10	10	1.03 ± 0.90 PFM 0.86 ± 1.16 ALL ceramic
Frank et al	2009	RCT	24	12m	40	NR	40	1.23- 0.97
Irena et al	2008	RCT	22	1y	40	20	20	mean ZrO ₂ 3.4 ± 0.7mm, Ti 3.3 ± 0.6 mm
James et al	2007	RCT	28	1	28	28	NR	(0.38) 0.28 mm
Wagenberg & Froum	2006	RCT	891	1-16	383	NR	208	NR
Bornstein et al.	2005	RCT	28	5	39	NR	39	0
Elkhoury et al.	2005	RCT	39	5	39	NR	39	3.08
De Boever	2005	RCT	16	3-10	10	NR	10	2
Wennstroöm et al.	2005	RCT	40	5	44	44	NR	0.96
Levin et al.	2005	RCT	48	3-9	29	NR	29	NA
Jemt & Lekholm	2005	RCT	10	5	10	10	NR	0
Braegger et al.	2005	RCT	48	8-12	69	69	NR	NA
Taylor et al.	2004	RCT	39	5	38	NR	38	0
Bernard et al.	2004	RCT	28	2-9	32	32	NR	NA
Romeo et al.	2004	RCT	250	1-7	121	121	NR	2.5
Bianchi &	2003	RCT	116	1-9	116	116	NR	NR

Sanfilippo								
Gotfredsen	2004	RCT	20	5	20	20	NR	NR
Andersen et al.	2002	RCT	8	5	8	8	NR	0.59
Haas et al.	2002	PCT	71	4-10	75	NR	75	NR
Gibbard & Zarb	2002	RCT	42	4-13	48	NR	48	1.1
Mericske-Stern et al.	2001	RCT	72	5-9	26	24	NR	NR
Palmer et al.	2000	RCT	15	5	15	15	NR	0

NR: NR, not reported.

Table 5:- The biological complication different superstructure material

Study	year	Study design	No.of patient	Follow up	No. of superstructure	Estimated rate of bone loss	Estimated rate of soft tissue complications
Shu-Juan Yu et al	2017	RCT	196	1y	100	1.22-0.99	0.98
A. G. T€URK et al	2013	RCT	23	1y	42	0.670	NA
Anja et al	2012	RCT	22	5y	40	ZrO ₂ 3.3 ± 0.6 mm, Ti3.6 ± 1.1 mm	1.03
Mandana et al	2011	RCT	36	1y	75	AC: 0.08 mm, SD 0.25; MC: 0.10 mm, SD 0.17	1.05
Gallucci et al	2011	RCT	20	2y	20	1.03 _ 0.90 PFM0.86 _ 1.16ALL ceramic	1.2
Frank et al	2009	RCT	24	12m	40	1.23- 0.97	NA
Irena et al	2008	RCT	22	1y	40	meanZrO ₂ 3.4 _ 0.7mm, Ti 3.3 _ 0.6 mm	NA
James et al	2007	RCT	28	1	28	(0.38)0.28 mm	0.25
Wagenberg & Froum	2006	RCT	891	1-16	383	NR	0.95
Bornstein et al.	2005	RCT	28	5	39	0	1.02
Elkhoury et al.	2005	RCT	39	5	39	3.08	NA
De Boever	2005	RCT	16	3-10	10	2	NA
Wennstroöm et al.	2005	RCT	40	5	44	0.96	NA
Levin et al.	2005	RCT	48	3-9	29	NA	1.36
Jemt & Lekholm	2005	RCT	10	5	10	0	0.98
Braegger et al.	2005	RCT	48	8-12	69	NA	1.25
Taylor et al.	2004	RCT	39	5	38	0	1
Bernard et al.	2004	RCT	28	2-9	32	NA	0.98
Romeo et al.	2004	RCT	250	1-7	121	2.5	0.23
Bianchi & Sanfilippo	2003	RCT	116	1-9	116	NR	0.56
Gotfredsen	2004	RCT	20	5	20	NR	7.5
Andersen et al.	2002	RCT	8	5	8	0.59	1.05
Haas et al.	2002	PCT	71	4-10	75	NR	NA
Gibbard & Zarb	2002	RCT	42	4-13	48	1.1	0
Mericske-Stern et al.	2001	RCT	72	5-9	26	NR	NA
Palmer et al.	2000	RCT	15	5	15	0	NA

Figure 1:- Overview of the search strategy.**Results:-**

A total of twenty-six studies⁽⁴⁻³⁰⁾ of implant single crown superstructure were included in this study. The analyzing data of the selected studies are described in Table 1. All the studies were published from 2000-2017. In nineteen studies⁽¹⁰⁻²⁹⁾ the implants were placed by means of a standard surgical protocol in a healed normal implant site of bone Type III or IV. an 'early' implant placement in two studies (Type II) was performed and immediate implant placement in other three studies (Type I) was done. some special issues were addressed in Several studies, such as early implants loaded after only six weeks or immediate implants loading immediately, Also, two studies informed on small- implants diameter, where the diameters ranged of 3 mm to 2.9 mm and used to support Single crown superstructure.

The studies were directed in an official environment, such as medical universities or implant specialized clinics. Two of the included studies were done in multi-clinic studies. The twenty-six studies⁽⁵⁻³¹⁾ involved of a total of 1530 single crown superstructure. Twenty-six of the included studies reported on implant superstructures material, 80% of the implant superstructures were metal–ceramic, 15% were all-ceramic implant superstructures while the rest were of gold-acrylic design. Only 10% of the implant superstructures were screw retained and 90% were cemented retained implant superstructures (Table 2).

The effect of superstructure materials:-

Single crown superstructures survival was defined as the Single crown superstructures lasting in situ with or without complication for the observation period. after a mean follow-up time of 5 years, thirteen studies (with a total number of 534 Single crown superstructures gives data on the survival of the superstructures (Table 4). Fifteen out of the thirty-three Single crown superstructures were lost while the supporting implants were lost but in the lasting eighteen cases only the superstructures failed. The rate of failure per 100 Single crown superstructures years have ranged from 0 to 2.19 (Fig. 3). according to the superstructures material the studies were also divided utilized: a group of 7 studies with a total of 236 porcelain fused to metal crowns and a group of 2 studies with a total of 162 nonmetallic ceramic crowns. The group with porcelain fused to metal crowns showed a significantly higher survival rate. Peri-implantitis were reported in 10 studies as Biological complications but in several ways by the different authors. Two studies used the universal term of ‘soft tissue complications’; ‘signs of inflammation’ were reported in four other studies as probing pocket depth combined with bleeding on probing, and Gotfredsen et al. described cases with ‘soft tissue dehiscence.’ Other studies described on fistula formation. In ten studies, radiographic analysis used to evaluate the marginal bone height.

Discussion:-

Survival rate of crowns on single implant supported tooth was documented to be high in 5 years period in addition to, increase in technical and biological complications. In case of absence of single tooth many treatments can restore it such as implant supported single tooth restoration, conventional fixed partial denture or cantilevered fixed partial denture.⁽²⁵⁾

RCTs are seemed to be of high evidence level to contrast between different treatment patterns. consequently, obscurity of RCTs in comparing these various treatment patterns will lead to depreciation the evidence level. i.e. in this systematic review retrospective and prospective studies were involved. a tremendous importance clinically was to contrast and evaluate wide range of treatment patterns as to select the most suitable treatment for patient advice. More over, the on top systematic reviews were accomplished according to the same standards. Containing retrospective and prospective studies with a perception time not less than five years. however, It can be contended that a subsequent time of five years is too short to get dependable data on survival rates and intricacy rates.^(30,31)

Ways that all studies were incorporated into this review is releasing with in the most recent ten years and more than 33% inside the most recent two years shows that the utilization of dental implants to help single crowns is generally recent. Henceforth, a follow-up time of no less than five years was an important trade off. Conversely, ten years contemplates on the life span of traditional fixed partial dentures go back to the 1990s. Subsequently, alert must be practiced in the correlation of technical complications (i.e., veneer cracks) of regular FPDs made over twenty years prior and implant supported single crowns made five to ten years back. Most of the examinations on ordinary fixed partial dentures investigated gold-acrylic fixed partial dentures while the implant-supported single crowns are for the mostly made of metal– ceramic.⁽⁴⁰⁾

The survival of superstructure materials:-

After five years the survival rate of single crowns on implants became 94.5% inside this study. This evidence derived from 13 research which include 534 implant-supported single crowns. A very similar survival percentage was verified after five years of 95% (95% CI: 92.2–96.8%) in evaluating 1289 implant supported fixed partial dentures.^(33,34)

with the intention to contrast the adverse remedy modalities for a missing single tooth, the final results for the implant-supported single crowns need to be compared with the outcomes of conventional fixed partial dentures and cantilever fixed partial dentures. contrasting the rate of survival after five years, the values for the implant-supported single crowns are very much like the ones from the conventional fixed partial denture and slightly better in comparison with the cantilever fixed partial dentures.⁽³¹⁾

in the next five years duration the percentage of failure of the implant supported fixed partial dentures and the Cantilever fixed partial dentures have raised according to Pjetursson et al.^(28,29) Consequently, it would be of terrific significance to collect long-time period records for the implant-supported single crowns. The existing study additionally evaluated the impact of the crown material on the survival rate. It became verified that metallic–ceramic crowns (95.4%) showed a statistically notably higher survival rate in contrast with all-ceramic crowns (91.2%). Moreover, studies comparing the final results of metal ceramic crowns with the all ceramic crowns in the same study were absent in this review.⁽²⁴⁾

The values for all-ceramic implant crowns inside this research had been much like the values of a current systematic review examining all-ceramic crowns on tooth abutments (Wassermann et al.)⁽²⁶⁾ In 12 incorporated research, In cream Alumina crowns of 1724 were determined over a minimal duration of 1-3 months as much as a maximum period of 100 months. Survival rates ranged from 86.5% to 100%. With the Kaplan-Meier approach for the In-ceram Alumina crowns the cumulative survival rate was of 92% after five years. Biological complications, peri-implant mucosal lesions (9.7% after 5 years) seems to be the most common biological complications for implant-supported single crowns. consequently, this value is similar to the pooled cumulative survival rate of biological complications after five years [8.6% (95% CI: 5.1–14.1%)] for patients handled with implant-supported fixed partial denture. inside the current study, it was documented that the crown layout (screw-retained vs. cemented) had no effect on the biological complications. This finding may be in understanding with a clinical study assessing the peri-implant microflora of implants for cemented and screw-retained superstructures. It might have been finished up that those sway of the dental microflora on the microbial colonization of the implants shows to be more significant over the mode of stabilization of the superstructure.^(19,20) Analyzing implant-supported single crowns with tooth-supported fixed partial denture, the tooth supported fixed partial denture indicated increased biological complications.

it was stated that about 9.1-9.5% of the abutment teeth contained caries after 10 years. In addition to, about 10% of the abutment tooth loss its vitality in the same 10 years period⁽³⁶⁾. Also, the remedy of the peri-implant mucosal lesion my be less time consuming and less technique sensitive when compared with the treatment of non-vital or carious tooth.

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