Evaluation of Cement-Retained Versus Screw-Retained Implant Supported Restoration for Marginal Bone Loss - An In Vivo Study

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ABSTRACT
Implant therapy is a high predictable treatment modality, thanks to the high rate of success with implant treatment. After successful placement of implant, the dentist faces the challenge of restoring it. Of the many options available, screw-retained and cement-retained implant prosthesis are most common.

Aims: To evaluate and compare cement-retained versus screw-retained implant supported restorations for marginal bone loss, implant survival and prosthetic complications.

Settings and Design: The study was conducted in 30 patients visiting the institute for prosthetic replacement of missing lower posterior teeth using dental implants, depending on the available bone type, volume and prosthetic needs were selected.

Methods and Material: All the patients who fulfilled the inclusion criteria were recalled for follow up at 3, 6, 12 months of prosthetic loading and evaluated using standardized radiographs for marginal bone loss. Statistical analysis used: Independent t test.

Results: Group wise comparison of bone level measurement at 0, 3, 6, 12 months time interval at mesial and distal site for screw-retained prosthesis bone level was 0.74±0.14mm and 0.64±0.14mm at 6months and 1.03±0.17mm and 0.89±0.14mm at 12months respectively; for cement-retained prosthesis bone level was 0.55±0.15mm and 0.43±0.09mm at 6 months and 0.84±0.12mm and 0.70±0.14mm at 12months. Statistically significant bone loss was seen in screw-retained prosthesis than cement-retained prostheses at time interval of 6 months and 12months.

Conclusions: Within the limitations of the present study, it can be concluded that the cement retained fixed implant-supported restorations show less marginal bone loss than screw retained fixed implant-supported restorations.

Keywords: Implant prosthesis, screw retained, cement retained, marginal bone loss
INTRODUCTION:
A predictable surgical protocol for endosteal rigid fixation was developed and reported by Branemark and Adell et al.\cite{1,2,3} With the high rate of implant success for edentulous, partially edentulous and single tooth restorations, the concept of implant therapy is now a high predictable treatment modality.\cite{4} Fixed implant supported restorations have become the standard treatment for partially or totally edentulous patients, improving their mastication and appearance.\cite{5} After successful placement of implants, comes the challenge of properly restoring the implant so the patients is able to gain function. There are many types of restoration that can be used with implants: screw-retained prosthesis, cement-retained prosthesis, implant-supported overdenture, and Hybrid overdentures. These prostheses are capable of replacing one tooth, several teeth, and up to entire dental arch.\cite{6,7}

Screw-retained implant prosthesis quickly became popular in dental practice because of the ease of retrievability in case of an implant failure. Screw retained prosthesis are ideal in posterior location where there is a lack of space between the maxillary and mandibular arches. However, the major downfall of these restorations is that of aesthetics, occlusion and the need for more components.\cite{6,7} In case of cement-retained prosthesis, the absence of screw holes in the final prosthesis increases the strength of the porcelain on the occlusal surface of the prosthesis.\cite{6,7} In addition, cement-retained implant prosthesis have shown better aesthetics, superior occlusion, less porcelain fractures, and loading characteristics. The issue of difficult retrievability with cement-retained implant prosthesis has been addressed by using provisional cement when restoring implants instead of permanent cement. Thus, in the event that the prosthesis needs to be retrieved, it can be easily manipulated and removed because of the provisional cement.\cite{6,7}

Deciding on which retention system to use generally occurs during the planning stage when the advantage and disadvantage of each system are considered based on the proposed treatment.\cite{8}

In screw-retained implant fixed prosthesis, anterior implants are placed more lingual than for cement-retained restoration because the access hole to the prosthetic screw is placed in the cingulum. The correction of facially placed implants for screw-retained restorations may be more difficult and may lead unmanageable aesthetic compromises.\cite{8}

A cement-retained restoration should ideally have 8mm or more of crown height space (CHS). This dimension permits at least 1mm for occlusal material on the crown, 5mm of abutment height for retention and resistance form (with a subgingival margin), a 1-mm subgingival margin, and 2mm for a junctional epithelial attachment above the bone. If inadequate space is present, an osteoplasty of the bone is indicated before implant insertion.\cite{8} One of the debate is the choice between screw and cement retained implant prosthesis which has long been discussed but the best type of implant prosthesis remains controversial among practitioners.\cite{4} The factors that are affected by different methods of retention of the prosthesis to the implants are: ease of fabrication, cost, esthetics, occlusion, retention, incidence of loss of retention, retrievability, passivity of fit, restriction of implant position, effect on peri-implant tissue health, provisionalization, immediate loading, impression procedure, porcelain fracture and clinical performance.\cite{4} The present study was conducted to evaluate and compare cement-retained versus screw-retained implant supported restorations for marginal bone loss, implant survival and prosthetic complications.

Standardized Intra-Oral Periapical Radiograph (IOPAR) at regular follow up intervals are used to detect peri-implant radiolucency and/or progressive marginal bone loss or saucerization. (Figure 1) If more than half of the bone around the implant is lost, that implant is considered to have failed.\cite{9} Thus, the success of implant depends directly on crestal bone resorption and it is one of the major determinant factors for the post-operative success of implant. Despite the excellent survival rates of dental implant, long term studies have shown 1.5 to 2 mm of bone loss around implant neck during 1st year after functional loading and an annual rate of marginal bone loss around 0.2mm.\cite{9}
Subjects and Methods:
The study was conducted in 30 patients with 30 implants visiting the institute for prosthetic replacement of missing teeth using dental implants. The study was approved by institutional ethical committee. Patients having missing lower posterior teeth to be treated with implants depending on the available bone type, volume and prosthetic needs were selected after giving an informed consent.

Inclusion Criteria:
- age 25-55 years.
- healthy individuals.
- good oral hygiene.
- posterior edentulous regions.
- availability for follow-up visits.
- no need to bone augmentation prior to implant placement.

Exclusion criteria:
- uncontrolled diabetes or systemic disease.
- individuals with blood dyscrasias.
- radiation to head and neck.
- individuals with osteoporosis.
- heavy smoking.
- periodontally compromised patients.

All patients who fulfilled the inclusion criteria were called for follow-up. For all groups of implant supported prosthesis, the marginal bone loss was measured in standardized intra-oral periapical radiograph (using long cone paralleling technique with RINN -XCP film holder and putty bite index).(Figure 1, 2) Radiographs were taken at the time of final prosthesis loading and frequently at three, six and twelve months follow up time.(Figure 3, 4) A computer assisted calibration (Adobe Photoshop Software) was performed for each radiograph by evaluation of the previous known values, such as fixture length, providing reliability and precision for the radiographic measurement. (Figure 5) The following measurement between landmarks were taken: the peri-implant marginal bone loss was measured in millimeter (mm) from reference point; the shoulder of the implant(A) to the first visible bone level to implant contact at mesial and distal sides (B). [10, 11] (Figure 6)
Fig. 2 Rinn XCP film holder with putty index

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Fig. 3 Follow up radiographs for cement retained group

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Fig. 4 Follow up radiographs for screw retained group

Fig. 5 Computer Assisted Calibration using Adobe Photoshop
RESULTS:
After collection of data, the data were encoded and entered in Microsoft Excel 2019. The bone level measurement was calculated in terms of mean ± standard deviation. The comparison of mean values of bone measurement was compared by using Independent t test. Statistical Package for Social Science (SPSS) version 22 was used for the analysis. P<0.05 was considered as a level of significance.

1- group wise comparison of bone level measurement at 0, 3, 6, 12 months time interval at mesial site:
- for screw-retained prosthesis bone level was 0.74±0.14mm at 6 months and 1.03±0.17mm at 12 months.
- for cement-retained prosthesis bone level was 0.55±0.15mm at 6 months and 0.84±0.12mm at 12 months.

2- group wise comparison of bone level measurement at 0, 3, 6, 12 months time interval at distal site:
- for screw-retained prosthesis bone level was 0.64±0.14mm at 6 months and 0.89±0.14mm at 12 months.
- for cement-retained prosthesis bone level was 0.43±0.09mm at 6 months and 0.70±0.14mm at 12 months.

So, statistically significant bone loss was seen in screw-retained prosthesis than cement-retained prosthesis at time interval of 6 months and 12 months. (Figure 7, 8).

Fig. 6 Landmarks A and B for measuring marginal bone loss

Fig. 7 Bone loss values for cement retained group

Fig. 8 Bone loss values for screw retained group
DISCUSSION:
Long term preservation of crestal bone height around osseointegrated implants is often used as a measure of primary success. Prospective long-term studies exhibited survival and success rates largely exceeding 95% after 5 and 10 years of follow-up for the Straumann® implant system. A mean crestal bone loss ≤1.5 mm during the first year and ≤ 0.2 mm per year thereafter is proposed as one of the major success criteria.\[12 - 15\]

In the present study, for screw-retained prosthesis, bone levels at 6 and 12 months were 0.74±0.14mm and 1.03±0.17mm respectively. The bone levels for cement-retained prosthesis at 6 and 12 months were 0.55±0.15mm and 0.84±0.12mm respectively. Thus, statistically significant bone loss was seen in screw-retained prosthesis than cement-retained prosthesis at time interval of 6 and 12 months.

If the issue of retrievability is set aside, it is difficult to justify the use of screws to retain prostheses, with the exception of limited abutment height. In areas of limited inter ridge space; a screw is more effective than cement. The disadvantages of a screw-retained implant system include lack of aesthetics at the screw access channel, particularly if the channel was cast in metal; possibility of porcelain fracture around the screw access channel; incidence of screw loosening and finally, screw-retained systems generally leave a micro-gap beneath the gingival crest, resulting in chronic gingival inflammation.\[16\]

Cemented prostheses, on the other hand, have many substantial advantages. They provide a passive stable environment because they are cemented on well-adapted machined abutments with discrepancies in fit of the castings to the abutments being negated by the grouting action of the cement. Non-passive frameworks are seated and adjusted by use of routine chair-side clinical procedures and indicating materials. Sectioning and soldering is not a routine procedure as it is for screw retained castings. The lack of screw holes in cemented prostheses provides a design that enhances the physical strength of porcelain and acrylic resin, resulting in less fracture.\[16\]

Cement-retained implant prostheses provide easier access to the posterior of the mouth, reduced costs, reduced complexity of components, reduced complexity of laboratory procedures, and reduced chair-side time. In addition, cement-retained prostheses have superior aesthetics, which is important from the patient's perspective.\[16\]

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. 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.\[5, 17, 18\]

REFERENCES: