ABSTRACT

Cement-retained restorations are the most commonly used restorations, though they can compensate for minor discrepancies in the fit of the prosthesis using cement and cement space but the major drawback is retrievability of such prosthesis. The increasing practice of permanently cementing the implant supported prosthesis is more likely to have biologic and technical failures. This article describes various methods that simplify the retrievability of cement retained prosthesis. As the retrievability of the implant supported prostheses is a basic consideration while delivering quality patient based treatment outcomes.

Keywords: Abutment screw, Cement-retained prosthesis, Cross pins, Guide holes, Lateral access holes, Precision implant locating device, Retievability, Screw access holes, Screw-retained prosthesis.

INTRODUCTION

Different treatment options for the restoration of the edentulous area have been formulated since ancient times to a more revolutionized dental practice nowadays with implant as a newer option.12 Dental implants have to a great extent overcome the drawbacks of the conventional removable and fixed treatment options.

The cement-retained prosthesis and the screw retained prosthesis are abutment retained prosthesis and choosing between the two should be done very carefully according to the demand of the clinical situation (Fig. 1).

SCREW-RETAINED PROSTHESIS

Retrievability is the main advantage in screw retained prosthesis but esthetics and occlusion are compromised.

CEMENT-RETAINED PROSTHESIS

Cemented implant prosthesis is restoration in which the superstructure is cemented onto the implant abutment (Figs 4A and B). In case of minor discrepancies in the fit of the prosthesis, compensation is made by the cement space that exists between the crown and the implant.6,9

The main advantages of the cement-retained prosthesis are as follows:3,7,9,11,12
- Simplicity of the technique
- Better esthetics
- Passive placement
- Retention
- Reversibility
- Occlusal stability
- Ease of manufacture
- Correct loading
- Reduced cost of treatment
- Less chair side time

At the interface of implant abutment and prosthesis, it offers more stability, reversibility and security (Figs 2A and B).7 Cleaning around the screw replacement is also easy.11,12 Higher risk of mechanical issues occurs with screw retained prosthesis, therefore fine adjustment of occlusion, proper screw tightening and precise fit of the prosthesis is essential for minimizing the mechanical failures.9,12 Various advantageous effects of screw-retained prosthesis are discussed (Fig. 3).
Figs 2A and B: Screw-retained implant supported prostheses

• This design is devoid of screw holes, therefore increases the strength of the porcelain and acrylic resin and diminishes the chances of fracture (Fig. 5). The only disadvantage is that of retrievability.

RETRIEVABILITY

In case the abutment loosens, due to poor oral hygiene, peri-implantitis then repair or retrievability is a common prosthetic option. The disadvantage of this option mainly is increased laboratory cost and complexity. This occurs commonly if the screw access opening (Fig. 6) is not known which can cause irreversible damage to the abutment and restoration.

Therefore, various methods have been suggested to improve the retrievability of the cement retained prosthesis. These methods are broadly categorized as follows:
1. Direct methods
2. Indirect methods
   • Two-dimensional (2D)
   • Three-dimensional (3D)

DIFFERENCES IN SCREW RETAINED AND CEMENT RETAINED PROSTHESIS

A cemented crown has no screw access hole and looks like a natural tooth whereas screw-retained crown has a small access hole that is restored with a tooth colored filling. In screw retained prosthesis, the screw access is closed with composite resins which obliterates the occlusal anatomy and in cases of cement retained restorations stable occlusal anatomy can be achieved (Figs 7 and 9). Both have different inclination and angulation, it is easier
to have cement retained restoration with slight difference in the implant angulations. Placing implants to receive screw-retained restorations is difficult, as the trajectory of implant is limited by a small area to locate the screw access hole (Figs 8A and B).

**NUMEROUS TECHNIQUES TO RETRIEVE CEMENT-RETAINED PROSTHESIS**

1. The use of digital photographs to locate implant abutment screws for implant supported cement-retained restorations.\(^\text{14}\)
• The photographs are taken when the periodontal probe is held in place horizontally at the access hole location on the top portion of the incisal or occlusal surface of the teeth. This forms the X-axis when viewed facially (Fig. 10A).
• When the periodontal probe is held vertically on the middle area in the space between the adjacent teeth, the photograph reveals a Y-axis coordinates of abutment screw access (Fig. 10B).
• The Z-axis coordinate is seen at the occlusal or incisal part of the teeth. The screw access opening is then marked on to the photographs and stored digitally for future reference (Figs 10C and D).

Advantages: It will not damage the implant abutment. The patient’s visit will be relatively brief.

2. Use of provisional cements to fabricate a cement retained implant prosthesis:
• The cementation of the implant supported prosthesis can be done with the provisional cement as the luting cements act as shock absorbers thus permit retrievability of the restoration when engaged to apply forces (Figs 11A and B).
• The tensile bond strength between cement and abutment is increased on the surface treatment of the abutment.

3. Ceramic staining of the occlusal surfaces of the restoration to locate implant abutment screw position:
• The implant abutment should be surveyed on the final cast and an occlusal ceramic stain is placed corresponding to the screw access channel.
• After the crown is luted, an outer stain is visible and then the crown is perforated at the site of screw access.
• The site is verified with the help of radiographs and sealed with light polymerizing material.

4. Use of cylindrical guide holes in the lingual aspect of implant restorations for the removal of cemented superstructure:
• A removing driver (Fig. 12A) is inserted into the guide hole through the access hole and turned to raise the superstructure by generating shear forces (Fig. 12B).
• These shear forces enable the removal of superstructure from the abutment by fracturing the cement layer (Fig. 12C).
An Insight into Different Innovative Techniques to Retrieve Cement-retained Implant Supported Prosthesis


Figs 11A and B: (A) The retrieval screw is not engaged and (B) the retrieval screw is engaged and the forces break the cement seal to uplift the superstructure from abutment.

Advantages: Easy and reliable. Does not fracture the superstructure.

5. Use of lateral set screws:
• The pressure is applied perpendicular to the long axes of the abutment by engaging a set screw in the threads in the restoration and a dimple on the abutment. 
  Advantages: It allows easy retrieval of the restoration. 
  Does not require the use of cement. 
  Does not require a screw hole access in esthetic or functional area. 
  Disadvantages: They are difficult to fabricate.

6. Use of clear guide template:
• A vacuum formed clear retaining screw location guide similar to the surgical guide is fabricated with the help of 0.020 mm coping material on the cast. 
• The access holes are prepared in alignment with the guide pins on the retaining screw location guides on the cast where guide pins are attached to the implant replicas on implant level cast. 
• With the help of the guide holes the screw access channel can be located and this helps in retrieving the cement retained prosthesis.

Advantages: It is accurate and time saving. 
It is cost-effective. 
Disadvantage: The original implant-abutment-level casts should be retained.

7. Cross pinning of the cement retained restoration:
• The retrievability of the restoration is enhanced by attaching a transverse screw to the implant abutment. 
• The cross pin screws prevent removal of the prosthesis along its path of insertion as they customize the implant prosthesis to yield a retrievable prosthesis along with optimum esthetics (Fig. 13).

Advantages: Cross pin screws of various diameters

Figs 12A to C: (A) Removing driver, (B) removing driver is inserted into the screw access hole and (C) the removing driver is rotated to elevate the superstructure due to action of shear forces as shown by the arrow.
8. Use of precision implant-locating device to locate implant screw access channel:3,13
- A precision implant locating device records the access position of the abutment screw by fabricating a flat plate with a provisional or custom tray material and polymerize it (Fig. 14A).
- A hole is prepared perpendicular to the center of the plate and a guiding rod is inserted in the plate and rotated to index the plate as the rod aligns with the teeth on either side of implant restoration about 1 to 2 mm above the occlusal surface and the index teeth.

9. Use of Burs of different diameters to prepare access hole:14
- This implies removal of both the screw retained and cement retained prosthesis by using two different diameter burs to prepare access holes in the abutment and the use of light polymerized resin and provisional cement facilitate removal of the restoration.

- Heavy body occlusal registration material is applied between the index teeth and the inferior side of the plate (Figs 14B to D).
- This device is removed and is used to locate the screw access of the abutment even after cementation of the crown (Figs 14E and F).

Figs 14A to F: (A) The probe indicating the guiding rod, (B and C) fabrication of precision implant location device on the cast, (D) the placement of precision implant location device with the restoration on the cast and (E and F) intraoral placement of precision implant location device to check the position of screw access channel.
Figs 15A to H: (A and B) The handheld scanner scanning the post and crown on the abutment after removal of the post, (C to F) the scanning of the abutment and crown images using CAD/CAM software to trace and record the screw access hole path and (G and H) the scanned images of the crown
• Ultrasonic device can also be used to remove the prosthesis without any harm to the abutment or coping after removal of light polymerized resin. 

Advantages: The technique provides reversibility, security and versatility.

Disadvantage: It is not applicable in limited interocclusal distance.

10. Three-dimensional image—superimposition computer-aided design and computer-aided manufacturing (CAD/CAM) technique.1

This is a new approach that uses a 3D recording device to locate the screw hole position and angulation with a CAD/CAM technology.1

Advantages: The data can be saved as a digital file. Does not require physical storage space. No distortion or loss of the recording device.

Disadvantage: A 3D scanning machine is required.

TECHNIQUE

• A long post is inserted in the screw hole of the abutment to reveal the angulation of the screw hole after the definitive implant restoration is fabricated.

• The abutment and post are coated with an anti-reflection agent to prevent scattering of light and reflection.

• Following this the patient should be registered with the program.

• The handheld scanner is used to scan the abutment and the post which is recognized as ‘preparation’ (Figs 15A and B).

• The crown is placed on the abutment after removal of the post from the abutment.

• The crown is also coated with an anti-reflection agent and scanned on the definitive abutment as ‘clone’.

• The abutment and crown images are superimposed on the computer using the CAD/CAM software to trace and record the path of screw hole (Figs 15C to F).

• The scan of the crown is selected for ‘wax up’ and under the crown and bridge section, the CAD/CAM software will generate a superimposed image of the crown and post.

• The scanned 3D file is saved under the patient’s name as a permanent record (Figs 15G and H).

CONCLUSION

The location of the screw access opening is necessary for the removal of the cement retained crowns without irreversible damage to the crown or abutment, which is generally difficult. Retrievability becomes important when a loosening of abutment screw occurs or at the time of repair. Permanent damage can occur to the inner implant surface or screw fixture of the implant if additional forces are applied.2 Design modification of the restoration can be done by not adding the veneering porcelain to the cast metal. The metal casts should be designed to provide complete porcelain support within the screw channel.2 Retrievability is also easier with the help of an intermediate layer of cement along with the engaging feature of the abutment.4 The newer 3D scanner offers the advantage of digital recording of the position and angulation of the screw hole without damage to the superstructure and maintaining the records as a digital file for each individual.1

REFERENCES


