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Impression Techniques in Implant Dentistry

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ABSTRACT: *Dental implants are rapidly gaining popularity in its use as fixed prosthesis. Implant impression is one of the most important steps in achieving passive fit by accurately relating an analogue of the implant or implant abutment to the other structures in the dental arch. Further the accuracy of impression is affected by the selection of impression tray, impression technique and type of impression material, number and angulation of implants. Here a brief overview of implant components and impression techniques is outlined.*
Keywords: *Implant,impression, abutment, implant analoug*

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I. Introduction

Dental implants have become a quite successful method for restoration of fully and partially edentulous patients. Impression procedure becomes exacting in implantology as compared to fixed partial denture because of lack of periodontal ligament fibres in implants. The critical aspect is to record the spatial intraoral orientation of the implant, rather than replicating minute surface detail.

Before going in detail about the impression techniques a brief overview of the parts of implant and procedure of placing an implant

Brief overview of the procedure (fig no.1)

Components

The success, function and aesthetics of an implant restoration are dependent on the proper treatment planning and through knowledge of components and instrumentation. Some of the commonly used components are drivers, healing abutments, lab analogues, screws and impression copings.

Drivers are designed to carry different types of components of implant to the mouth for easier placement and removal.
(Fig no.2, 3)

1.Healing abutments and cover screw

After an implant is placed, the internal components are covered with either a healing abutment, or a cover screw. A cover screw is flush with the surface of the dental implant, and is designed to be completely covered by mucosa. After an integration period, a second surgery is required to reflect the mucosa and place a healing abutment[1]
A healing abutment passes through the mucosa, and the surrounding mucosa is adapted around it.
(fig no.4)
Healing abutments are available in varying heights and diameters which are selected based on clinical situations. (Fig no.5). After an implant is placed, the internal components are covered with either a healing abutment, or a cover screw.
When following a traditional two-stage procedure, a cover screw is usually immediately screwed on to the head of the implant to protect it from bone or soft tissue growing onto and into it. The soft tissues are then sutured together covering the implant fixture and the cover screw.

Second stage surgery

After a period of healing (commonly ranging between six months in the maxilla and three months in the mandible), the second stage surgery is performed. The implant is exposed through a small incision in the mucoperiosteum allowing access to the cover screw

The cover screw is removed and replaced by a 'healing abutment'. The healing abutment pierces through the soft tissues and is exposed within the oral cavity, allowing the soft tissues to heal around it . This period is commonly four to six weeks but may vary depending on the healing of the soft tissues.Once the soft tissues have healed a variety of alternatives are available.

To make a fixture head impression the healing abutment is removed and an impression coping is then screwed onto the implant head and a silicone impression is taken. The impression is then sent to the dental technician, who will manufacture the restoration.Whilst the restoration is being manufactured the healing abutment is screwed back onto the implant head.[1]

II. Crest module

Portion of implant fixture which provides a connection to abutment. Connection area has a platform on which abutment is set.

Crest module design- slightly larger than outer thread of the implant body. This design serves to

- Seal the osteotomy site completely-acts as a barrier to bacterial ingress during initial healing
- Greater initial stability-compress the crestal bone region due to large dimension
- Greater surface area- decreases stress

The crest module can be parallel or angled. (fig no.6). The angled crest module increases the surface area and transfers the beneficial compressive forces to the bone to stimulte bone deposition. The parallel design transfer the shear forces more which is harmful to the bone leading to resorption

III. Internal and External Hex

Hex (hexagonal) is to retain the prosthetic component and to get intimate and accurate fit within the components (Fig no.7)

IV. Laboratory analogue

Laboratory analogue are metal replicas that duplicate the implant head or abutment connected to the implant which are used in laboratory to construct working model.

V. Impression copings

Impression copings have been designed for making final impression after the soft tissue has matured. These copings have the same flare as the healing abutments and should fully support the soft tissue around the head of the implant.They are various types of copings available which are selected based on the impression techniques.[2]

In transfer type the coping is retained in the mouth when set impression is removed. In pick up type the coping gets incorporated in the impression and it is removed from the mouth with the set impression.[Schaefer O, Schmidt M, et al 2012][3]

If a temporary restoration is made it will be manufactured on temporary components, such as temporary cylinders

Permanent restorations may be screw retained directly to the implant fixture head or via an intermediary component known as an 'abutment'. Restorations or abutments may be either screw retained using prosthetic screws or cement retained

VI. Pilot drill

Once the pilot hole has been completed, the dentist will continue the drilling process using a set of bits, each of which has a slightly larger diameter.As each one is used in turn, the hole will gradually become larger, until it is the correct diameter for the implant that's been selected.

VII. Hex driver

Handpiece Hex driver is used for installation and removal of cover screw, healing abutments and abutment screws. The handpiece hex driver is used with latch-type contra-angle handpieces. The overall length is 20mm; the shank length is 6.5mm.The driver head design can be square, hexagonal and abutment driver and contra-angle torque driver.

VIII. Screw Taps

Screw Taps (Optional for Dense Bone) (Fig no.8)

IX. Torque Wrench

Place abutments onto the connection and hand-tighten with the final abutment screw in place; insert the required tip into the Torque Wrench.Engage the abutment screw with the driver and apply firm apical pressure to ensure proper seating of the tool. Failure to engage the abutment screw properly may result in stripping of either the driver or the component.

To assure proper torque is applied, set the wrench to the desired value by turning the torque meter dial until the desired torque value is shown in the window on the handle of the torque wrench.

Align the marking on the torque meter dial with the markings on either side of the window. (Fig no.9)

To apply torque to the abutment screw, turn the wrench slowly in a clockwise direction.Continue turning until the wrench "slips." When the wrench slips a clicking sound is heard and tension is released on the torque wrench.

This indicates that the pre-set torque value has been reached andassures that the proper torque value has been delivered.[4]

Implant Placement Procedure [5]

Soft Tissue Reflection Following administration of appropriate anesthesia, make an incision of appropriate design for elevation of a flap. Perform alveoloplasty on the crest of the ridge, if needed, to create a more even plane in which to place the implant. Irrigation should be used for all modifications of the bone.

General Drilling Guidelines

- A speed of 800–1200 RPM is recommended when using the Pilot Drills or Surgical Drills.
- Screw Tap speed should be no greater than 25 RPM.
- All drilling and tapping procedures should be performed using copious, sterile irrigation.
- Do not apply lateral pressure during drilling and tapping procedures.
- Drill the osteotomy using light pressure along the long axis of the osteotomy.

With proper irrigation, perforate the alveolar crest using Lance Drill.Using a Pilot Drill, drill a pilot hole to the appropriate depth marking on the drill

Check the orientation of the initial osteotomy using a Parallel Pin. If placing more than one implant and parallelism is desired, begin drilling the next site and align as the trajectory of the bone permits.

Depending on implant diameter and the density of bone at the osteotomy site, it may be necessary to utilize one or more of the Surgical Drills to widen the osteotomy. To avoid over-preparation, widening drill diameters should be used only as necessary, and in proper succession.

Select the desired Surgical Drill, accounting for the density of bone at the osteotomy site and the diameter of the implant to be placed. With proper irrigation, drill to the appropriate depth marking on the drill. The final drill for each implant diameter should be based on the density of the bone. The goal is to achieve high primary stability upon implant placement.

Insert Implant into osteotomy continue advancing the implant in place using an appropriate implant driver with either a handpiece or torque wrench. A minimum torque value of 35 Ncm upon final seating indicates good primary stability.Implants are threaded into the osteotomy utilizing drivers that engage the internal connection of the implant.

Impression techniques

Implant level Impression (Fig no.10)
Abutment level impression(Fig no.11)

Pick up type /open tray

The impression coping incorporated in the impression and is removed from the mouth together with the set impression and is known as a pick up type/open impression

They require access to the retaining screw to allow release of the screw prior to removal of the impression coping — impression assembly, the analogues are attached to the impression copings while they are embedded in the impression tray(Fig no.12)

A custom tray with access to the impression coping screws is required.
Some precautions to take are:

- Making a radiograph when the impression coping/implant or impression coping/abutment is below the level of the mucosa to insure seating of the impression copings.

- Using vinyl gloves when a polyvinyl siloxane impression is used to prevent retardation of setting of the impression material from the interaction of latex gloves with the material.[Kahn R, Donovan T E, Chee W W,1989][6]

. It has been shown that the pick up type impression coping is the more accurate type of impression as errors occur on removal and replacement of the transfer type impression copings, especially in the occluso-gingival direction. [Liou A D, Nicholls J I, Yuodelis R Aet al 1993][7]

Indications
- More accurate for multi unit impressions
- In cases with implant/abutment angulations and path of insertion withdrawal

Advantages of Open Tray
- An advantage of this technique is the dentist can confirm the laboratory preparation and contour of the provisional prosthesis to achieve the desired healing and soft tissue contour before final crown fabrication.
- Reduces the effect of the implant angulation
- Reduces the deformation of the impression material.
- Removes the concern for replacing the coping back into its respective space in the impression.

Disadvantage of Open Tray
- The movement of impression copings inside the impression material during clinical and laboratory phases may cause inaccuracy in transferring the spatial position of implants from the oral cavity to the master cast.

The open technique can be further subdivided into splinted and non-splinted techniques.
The splinting procedure is recommended in case of multiple implants to decrease the amount of distortion and to improve impression accuracy and implant stability. Splinting of the transfer copings prevents rotational movement of impression copings in the impression material during analog fastening, which provides better results than not splinting

Transfer type/ closed tray
The copings are connected to the implant and after the removal of impressions they are retained on the implant. These copings are then removed from the implant, attached to the implant analogues and reinserted in the impression.They remain in the mouth on removal of the set impression. No custom tray is required for this type of impression.
(Fig no.13)

Indications
Liou Ad (1993)
- Limited inter arch space
- Tendency to gag
- Difficult access in the posterior region of the mouth

Advantages of Closed Tray
- Easier
- Suitable for short inter arch distance.
- Visual fastening of the analog to the coping is more accurate*Conrad H. (2007)*

Disadvantages of Closed Tray
- Inaccuracies with recovery and subsequent deformation of impression material may be encountered with nonparallel implants.
- Not Suitable for deeply placed implants.*Conrad H. (2007)*

Abutment level
Following confirmation from the radiograph of complete seating they are then definitively secured by tightening the retaining screws with a torque device.
Incorrect seating may be due to
Failure to ensure that the abutment correctly engages an anti rotation features.
The presence of soft tissue or bone encroaching on the head of the implant.
Prepared abutments are usually supplied in various materials such as alumina,various materials such as alumina, zirconium and titanium,zirconium and titanium.

The manufacturer typically supplies these as stock shaped abutments, which can be as stock shaped abutments, which can be placed directly on the implants and placed directly on the implants and modified by the clinician in the mouth modified by the clinician in the mouth.

The technique of preparing them is similar to traditional crown and bridge techniques, crown and bridge techniques. Preparation can be carried out directly in the mouth. This will allow the margins of the abutment to follow the gingival contour.Utilizing standard crown and bridge principle, an impression can be recorded of the prepared abutments directly in the mouth.

Advantages of Abutment level impressions

- Simple provisional restoration fabrication
- Selecting abutments in the laboratory
- For custom-made abutments

	Implant level	**Abutment level**
Ease of impression making	Requires subgingival placement of coping	Easier, b'cz margins are mostly supragingival
Impression copings	Necessary	Conventional impresion without coping is available in some cases
Abutment selection and preparation	On a model in a lab	Can be done in mouth,chairside
Abutment modification	Not needed once delivered	May be needed in the mouth
Custom abutment	Available	Not available
Interim and final crown fabrication	Can be performed in the lab together with the abutment selection and preparation	Often necessary

Indirect technique

Abutment placed at the implant site ---→Impression cap snapped onto the abutment ---→Tray material used to make an impression---→Impression cap picked up by the impression---→Implant analogue attached to abutment---→Impression poured(Fig no.14)

Direct technique

Here impression is taken with abutment and transfer coping. The abutment is then removed from the patients mouth and this same abutment is used for casting and fabrication of the prosthesis. Since we use the abutment directly it is called direct technique.

In indirect technique, the abutment remains in patients mouth, we use implant analogue. Since we are not directly fabricating onto the abutment,but use analouge, it is called indirect technique

Comparison

SPLINTED IMPRESSION COPINGS

The open technique can be further subdivided into splinted and non-splinted techniques.

The splinting procedure is recommended in case of multiple implants to decrease the amount of distortion and to improve impression accuracy and implant stability. [8]

Splinting of the transfer copings prevents rotational movement of impression copings in the impression material during analog fastening, which provides better results than not splinting[9]

SPLINTED IMPRESSION COPINGS PROCEDURE[10]

Impression copings were splinted with dental floss and autopolymerizing acrylic resin.

The transfer copings were tied up with four complete loops of dental floss and splinted with autopolymerizing acrylic resin (pattern resin) and allowed to set for 3 minutes

Seventeen minutes after setting, the acrylic resin substructure and splinted transfer copings were removed from the framework, and the splints were sectioned into four separate pieces with a handpiece diamond disk and a 0.2-mm standardized gap space was left between the single pieces. The square impression copings were then readapted to the implants in resin model and resplinted with same acrylic resin .The impression procedure was then accomplished. (Fig no.15)

The heavy consistency polyvinylsiloxane impression material was loaded inside the impression tray and light consistency polyvinylsiloxane impression material was meticulously syringed around the impression copings to ensure complete coverage of the copings

Implant analogs were fastened to the impression copings in the impressions. The impression was now poured to create a model

Snap-fit (press fit) plastic impression coping
This technique uses press-fit impression coping which is connected to the implant by pressing instead of screwing and the plastic impression copings are picked up in the impression.[*Nissan J, Ghelfan O,2009]*[11]

This technique is not a pickup impression because it does not require an open tray, but instead uses a closed tray. (Fig no.16, 17)

It is not a transfer impression, either, because the plastic impression copings are picked up in the impressions[Heeje Lee, JosephS, JLHochstedler et al 2008][12]

Snap fit impression coping placed on implantsImplant analogue attached to the picked snap fit impression coping

Advantages[11]
1. Helps to overcome the movement of impression coping inside the impression material
2. Time saving
3. Has the advantage of both the open and closed tray implant impression techniques
4. More comfortable for both the clinician and the patient
5. Easy to manipulate

Nissan J, Ghelfan O,2009
The snap-fit technique may be a reliable impression making technique but regarding accuracy of this technique none of the study is available for investigation [Sumathi K ,Sneha S Mantri et al 2015]

Steps to be considered……
It is important to take a periapical X-ray to verify the fit between the transfer coping and the implant.
Verify the seating of components
Improper interface, note small gap between impression post and implant analogue.
Ensure that impression pin and model analog are securely screwed together and fully seated in impression

Inhibition of the polymerization of vinyl polysiloxane (VPS) impression materials has been reported to occur with the use of latex protective barriers such as gloves

Trays for impression
Metal not plastic
Use tray adhesive
Rim lock tray
Models obtained from impressions with special trays present higher accuracy with respect to the impressions obtained with stock trays

DIGITAL IMPLANT IMPRESSION
More recently, one of the major developments in implant prosthodontics has been the adoption of engineering principles in the form of computer-aided design and computer aided manufacturing (CAD/CAM) to construct implant prosthesis.
This technology utilizes 3-D intraoral scanners which has revolutionizing the way we take impressions .The digital implant impression technique has proven its possibilities as an effective alternative for the analogue impression-taking technique [Nissan J, Ghelfan O. 2009][11]

Advantages
1.Improved patient acceptance

2.Reduced distortion of impression materials

3.Pre-visualization of the preparation three-dimensionally

4.Virtual assessment of the implant prosthetic space

5.depth of restorative interface

6.emergency profile configuration before proceeding with laboratory steps

7.potential cost and time effectiveness [13]

[Sang J. Lee German O. Gallucci,2013]

The main requirements for the CAD/CAM are the [14]
(1)the digital scanner, which scans and transforms the geometry into the digital data which can be processed by the computer

(2) software that processes the data and creates a CAD model

(3) a production technology that transforms the data set into the desired product by means of CAM [Jaafar Abduo, Karl Lyons,2013]

Scanning principle
The intraoral scanning devices utilize a sophisticated optical surface scanning technology that works similarly to a camera, but instead of simply capturing lights and colors, the sensors measure light reflection times from various surfaces through processes to capture the object three-dimensionally.

This information is then captured by the three-dimensional software that utilizes specific alignment algorithms to allow for registration of the object.

Three of the common scanning principles used today by intraoral dental scanners on the market are triangulation, active wave-front sampling, and parallel confocal laser scanning.

Each of these techniques utilize a combination of these various imaging capturing methodologies to collect the surface data of the teeth and mucosa so that the information can be registered and "stitched" together through an alignment process in order to create the virtual three-dimensional model

Disadvantages
(1) Its More easy to carry out in the maxilla due to direct view.

(2) In case of multiple implants difficult to identify the position of the abutments.

(3) Inability to scan the proximal area of the neighbouring tooth when situate too close to the abutment.[Wismeijer, R. Mans, M. van Genuchten, H. A. Reijers.,2013][15]

Digital Implant Dentistry will have an enormous impact on the dental implant market in the near future because of the predictable results, more predictable cost, save time for both the patient and the dental team.

Digital planning and processing will also make the dental implant treatment option much less burdensome and easier to deliver for the dental implant team and patient, thus improving acceptability and utilization globally
Conclusion

One of the critical factors which affect the long term success of the implant is its passive fit of the implant prosthesis.

In order to achieve this a clinician should have sound knowledge regarding the components used during impression, the choice of impression materials and the selection of suitable impression techniques based on clinical situation.

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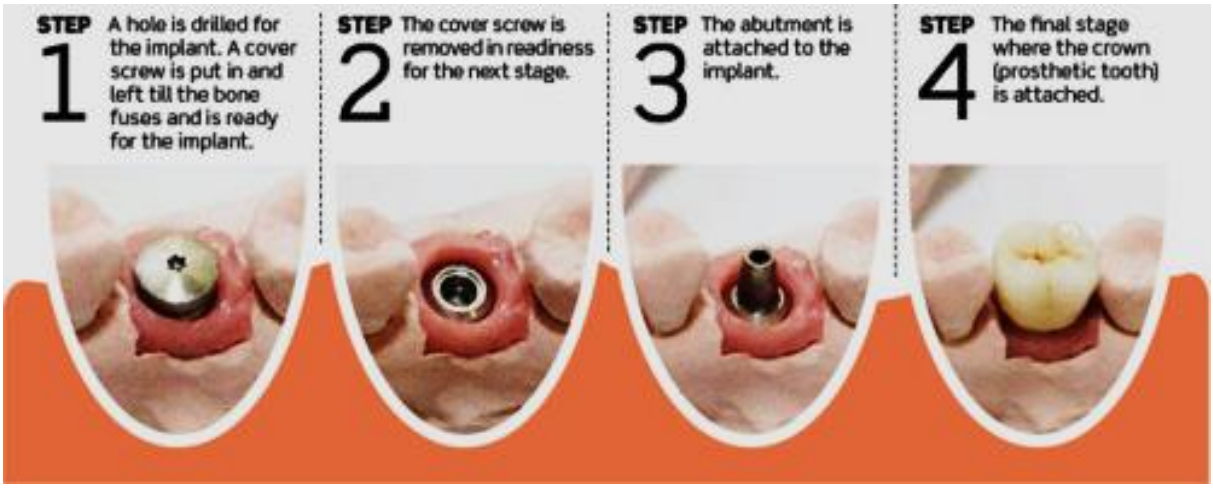


Fig .1 Brief overview of the procedure

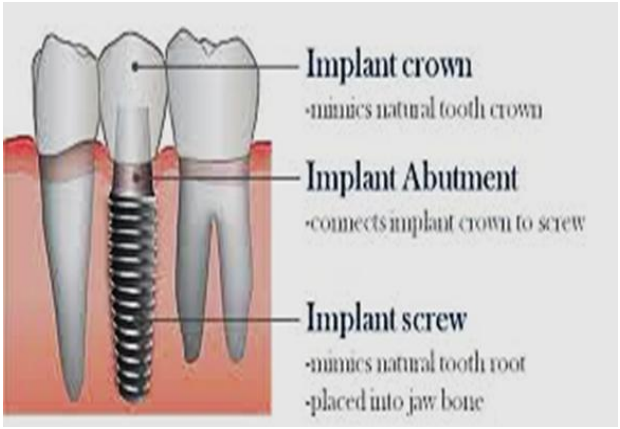


Fig.2 Components of implant

Fig.3 Components of implant

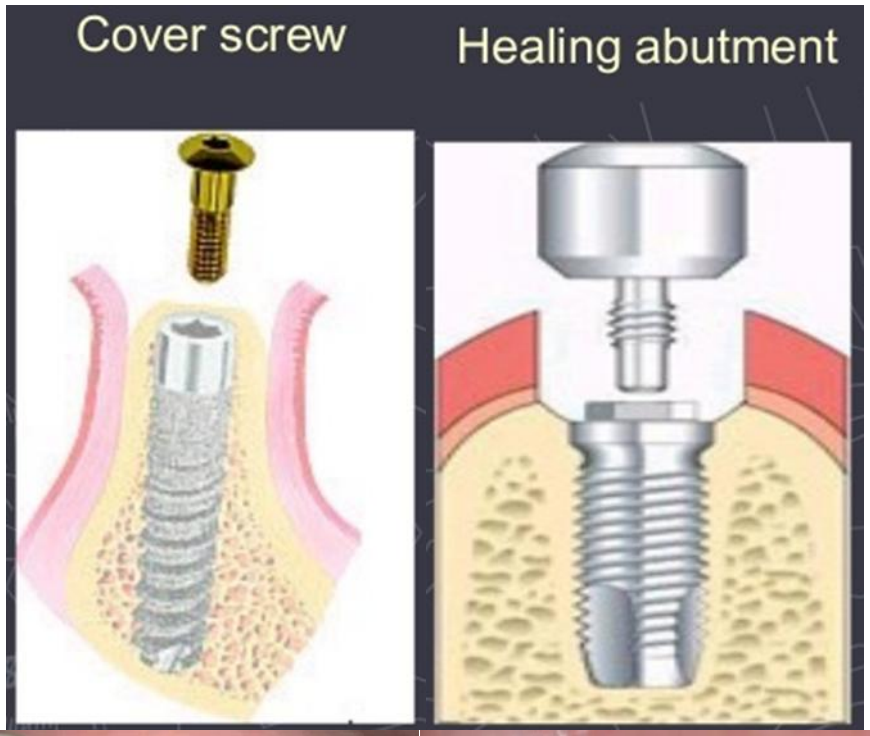


Fig.4. Cover Screw **Fig.5.**Healing abutment

Fig.6 Parallel and Angled Crest Module **Fig.7** External and Internal Hex

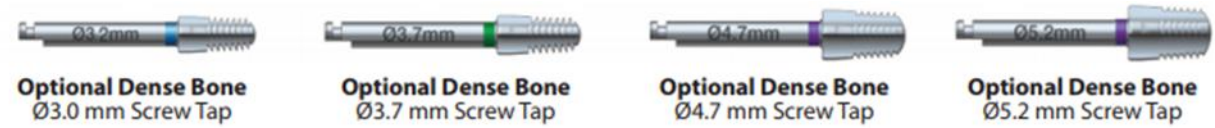


Fig.8 Screw Taps

Fig.9 Torque Wrench

Fig.10 Implant Level Impression

Fig.11 Abutment level impression

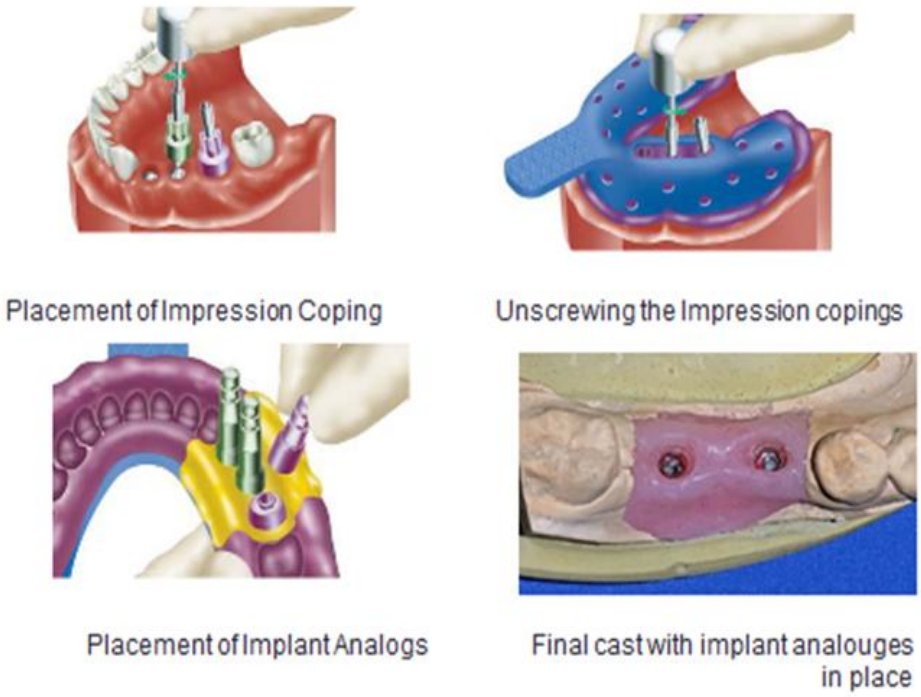
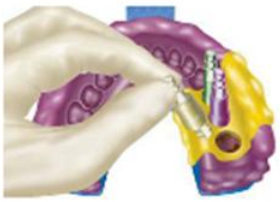


Fig.12 Pick up type /open tray impression technique

Placing of impression coping on the implant

Impression making with closed tray



Orienting the impression coping with lab analog into place

Fig.13 Transfer type/ closed tray technique

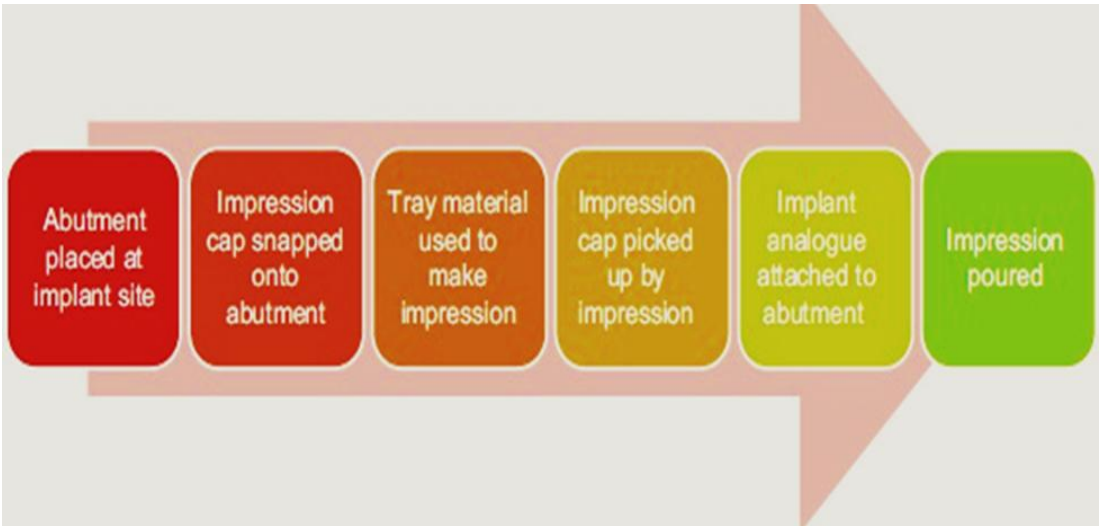


Fig.14 Indirect technique

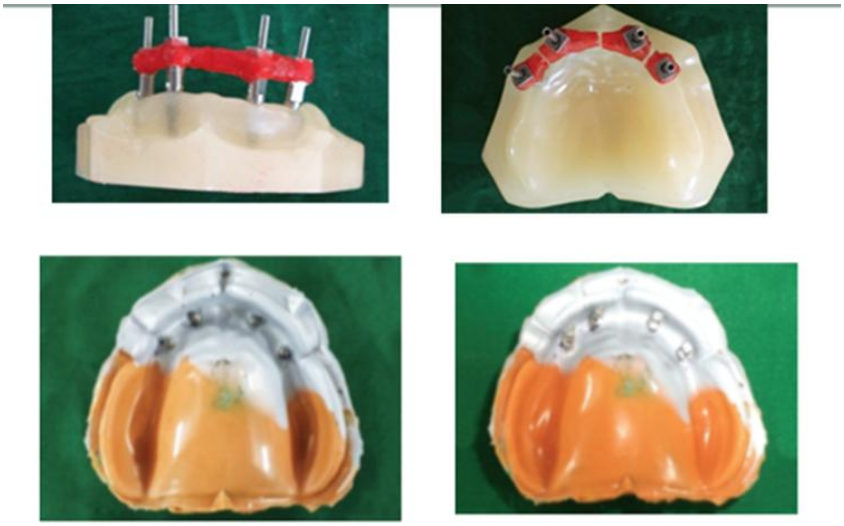


Fig.15 Splinted impression copings procedure

Fig.**16** Snap-fit (press fit) plastic impression coping

Fig.17 Snap-fit plastic impression coping

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