



Are Online platforms the new classrooms?

The year 2020 has been nothing less than a year of changing norms in all aspects of life and dentistry has been no different. The entire teaching platform has shifted from actual to virtual mode of teaching thereby opening up a world full of possibilities in terms of access to learning materials. Though purists may argue that nothing supplements a good classroom session and though I partly agree to it, my point of view is a good teacher can teach anywhere be it actual or virtual and the same goes for students too who are keen to learn.

Though the faculty aren't tech savvy, they have taken all the possible efforts to make sure the students learning process doesn't suffer. There have been numerous global education platforms that have provide access to free webinars from stalwarts thereby believing in the age old adage that sharing is caring. As COVID 19 seems likely to be around for some time, the question to be asked is once things return to normalcy post COVID-19, will contact lectures still be popular or people would prefer to access contents online.

Though I have made use of my forced home arrest during the covid times by attending multiple webinars on varied topics of dental discipline, I somehow at the end of it still feel a lacuna in the connect the speaker establishes with his audience through an online platform compared to a contact session.

Add to that the numerous distractions that come forth your way in the form of phone calls, mails, messages and clearly there is a loss of focus. I also noticed that a lot of the speakers who develop such an excellent rapport with the audience in a contact session could not replicate the same mojo online and as a teacher who engages a hundred students in a classroom, I fully empathize with them.

Having said that, I also enjoyed how speakers we could only dream of hearing and seeing were right across our screens giving us a wealth of information which otherwise would have cost us a lot of money for free or at a reasonable price. Everybody irrespective of their age or experience tuned in to hear the masters preach their work and words of wisdom.

In my personal opinion, a healthy blend of online and contact mode is the way forward for sometime at least till a semblance of sanity is seen regarding control of COVID 19 spread. Online modes are the way forward if sessions are made more interactive with quizzes and various online engagement tools making sure that the user is tuned in to the content.

Till then let us hope things turn out for the better and there is an improvement in the situation as seen

Dr.Umesh Y Pai

Bone augmentation using CGF-a Case report with two year follow up.

Prof Dr. Rakshith Hegde*, Dr. Nivya John**, Dr. Manoj Shetty+, Dr. Prathul Kumar++

Abstract

Successful implant treatment requires: Primary stability at placement Integration in a prosthodontically driven position Careful management of the living bone. Bone volume may be inadequate to completely embed the implant Incompletely covered implants may result in complication soft tissue recession inflammation and infection and eventual loss of implant .Bone augmentation with barrier membrane technique has proven to successful to regenerate the bone volume. Concentrated growth factors have shown promising results when used with combination of grafting materials.This case report presents a case wherein the site of implant placement has been incorporated with a mixture of cgf and allograft. A two year follow up shows good tissue thickness and volume.

Keywords: Cgf, allograft, implants

Introduction

Bone augmentation with barrier membrane technique ,the concept of GBR was first described in 1959 when cell occlusive membranes were employed for spinal fusions.¹ A variety of non resorbable and resorbable bone grafting materials have been used in bone augmentation with GBR concept Oral Implantology. From a manufacturing aspect what we should look for is material biocompatibility ,stability over the required duration of barrier function, space maintenance ,exclusion of undesired cell ingrowth and ease of use^{2,3,4,5}

The size of the defect also influences the bone healing capacity .In large defects the bone formation is limited to the marginal stable zone with a central zone of disorganized loose connective tissue,thus combined use of bone grafts or bone replacements substitute with cell occlusive barrier membranes are advocated in bone regeneration of larger defects.One such example is eptfe membranes which is

considered a standard for bone augmentation. However soft tissue dehiscence is a common complication.^{6,7}

Thus bio resorbable membranes were developed. Although these membranes also elicit soft tissue inflammation and soft tissue dehiscence, the communication with the oral cavity accelerates resorption rate thus reduces the contamination of the regenerated bone matrix.^{8,9}

Variety and contemporary surgical procedures and dental materials available for reconstruction of body defects and concentrated growth factors is one of the risk-free procedures. Growth Factors are mediators which regulate key processes like tissue regeneration, including cell proliferation and differentiation, synthesis of extracellular matrix, chemotaxis and angiogenesis. Thrombocytes play a major role in repairing of mineralized and soft tissues. The latest approach to Guided Bone Regeneration and Augmentation of the lost bony structures of alveolar ridge is

application of the fibrin rich block with concentrated growth factor.¹⁰

The following case report depicts a case with anterior missing teeth and was rehabilitated with hard tissue augmentation using CGF mixed allograft and immediate implant placement.

Case report:

A young patient presented with missing upper front teeth to the department of Oral Implantology. The history revealed that the cause of loss of teeth was traumatic injury. After Oral prophylaxis and endodontic scaling, patient was advised oral implants with lateral augmentation.(figure 1,2)

The patient was pharmacologically managed with prophylactic and therapeutic dose of antibiotics.(amoxicillin 500mg).

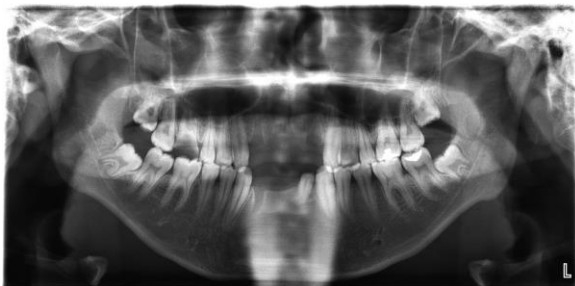


Figure 1: PRE OPERATIVE OPG



Figure 2: PREOPERATIVE INTEROCCLUSAL VIEW

On the day of surgery, collection of venous blood (saccos protocol) was done from superficial vein with a 21-gauge needle with all the blood counts in normal range. 9 mL of blood was drawn into each sterile Vacutainer blood collection tube (Greiner Bio-One, GmbH, Kremsmunster, Austria) silicon coated as a serum clot activator. These tubes were then immediately centrifuged in a special machine (Medifuge MF200, Silfradent srl, Forlì, Italy) using a program with the following characteristics: 30 seconds acceleration, 2 minutes at 2,700 rpm, 4 minutes at 2,400 rpm, 4 minutes 2,700 rpm, 3 minutes at 3,000 rpm and 36 seconds deceleration and stopped.

At the end of the process, three blood fractions were identified(figure 3): (1) the upper layer, representing the liquid phase of plasma named platelet poor plasma (PPP), (2) the lower layer, at the bottom of the tube, consisting in free red blood cells (RBC); (3) the middle layer, representing the solid CGF¹⁰

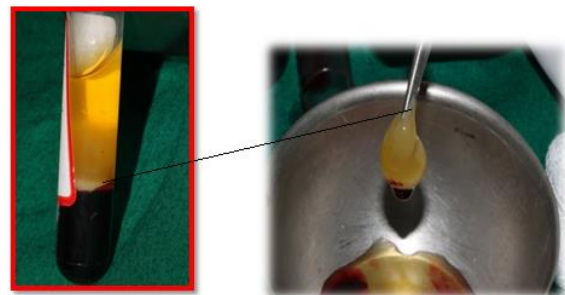


Figure 3: CGF collection from patient venous blood

The placement of implant was conducted in a sterile operating theatre.

Disinfection of the facial skin was done using Povidone – Iodine Solution IP (Betadine) paint. Patient was given an oral mouth rinse, Induction of local anaesthesia

was carried out using Lignospan special (2% lidocaine with 1:80,000 Adrenaline) .

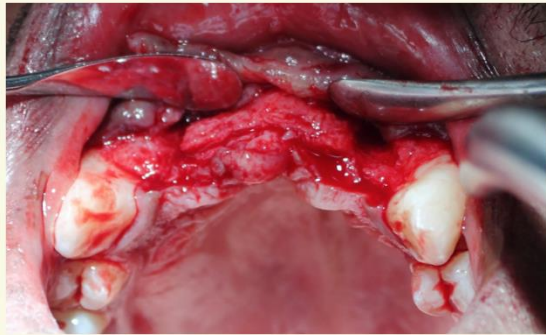


Figure 4:flap elevation

After a full thickness flap elevation (Figure 4). A 2 mm pilot drill was used to mark the initial osteotomy sites. Paralleling pin was used to check the parallelism and depth of the osteotomy site. A 3.2mm twist drill was used next and the osteotomy widened . After the preparation of the osteotomy site, a 3.5 x 11 mm implant was placed with the help of physio-dispenser .All the implants were placed at a minimum insertion torque of 25 Ncm assessed by the physio-dispensor(Figure 5).



Figure 5: implant placement

CGF was removed from test tube, using sterile tweezers and was mixed with the allograft (figure 6a,6b) and then placed into the site and closure was attained using vicryl sutures.



Figure 6a: graft placement

Patient was requested to revisit for suture removal and follow up check ups. Prosthetic phase began with implant level impression procedures. During the waiting period of 6 months (figure 7)sulcus former were placed to attain the gingival silhouette .At the time of fit in,the sulcus formers were removed and impression was made(figure 8) .Customised abutments were placed and torqued at 25 Ncm which is the recommended torque for implant abutment connection for Ankylos ® system A metal-ceramic bridge was fabricated which was autoclaved before cementing and was cemented using zinc-phosphate cement.(Figure 9,10a,10b)

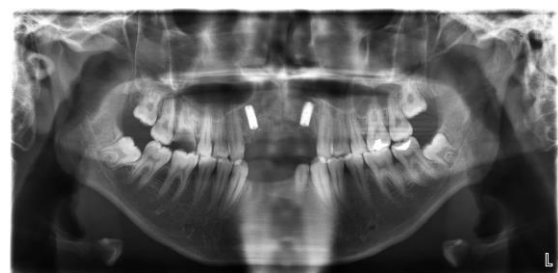


Figure 7: 6 month post operative radiographic view



Figure 8: impression coping in place



Figure 9: prosthesis



Figure 10a: fit in of the prosthesis

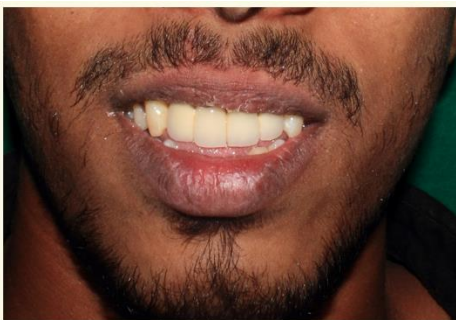


Figure 10b: smile view post cementation

Post operative radiographs(Two year follow up) revealed well seated abutment and a stable crestal bone level.(figure 11)

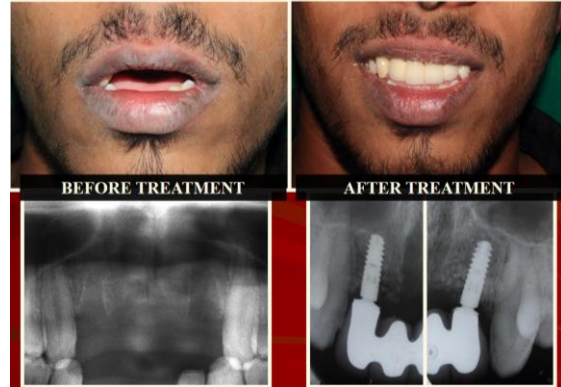


Figure 11: two year follow up

Discussion

When comparing the various available graft materials used with or without a membrane, Giorgio Pagni et al. In his study concluded that biomaterials such as bio-OSS and hydroxyapatite when placed in submerged situations resulted in better healing. Thus, synthetic bone graft materials are being preferred by more clinicians.

CGF, first introduced by Sacco, has recently become popular. CGF is produced by the centrifugation of venous blood as same as PRF. However, the technique is different on centrifugation speed. Unlike PRF, CGF use variable rpm from 2400-2700 rpm to separate cells in the venous blood, therefore, results in fibrin rich blocks that are much larger, denser and richer in GF than common PRF. This shows better regenerative capacity and higher versatility when using the fibrin rich block.

CGF also shows higher tensile strength, more growth factors, higher viscosity and higher adhesive strength than PRF. CGF

can act as barrier membrane to accelerate soft tissue healing or be mixed with bone graft to accelerate new bone formation.^{10,11}

In the above mentioned patient it was decided to mix the allograft with CGF and place the graft and then further cover it up with a slow resorbable barrier membrane. Geistlich Bio-Gide® integrates with surrounding tissues to protect the initial coagulum. The bilayer structure helps in preventing ingrowth of soft tissue into the augmented site, and optimally degrades to allow for the cascade of biologic events leading to regeneration.^{12,13}

The post operative radiographs revealed a stable crestal bone level. Patients esthetic demands were met, in spite of the excessive axiocoronal length of the bridge which was compensated by the patient's thick lips and low smile line, however, it is advised to strictly follow a prosthetically driven implant placement irrespective of the bone architecture.

Conclusion:

This case report presented with a dental trauma that caused an edentulous anterior area. Extensive care must be taken to rehabilitate these sites especially when we suspect fractures and poor density bone. CGF provides a safe, cost effective alternative to autografts during grafting procedures. CGF can be used in other implant case scenarios that include sinus augmentation and ridge preservation. More studies about the efficiency of CGF can validate its use in the future.

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*- Professor, Department of Prosthodontics

** - Lecturer, Department of Prosthodontics

+ - Professor and Head of Oral Implantology

++ - Tutor, Department of Oral Implantology

A B Shetty Memorial Institute of Dental Sciences,

Mangalore

THE ROLE OF DIGITAL CAMERA IN SHADE SELECTION: A REVIEW

Dr. Tanay Chawda*, Dr. Alisha Ono Idris*, Dr. Amrita Bellap*, Dr. Shobha J Rodrigues⁺⁺, Dr. Umesh Y Pai⁺⁺⁺

Abstract

Dental Photography has evolved at an astounding rate over the past few years. It has helped dentists identify, diagnose, record, and present their cases with unimaginable accuracy and details. It not only improved the overall quality of treatment, but it also helped ease communications with fellow dentists and dental laboratories. Shade selection procedures are often limited by the colour of the prefabricated shade tabs of the manufacturers and force dentists to select only those shades that are provided in the shade guides. It makes it extremely difficult to convey the exact optical properties of the patient's teeth to the dental laboratory. The solution to this problem was the introduction of digital photography in shade selection procedures. However, digital photography can only be used for shade selection if the dentist is able to immaculately capture the true colours of the patient's teeth. This requires an in-depth knowledge about the working of the digital camera, its limitations, and ways to overcome these limitations.

Keywords: Digital Camera, Dental Photography, Construction, Functioning, Exposure, White Balance, Grey Card, Flashlight, Software

One of the biggest problems of shade selection has been the amount of information that can be communicated to the dental laboratory. Conventional shade guides simply convey the base colour of the prosthesis not any other characteristics that the prosthesis may need.¹

Dentists often use "shade communication diagrams" for a more detailed illustration of what is required in the prosthesis, but even these lack the details required for accurate results.

Hybrid devices fixed this issue to a great extent, but the dental laboratories also needed complex software and sometimes even hardware to efficiently utilize this information

Digital cameras thus presented as a perfect solution to both of these problems

ADVANTAGES OF A DIGITAL CAMERA²

With a series of images, they can communicate the tooth's:

1. Shade
2. Surface texture
3. Translucency
4. Form
5. Size
6. Characteristics

And on the other hand, the dental laboratory simply needs a digital screen in order to process all the details provided

This makes the digital camera an important tool, regardless of the methods of shade selection and laboratory communication used.

DISADVANTAGES OF A DIGITAL CAMERA³

The use of a digital camera to aid in shade selection encounters some unique problems.

1. A learning process is required before the dentist can effectively use the digital camera for shade selection
2. The digital camera has various settings that alter the way the object (tooth) appears, which depend on:
 - a. The environmental lighting conditions
 - b. The flash of the camera (if used)
3. The apparatus required may be expensive

For the proper use of a digital camera/DSLR (Digital Single Lens Reflex) camera for shade selection procedures it is extremely important to first understand its construction and settings.

CONSTRUCTION OF A DSLR CAMERA:⁴

The following image (*Fig. 1*) depicts the internal structure of a DSLR camera.

Notice the various parts of a DSLR camera and the path the light takes to enter the viewer's eyes. Each of these parts plays a key role in the outcome of the final image and ultimately contributes to the esthetics of the final restoration.

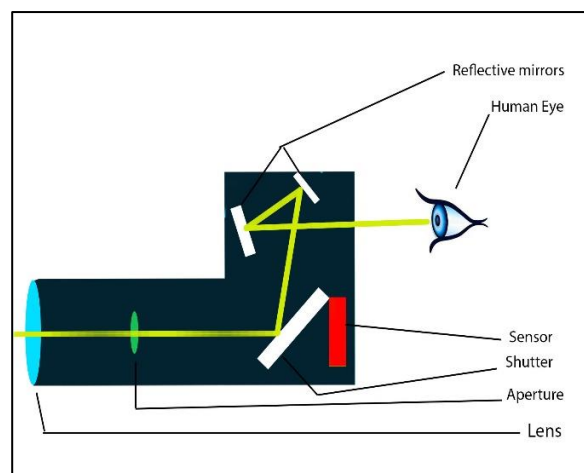


Fig 1: Internal Structure of a Camera

FUNCTIONING OF A DSLR CAMERA⁵

Light first enters the DSLR camera via the "Lens". This lens then converges the image which then passes through an "Aperture".

The opening of the aperture can be altered to change the amount of light that falls on the sensor.

The light then falls on a "Shutter" which usually remains closed but can be opened to allow light to fall on the sensor to generate an image.

The closed shutter acts as a reflector of light. This pairs with the reflective mirrors in the prism of the eyepiece to direct the light/image into the "Viewfinder".

SETTINGS OF THE CAMERA

The two main settings of the camera that need to be adjusted are:

1. Exposure
2. White Balance

EXPOSURE⁶

Exposure of an image is a measure of the amount of light captured by the sensor of the camera.

Higher the exposure, more the light falling on the sensor and brighter the image.

Exposure is of key importance in shade selection using a DSLR camera as the exposure of the image should match the illumination of the teeth and shade tab guides seen by the human eye. Any discrepancy in this will result in inaccurate shade selection.

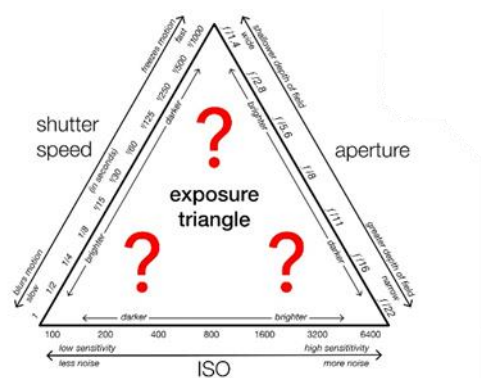


Fig 2: Exposure Triangle

As can be seen in *Fig. 2* the exposure of an image can be controlled by 3 settings on the DSLR camera:

1. Shutter speed (higher shutter speed decreases exposure)
2. Aperture (higher aperture decreases exposure)
3. ISO (higher ISO increases exposure)

The combination of Shutter speed, Aperture and ISO constitutes an “Exposure Triangle”

SHUTTER SPEED⁷

The shutter speed of a DSLR lets the user alter the speed with which the shutter opens and closes.

Faster the shutter speed, lesser the light that falls onto the sensor and thus lesser the exposure of the image.

This is measured in terms of “seconds”

The recommended shutter speed for dental photography is around 1/90th second to 1/125th second^{8, 6}

APERTURE⁹

Aperture is the setting that enables the user to alter the size of the Aperture of the camera.

It is measured in terms of F-number or F-stops.

The F-stops indicate the ratio of the system's focal length to the diameter of the entrance of the lens.

A larger F-number indicates a smaller aperture, and thus lower the exposure

ISO¹⁰

ISO stands for International Organization for Standardization.

It indicates the light sensitivity of the sensor of the camera.

Higher the ISO, greater the sensitivity and thus greater the exposure of the image.

The recommended ISO for dental photography is 100¹¹

WHITE BALANCE¹²

The “White Balance” setting alters the colour temperature in degrees kelvin of the image.

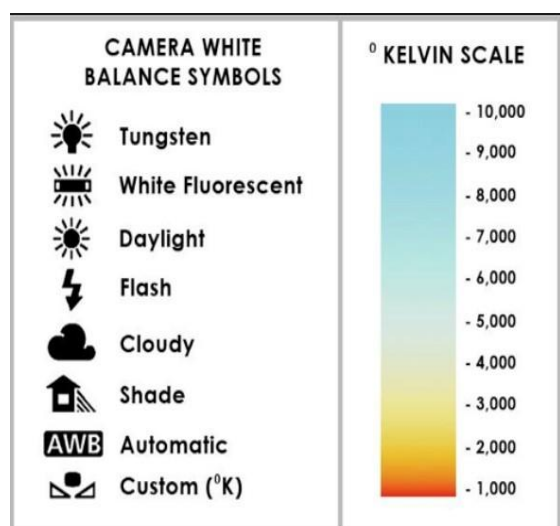


Fig 3: White Balance and Kelvin Scale

This setting affects the tint (or hue) of the image.

A higher degree kelvin will impart a bluish tint to the image, while a lower degree kelvin will impart a reddish tint to the image.

Fig. 3 demonstrates the various white balance setting of the DSLR, and colour temperature settings associated with it in degrees kelvin.

Note the change in gradation from a lower to a higher colour temperature.

If the white balance of the photograph is incorrect then the hue of the tooth completely changes. This would completely hamper the shade selection procedure and result in the fabrication of a

prosthesis with the wrong shade and thus necessitate expensive and time-consuming remakes of the dental prosthesis.



Fig. 4: White Balance Settings.

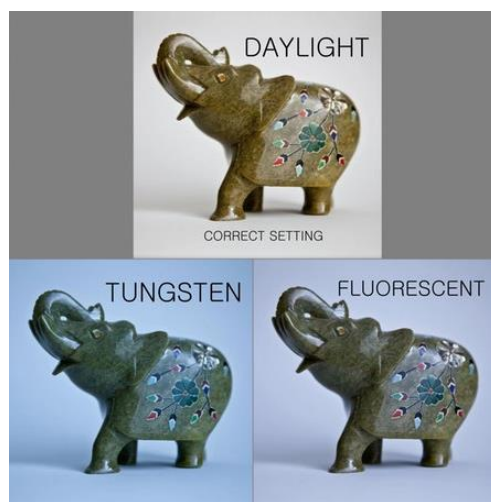


Fig. 5: More White Balance Settings

Fig. 4 and fig.5 demonstrate the effect of various white balance settings on an object.

The use of these settings is to obtain an image that depicts the object as it would appear when viewed under the midday light in western Europe.¹³

Example: If an object is viewed on a “shady” day then it would appear to have a slight dull bluish tint. To counteract this, the user may use the “Shade” setting in the white balance of the camera. This would negate the effect of the environment’s bluish tint by imparting its own reddish hue to it (3000°K)

The “Auto” mode automatically detects the neutral greys in the background of the image and adjusts the white balance accordingly.

The remaining settings require the user to manually observe and adjust the White Balance as required.

GREY CARD CORRECTIONS¹⁴

Capturing the true colours of the teeth in their original form is difficult even after correctly setting the camera.

Even the best camera can produce pictures with errors and can be incapable of recording the true colours consistently.

Despite using the manual settings colours may show alterations in the pictures taken under different conditions. This can be managed by the use of “18% grey cards”.

Using 18% grey cards and performing colour correction may reduce errors in recording colours drastically. This removes any faulty colour casts that may occur due to flashlight, angle, exposure settings, white balance settings etc.¹⁵

A grey card is a simple hard card which is grey in colour and is made using very high-quality protocols.

They are commonly used by professional photographers to capture accurate colours.

It is basically 18% grey and looks like credit cards which can be sterilized in an autoclave.

They are long lasting and almost never lose their colour if maintained optimally.



Fig. 6: 18 % Grey (Left), White (Centre) And Black (Right)

All cameras meter in a manner to achieve a “Mid Tone”. This mid tone is essentially neither too white nor too black.

This enables the camera to achieve a balance between not too white and not too black tones.¹⁶

Neither too white nor neither too black is essentially GREY. This means every camera sees in GREY during metering or aims at achieving a neutral 18 % grey.

While performing shade selection, we keep a 18 % grey card within the confines of the image we are composing. Our objective is to tell our image processing software that in the image we have an area which is 18 % grey.

Once the image is uploaded onto a software, we select the white balance tool and point out to the image processing software as to where 18 % grey colour is present.¹⁷

The software has an inbuilt 18% grey shade. It compares the pointed grey area on the image with its own inbuilt 18% grey.



Fig. 7: Grey Card Correction, Left: Before Grey Card Correction, Right: After Grey Card Correction

If a difference is found between these two shades of grey, the software corrects the image by removing the colour cast.¹⁸

USE OF FLASH LIGHT FOR SHADE SHADE SELECTION¹⁹

Electronic flashes are available in two types:

1. Compact type (mounted onto the camera)
2. Studio flash.

Both the kinds are commonly used as lighting sources for dental photography.

Electronic flashes give out light that is corrected to 'photographic daylight' with a colour temperature of 5,500 K.²⁰

Photographs taken with flash in daylight is ideal for dental photography as compared to just natural daylight.

This is because the three primary colours - red, green and blue, are seen in equal proportion in this colour temperature.

It is important to capture the three primary colours in equal proportions, since all types of photographs including the digital ones use the RGB model to produce the image.²¹

The electronic flash is advantageous to most scenarios since the light produced is predictable, instantaneous, and universally adaptable to any camera model.

Electronic flashes that are mounted onto the camera are available in various sizes and shapes. The types are:²²

1. Ring-flash
2. Unidirectional.



Fig. 8: Ring Flash



Fig. 9: Unidirectional Flashes Mounted In A Bi-Lateral Configuration (Twin Flash)

Ring-flash gives out a uniform burst of light, which is useful for capturing images of difficult-to-access areas like the posterior teeth.

The problem with a ring flashes is that it produces a uniform light burst, creating a shadow-less, flat, bland image which lacks lustre as well as can be seen in *fig.10*²³



Fig. 10: Image Clicked Using Ring Flash



Fig. 11: Image Clicked Using Twin Flash

Ring flash has shown excellent results by providing illumination of the posterior areas of the mouth.²⁴

On the other hand, they fail to provide great results while taking photographs of anterior teeth or aesthetic restorations.

This occurs because the uniform burst of light obliterates the fine detail, translucency, and subtle colour changes within an individual tooth.²³

However, unidirectional flashes produce shadows and highlights, which makes the teeth and gingiva look more three dimensional, with proper contrast and finer details as can be seen in *Fig. 11*.

In the unidirectional type of flash, the flashlight is mounted in a bilateral configuration on a bracket. This set up permits the light to be projected in a desired manner, which depends on the form of the patient's dental arch and the alignment of the individual tooth.²⁵

This configuration gives excellent results when taking photographs of anterior teeth and captures their detailed characterisation, colour, texture, and translucency. This feature is of paramount importance for prostheses in the aesthetic zone.²⁶

Unidirectional illumination can highlight fine details within the same tooth as well, which helps the lab technician to be able reproduce those characteristics in the final prosthesis.²⁷

PROCEDURE²⁸

1. Perform shade selection procedure conventionally
2. Place the shade tab near the tooth with a grey card next to it.
3. Adjust the settings (exposure and white balance) of the camera and click a picture of the tooth, shade tab (showing the shade name) and the grey card.
4. Adjust the settings again and retake the photographs until the image clicked matches the colour and exposure of the tooth, shade guide tab and grey card as seen by the naked eye.

5. The final image is then sent to the laboratory.
6. Additional black and white cards may be incorporated into the photographs which would help the laboratory technicians adjust their monitors. This is done by adjusting the settings of their monitors to match the black, white and grey cards to adequately view the image according to the intended settings.²⁹

SOFTWARES FOR DSLR SHADE SELECTION

Use of certain computer softwares greatly help the dentists and laboratory in achieving better results in shade selection procedures by enabling them to perform tasks that would otherwise be impossible.

The software related tasks should only be performed if the dental photographs were clicked with grey card corrections. Otherwise the use of softwares will result in grave errors.

Computer softwares may be used by the dental laboratories to adjust the image sent by the dentist according to the settings of their computer system using their own grey cards as a reference. Once the dental laboratory receives a dental image with a grey card in it, the laboratory can then adjust their own screen settings until the grey card in the image looks like the grey card they possess.³⁰

These softwares also enable the laboratory technicians to perform their own digital shade selection with the help of a digital library of shade tabs. This digital library can be created by simply photographing the shade tabs with grey card corrections and

storing a copy on the computer. Image editing softwares can then be used to identify the shade tab that possess the colour closest to the tooth used for shade selection.^{31,32}

Further, the digital colour measuring capabilities of these softwares enable the users to determine how close the colour of the tooth is to the selected shade guide tab. And whether any change in shade selection is required.³³

Some of the softwares that can be used for these purpose are:³²

1. Adobe Photoshop (Creative Cloud)
2. Picasa
3. Dentrix Image
4. Image Fx
5. Visora
6. Elements
7. Thumbs Plus
8. Paint Shop Pro (Coral)

CONCLUSION:

The search for an ideal shade selection device capable of perfectly recording the colour of the object and transferring this data to the dental laboratory is still ongoing and much research is needed in this field.

The digital camera greatly aids both the dentist in conveying vital information and the laboratory technician in better understanding this information to fabricate the desired prosthesis. But, both the dentist and the laboratory technician must be well

equipped with the knowledge to use this digital technology.

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- *- Post Graduate Student
 +- Professor
 +++- Associate Professor
- Department of Prosthodontics and Crown & Bridge,
 Manipal College of Dental Sciences,
 Mangalore.
 Manipal Academy of Higher Education (MAHE)

Articulators in current use: A review

Dr. Alisha Ono Idris*, Dr. Tanay Chawda*, Dr. Amrita Bellap*, Dr. Shobha J Rodrigues⁺⁺, Dr. Puneeth Hegde⁺⁺⁺

Abstract

Clinician always tries to aim for ways to simplify the procedures of fabricating a prosthesis and to reduce the time required for it to adapt into the patient's mouth.

The mouth of the patient is often considered as the best articulator. However, it is not mechanically possible to perform many procedures intraorally, which are involved in the construction of fixed or removable prosthesis. Hence, for the convenience of the patient, the dentist and the dental laboratory technician it becomes necessary to use an analogue for jaw movements, the articulator.

Regardless of simplicity or complexity of the articulator, its effectiveness relies on the operators understanding of its features, the accuracy of registering and transferring patients jaw relations and how the operator uses it.

Introduction

The temporomandibular joint has a complex mechanism; it not only permits movements like pivoting, rotating, opening and closing, but it also allows movements of translation and laterotrusion. Furthermore, the structures of the joint are not rigid, precise, and unmodifiable; rather, the muscles, ligaments and bone have a certain degree of elasticity. In accordance with this fact, the clinician has to fabricate a prosthesis that is within the adaptive capacity of this neuromuscular system. So, it is a mechanical device that represent the maxilla, mandible and TMJ. They mainly provide a framework where it is possible to relate, the maxillary cast with the mandibular cast in the three planes of space, relative to the patient's hinge axis and also of the instrument.

"Glossary Of Prosthodontics Terms" 9th edition -

"It is a mechanical device which represents the temporomandibular joint and jaw member to which maxillary and mandibular casts may be attached to simulate some or all of the mandibular movements".

ARTICULATORS IN CURRENT USE

THE GALETTI ARTICULATOR

The Galetti articulator was manufactured in 1950. In this device, plaster is not used to mount the cast but instead, two fixed posts in the front and one adjustable post at the back of the articulator holds the casts in place permitting a rapid mounting. ^[1]

It has fixed condylar guides and do not accept facebow transfer

HANAU ARTICULATORS

In 1921, Rudolph Hanau invented the Hanau-brand articulator. The articulator was designated as Model H and was originally designed for complete dentures.

The Hanau Model M Kinescope (1923)

Later in 1923, he invented another study model, called the “Hanau Model M Kinescope” articulator with two condylar posts on both sides. Here, Bennett angle can be adjusted. ^{[1][2]}

The Hanau Model H Series Articulator (1923)

These models accept face Bow. Horizontal condylar guidance was adjusted by Protrusive inter occlusal record.



Fig. 1

In these instruments, the lateral guidance was set by using the formula $L=H \setminus 8+12$ ^[2]. These were arcon instruments having incisal guide table which permitted wide range of three-dimensional adjustments. (Fig. 1)

The Hanau Model H₂ Series (1958)

This series was developed in 1958. Some models are: Model H₂-O (with attached orbital indicator), Model H₂-PR (with calibrated adjustments to protrude or retrude the condylar balls up to 3 mm, H₂-X (with extendable condylar shaft) and Model H₂ – XPR (combined features of above models), Model 96H₂

Model 96H₂

This is the current model of the original articulator. It maintains most of the features of the model H. The condylar elements are on an axle attached to the upper frame. The

guidance assembly is a closed-slotted system that is a component of the lower member and is fixed at 110 mm. ^[3]

The side shift (Bennett angle) is adjustable from 0° to 30° and is progressive in nature. The horizontal condylar guidance is adjustable from 0° to 75° and is rectilinear in nature.

Model 158 (1977)

The Hanau 158 model was made in 1977. Most of its features are similar to the 96H₂ except that it is an arcon type instrument. A special face-bow is used with this articulator, but it can receive most other face-bows. ^{[3] [8]} The horizontal condylar path can be adjusted from 0° to 60°, and the side shift can be adjusted from 0° to 30°.

Model 165 Hanaumate

It is based on fixed average values incorporated into its design. The condylar element is at 110 mm, 30° horizontal inclination, 15° progressive side-shift, and 10° exclusive inclination on the incisal guide table. ^{[4][5]} The upper member can be detached easily by opening the two locks. It can receive various face-bows. Cast are mounted using quick-release pins instead of mounting plates. There is excellent lingual visibility.

Model 166 Radial Shift (1981)

Arcon type, Fixed Inter Condylar Distance - 100 mm. Horizontal condylar guidance is adjustable from 0° - 60° and has ¾ inch curvature. ^[3] Medial wall has precurrent side shift curvature of 3mm radius which is adjustable from 0-3 mm.

Wide-View Models 183 And 184

The Hanau models 183 (Fig. 2) and 184 are arcon type instruments having similar features. ^[6] The difference being that the

upper and lower frames on the 184 model can be separated.



Fig. 2

The design permits great visibility from the posterior aspect amongst any of the Hanau models. The horizontal condylar path angle can be adjusted from -20° to 60° , and the side-shift angle can be adjusted from 0° to 30° . Both have rectilinear guidances.^[7]

Modular Articulator System

This is a system with a series of interchangeable guidance assemblies. The basic frames of the articulator are produced in two forms, one with a fixed intercondylar width at 110 mm and an adjustable version with adjustable intercondylar width at 100, 110, 125, and 140 mm. The choices include the following:

Adjustable "Bennett" (side shift) - The side shift is adjustable from 0° to 30° , has a $\frac{3}{4}$ -inch radius superior condylar tracking surface, adjustable horizontal inclination from 0° to 90° , and latches.^[8]

HANAU H2-O ARTICULATOR (Programming the Articulator)

Mounting the maxillary cast

The posterior reference points are located arbitrarily by inserting the plastic earpiece of both ends of the facebow into the patient's external auditory canals. The axis-orbital plane is established by connecting the posterior reference points to the anterior

reference point. The orbital indicator is positioned on the patient's right side to contact the right orbitale point. The prongs of the registration fork are warmed over a flame and inserted into the wax occlusion rim. The width of the facebow is adjusted so that the condylar rods are symmetrically placed in their contact with the posterior reference points. Subsequent equalized adjustment of the rods to the articulator condylar posts will maintain the symmetry of the mounted maxillary cast.^{[9][10]}

Before mounting the casts, the articulator should be adjusted. The protrusive condylar guidances are set at 30° , the lateral condylar posts at 15° , the incisal pin to 0, and the incisal table is locked in a horizontal position.

Both centric locks should be tightened so that the condylar elements do not move. After transferring the facebow to the articulator, the condylar rods are adjusted equally to engage the condylar posts. The tip of the orbital pointer is brought into contact with the under surface of the axis-orbital plait indicator attached to the upper articulator frame. The facebow height is adjusted by turning the elevating screw under the lock clamp for the registration fork. A cast support is adjusted to protect the occlusal fork from any distortion caused by the weight of the maxillary cast and the mounting dental stone/plaster. Minimal expansion slurry-activated stone is added to the cast to complete the mounting procedure.^[11]

Mounting the mandibular cast

The tentative centric relation registration is made with a pressureless impression paste such as zinc oxide eugenol or any rubber based impression material. Initially, the

upper wax rim is indexed with several V-shaped notches. The lower wax rim is reduced approximately 1.5 to 2 mm and then cross-hatched with a blade to form undercuts on the wax surface. After the registration is made, both baseplates are removed and seated on their respective casts. The incisal pin is set to 0 and both casts are related through the zinc oxide paste record. Minimal-expansion stone is added to the base of the mandibular cast and the articulator is closed.

Adjustment of the articulator

The protrusive occlusal record is used to set the instrument guides. An extraoral tracer can be attached to the wax occlusion rims with the central bearing plates set at the desired vertical dimension. The patient is encouraged to make various border movements like protrusive, right and left lateral movements while the pin touches the recording plate with light pressure. With the extraoral tracing assembly, the clinician can visualize the apex created that indicates centric relation^[10]. An accurate record can be made by injecting quick-setting stone between the occlusion rims while the patient maintains the centric relation position. This record can be used to verify the tentative centric relation or for remounting to a new relation.

The protrusive occlusal record is also made with stone as the patient maintains the mandible approximately 6 mm forward of centric relation as determined by the tracing. The record helps in relating the split maxillary cast to its mounting stone base^[12]. The condylar thumbscrews are loosened, and the incisal pin is raised. With the casts firmly seated in the stone protrusive record, the slope of the condylar path is adjusted until the cast is accurately keyed to the

mounting base. After recording the horizontal condylar guidance, the formula $L = H/8 + 12$ is used to calculate the lateral condylar guidance. According to Hanau, this formula has been used satisfactorily in determining the lateral inclinations since 1922. In the formula, L = lateral condylar inclination in degrees and H = horizontal condylar inclination in degrees as established by a protrusive relation record. The lateral condylar posts are rotated to the desired angulation in degrees and this position is maintained by tightening the thumbscrews.^[13] The approximate Bennett angle is determined and recorded.

WHIP MIX ARTICULATORS

The Whip-Mix Articulator

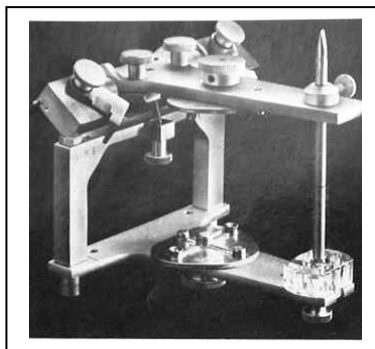
In 1964, Charles E. Stuart designed the Whip-Mix articulator. It is a semi adjustable arcon type which is a simpler version of Stuart's fully adjustable articulator. The condylar element of this instrument can be adjusted in the vertical and horizontal axis but not in the sagittal axis.

Several models of Whip Mix articulators are available that vary slightly in dimensions and their capabilities.

The Whip Mix Model 8500

The condylar elements that are present on the lower member can be adjusted to three positions. The narrowest intercondylar position is 96 mm, the intermediate distance is 110 mm, and the widest distance is 124 mm. The condylar guides in the upper frame are aligned with the condylar elements of the lower frame by either removing or adding the appropriate number of spacers on the shaft of the condylar

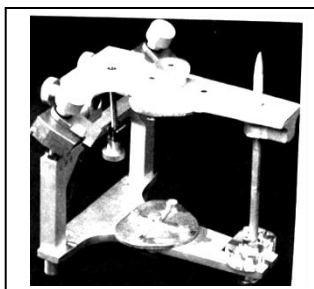
guides. The condylar guides are adjustable from a 0° to 70°. The medial walls can be adjusted from 0° to 45° to provide a progressive side shift. (Fig. 3)



(Fig. 3)

The Whip Mix Model 8800

In this instrument there is an extra ½ inch space for the mounting of maxillary cast. It is useful in conditions with extremely steep occlusal plane or in the presence of any osseous defect of the maxilla. Model 9800 is a combination of the upper member of model 8800 and lower member of model 9000. This provides greater distance between the upper and the lower members. (Fig. 4)



(Fig. 4)

The Whip Mix Model 8300

This articulator was made by Lundeen, Wirth, Lee, and others. There are ¾-inch curved superior walls of the condylar guides along with immediate side shift adjustments from the range of 0 to 4 mm and a progressive angle of 7½° on the medial wall.

It has a condylar locking screws, a centering guide pin, and the condylar elements are fixed at 110 mm.

Whip Mix Model 8340

It offers a modified version of the model 8300 articulator that allows interchangeability of casts between articulators.

Every articulator is manufactured with a specific mounting plate table attached to its lower member with a specific fixture called the Accumount. The relationship between the upper and lower frames is then individually checked to verify precise alignment.

Whip Mix model DB 2000 and DB 2200

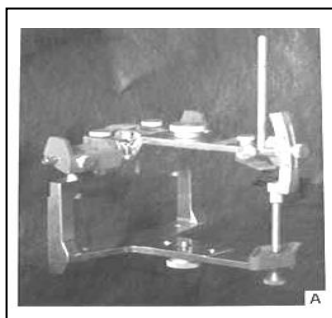
They are the latest articulators which also have an interchangeable 2240 model. All three instruments show an entirely new ergonomic upper and lower frame design.

PANADENT ARTICULATORS

A series of statistically selected three-dimensional analogs of condylar axis motion has been developed. The analog fossae have a curvilinear protrusive and mediotrusive paths of approximately ¾-inch radius.

There are five pairs in the set with side shifts of 0.5, 1.0, 1.5, 2.0, and 2.5mm and a 6° progressive angulation.

The Panadent articulator was designed in 1978 and the introduction to the current models were done in 1983. The most prominent change in the latest models were the presence of a mechanical latch. This latch holds the upper and lower members together yet allows it to open at 180° movement. (Fig. 4)



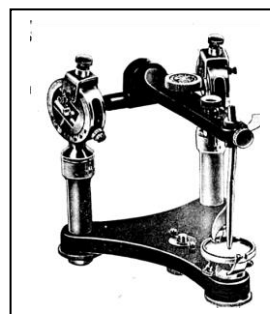
(Fig. 4)

The articulators use ¼-inch condylar elements, instead of the usual ½-inch size, which are fixed at a 110-mm distance. There are three models—SL, PSL, and PCL. The system was designed to select the correct analog and to determine the condylar path inclination with an extraoral quick analyzer tracing device.^[14]

DENTATUS ARTICULATORS

This brand of articulators is manufactured in Sweden. All the models are axle-type instruments so that the condylar element can make rectilinear movements within a slot present in the condylar assembly. The ARH, ARL, ARS, and ARD models have the condylar elements as part of the upper frame and the condylar guidance on the lower frame.

The ARH model (1944) has all the features of the ARH model plus a gauge block to ensure basic measurements for coordinating work between dentist and laboratory articulators. The ARH is the original Dentatus articulator. It has orbital indicator, adjustable condylar guidance from -60° to $+60^{\circ}$ and has a sideshift adjustable from 0° to 40° . (Fig. 5)



(Fig. 5)

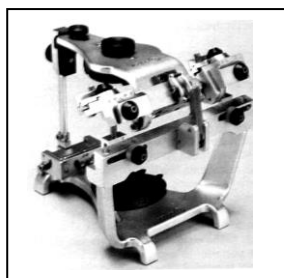
The ARL model (1958) This non-arcon model was introduced in 1958. It has calibrated condylar axis rods which can be used with a hinge axis technique. condylar guidance is adjustable from -60° to $+60^{\circ}$ and has a side-shift angle of 0° to 40° , calibrated anterior stop screws, calibrated axis extension rods, an adjustable metal incisal guide table, and a curved incisal guide pin.

The ARS model has fixed condylar guidance features of 30° tract inclination with a 15° Bennett angle and auditory pins to receive an ear face-bow. The guidance slot is open on the posterior aspect which lets the upper frame separate from the lower frame.^{[15][24][25]} It has a flat and a 10° incisal guide table.

DENAR ARTICULATORS

The Denar Model D4a Articulator (1968)
In 1968, Niles Guichet developed this articulator. It is programmed using tracings that are recorded by a pneumatically controlled pantograph.

DENAR D5A- This is the current model which is a refinement of the original one (Fig. 6). Guidance can be adjusted in all three planes of space.



(Fig. 6)

The side shift (Bennett Movement) adjustment is in the medial wall and can record both immediate as well as progressive side shifts. A precurrent (angular) insert for the medial wall and inserts for superior wall is also available which are made of nylon or acrylic resin.

In various articulators, anatomic landmarks are utilized to establish the anterior and posterior reference points. Hence the Denar Reference Plane Locator and Marker are used to relocate the anatomic reference points accurately. [16][17]

Denar Mark II (1975) - This articulator was introduced in 1975 (Fig. 7). It is a two-component instrument with a positive locking mechanism which holds the upper and the lower member together and permit 85 degrees of hinge movement. The horizontal condylar inclination is adjustable from 0° to 60°. Immediate side shift (Bennett) is adjustable from 0 to 4 mm and progressive shift is adjustable from 0° to 15°. Intercondylar distance is fixed at 110 mm but an adjustable intercondylar distance apparatus (110-122 mm) is also available.



(Fig. 7)

The posterior fossa wall has a 25° posterior inclination which permits the rotating condyle to move backward as it moves outward during lateral side shift. A straight rear wall option is also available. [18][19]

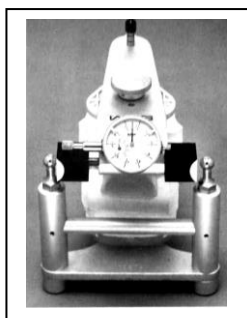
The Omni Articulator was introduced in 1984. This articulator can convert from closed track fossa to open track fossa using a positive locking latch. This feature fulfills the requirements for the fabrication of removable, fixed and complete dentures in one articulator. The Omni model is adaptable to a wide range of accessories of other models that can maximize its versatility.

SAM ARTICULATORS

This German articulation system is durable, stable, and precise. One aspect of its popularity is the ability to interchange mounted casts from one instrument to another.

The SAM 2 articulator (Fig. 8) has three interchangeable condylar housings that incorporate different curvatures to the superior wall. The curved surface produces a relative change of inclination, depending on the character of the curvature. [20] For instance, with housing 1, set at 45° at 3-mm protrusion, the angle will be 50°. With housing 2 set at 10 mm, the inclination will be 45° and with housing 3, set at 30° and at 3 mm advancement, the angle will be 55°.

The face bow is very similar to the ear-bow by Whip-Mix and Panadent. [22][23]



(Fig. 8)

VIRTUAL ARTICULATORS [27]

Virtual articulators are commonly known as “Software Articulators”. They are not mechanical devices, but they exist as computer software or program. They consist of virtual- condylar and incisal guide planes. A device called the Jaw motion analyzer is used to measure patient parameter precisely which are then transferred to the system. Similar to an average value articulator, some articulator software is set with average values to determine the guide planes.

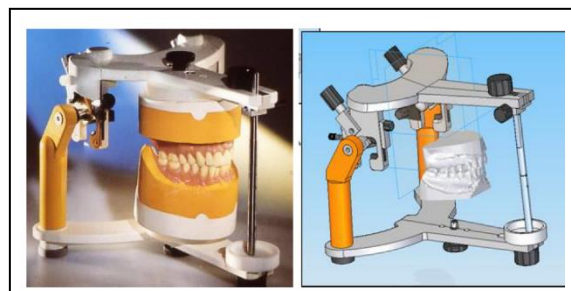


(Fig. 26)

Virtual models based on mechanical dental articulator (Fig. 27):

Its introduction was done in 2009. The concept was to develop various virtual articulators based on the mechanical models. By this the operator can choose which parameters are to be registered from the patients and can be used to compare the virtual and mechanical articulators for their adequacy. It is known for its simplicity which makes it easier for the user to choose

an appropriate articulator for jaw simulation.



(Fig. 27)

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*- Post Graduate Student

++- Professor

+++ - Associate Professor

Department of Prosthodontics and
Crown & Bridge,

Manipal College of Dental Sciences,

Mangalore.

Manipal Academy of Higher Education
(MAHE)

SOCKET SHIELD TECHNIQUE: A REVIEW

Dr. Amrita Bellap*, Dr. Tanay Chawda*, Dr. Alisha Ono Idris*, Dr. Umesh Y Pai⁺⁺

Dr. Shobha J Rodrigues⁺⁺

ABSTRACT : In order for an implant to be successful , osseointegration of the implant with the bone is required, which is possible only if there is adequate bone .After a tooth has been extracted several changes occur during the healing of the extraction socket followed by the continuous resorption of the bone due to loss of the periodontal apparatus and the blood supply. In an aesthetic zone , the resorption of the buccal bone followed by shrinkage of the soft tissues made it difficult for clinicians to restore the aesthetics.A novel technique was described in 2010 by Hurzeler et al who proposed a Partial Extraction Therapy , wherein only the lingual section of the root was to be extracted and the buccal bone was to be kept intact with the periodontium , this technique allowed clinicians to improve the esthetics and prevent the shrinkage of the hard and soft tissues. This review article aims to explain the socket shield technique and the rationale for it.

Key words: immediate implant, socket shield, buccal bone.

Introduction:

A technique of preserving the root fragment while extracting a tooth, especially the vestibular portion of the coronal 2/3r third of the root was first introduced by Hurzeler et al and it was referred to as the ‘socket shield technique’¹

This technique is a part of the classification of partial extraction therapy

Socket shield technique (SST) can be defined as part of the root is left attached to the labial bone, which aids in maintenance of the labial bone and soft tissue architecture. The labial root fragment is referred to as the ‘shield’ through all the chapters. An implant is placed in the palatal part of the socket in the same surgical appointment to support a restoration”²

The main aim of this technique is to preserve the blood supply and prevent the

loss of the periodontium, thereby keeping the buccal bone and bundle bone intact in order to prevent resorption

The buccal bone has bilateral blood supply from the gingiva above and the periodontium below. Once a tooth is extracted, buccal bone is deprived of the blood supply from socket side and this result in the loss of some buccal bone. The root section preserves the periodontium which consists of periodontal ligament (PDL)and its fibers, blood vessels, root cementum, bundle bone, and alveolar bone. The root fragment provides support to the buccal tissues and prevents the contraction as it is vital and will prevent any further remodelling to occur.

A modern technique was introduced by Baumer et al for preserving the hard and soft tissues and avoiding their shrinkage after loss of a tooth , without using any

regenerating materials with the use of an implant being placed immediately whilst retaining the buccal segment of the root.³

Only the sectioned buccal root is used to preserve the tissues along with an immediate implant being placed. The gap between the buccal section of the root and the implant may be filled with materials that resorb slowly. Teeth with relatively poor prognosis and may be considered for this procedure.

One of the major goals of prosthetic rehabilitation is to achieve and maintain the harmony between the pink and white zones especially in the aesthetic areas. Atraumatic extraction of a tooth with immediate implant placement was found to result in the loss of buccal bone, both vertically and horizontally as well as flattening of the interproximal bony scallop resulting in a complicated rehabilitation

The loss of supporting bone followed by the apical migration of soft tissue results in unesthetic black triangles between teeth. This creates a very challenging situation to a clinician in restoring the missing tooth with restoration having an acceptable esthetics, especially in the maxillary anterior region

Many preventive procedures such as ridge preservation procedures, and post collapse of the ridge procedures, such as bone augmentation, soft-tissue augmentation, or a mix of both, have been used in the past to compensate for this loss of bone and soft tissue.

After the extraction of a tooth immediate implant placement has been proven to be a viable and successful method. By comparing the success rate of both the immediate implants and delayed implants

, studies show that at least 1mm of recession will be seen in the the facial gingiva after an immediate implant is placed.

The recession was observed to be far greater with gingival biotypes that were thin.

The recession of the facial gingiva and the subsequent collapse of the ridge can present itself as a disaster for restoring aesthetics in the anterior maxillary region.

Aesthetics that have been compromised can be camouflaged to a certain degree in cases with gingival biotypes are thick and also patient with lip line that is relatively lower. However a failure of restoring the aesthetic demands of the patient can be seen in cases where several implants are to be placed and tissue available is insufficient and also in patients that have a high lip line and the gingival biotypes are thin.

The ‘socket shield technique’ has proven to be a good treatment alternative in order to manage the risks that are involved while restoring the aesthetics and prevent the shrinkage of the tissue after the tooth has been extracted

PRINCIPLE OF THE SOCKET SHIELD TECHNIQUE :

If a section of the buccal part of the root is preserved along with its entire periodontal apparatus then the body is misled into thinking that the root is still present and the gingiva and the bundle bone continue to receive their blood supply. This phenomenon is often known as “biological cheating”⁴

This biological cheating is the basic principle of the “Socket Shield Technique” and its variations.

CASE SELECTION :

Proper clinical assessment and a study of the radiograph must be done correctly in order to select a case for the SST procedure.

The parameter involved in the clinical assessment are⁴:

- ✓ Lip line
- ✓ Free gingival margin and Position of the tooth
- ✓ Gingival Biotype
- ✓ Interproximal height of the bone
- ✓ Space that is available for the restoration
- ✓ Infection at the site of the implant

A.LIP LINE

The lip line has been classified as:

- ✓ High
- ✓ Average
- ✓ Low

It is more difficult to achieve good esthetics in patients with higher lip lines as there is more display of the tooth and gingiva , thus posing as an obstacle for the dentist while providing the restoration. ⁶



- ✓ A low lip line is more preferable as the interface between the soft tissue and teeth wont be seen when the patient smiles.



B) Free gingival margin(FGM) and position of the tooth :

- ✓ There is a lower chance of the esthetics being compromised if the FGM is more coronal as any minor recession wont be seen as evidently. ⁶⁻⁸

C) Gingival Biotype

- ✓ A Thick gingival biotype is preferred over a thin one as recession post extraction is seen more evidently in thinner biotypes of the gingiva. ⁶⁻⁷

D Interproximal Height of Bone :

- ✓ In order to maintain an intact interdental papilla the height of the bone available interproximal plays a crucial role.
- ✓ A reduced height will cause the formation of a triangular dark space in between the tooth and the implant and thereby compromising the esthetics. ⁹⁻¹¹

E)Infection at Site of implant:

- ✓ Any periapical infection at the site of the implant can be risk and lead to complications after the surgery such as mobility in the shield . ¹²

F)Space available for the restoration :

In order to provide a good definitive prosthesis the space required for :

- ✓ Screw-retained prosthesis: 5mm
- ✓ Cement retained prosthesis:8mm



Sufficient space for restoration



Insufficient space for restoration

Classification of the Socket Shield

Technique:²

Based upon the location of the shield in socket.

TYPE		LOCATION
TYPE I	Buccal shield	In buccal part of the socket, between proximal line angles of tooth.
TYPE II	Full C buccal shield	In buccal part and the interproximal part on both sides of the socket.
TYPE III	Half C buccal shield	Lies in buccal part and one of the interproximal part
TYPE IV	Interproximal shield	Lies only in mesial or distal part of the socket.
TYPE V	Lingual-palatal shield	Lies on the lingual or palatal side of the socket.
TYPE VI	Multiple buccal shields	Two or more shield in the socket.

Indications

1. To support and preserve buccofacial bone plate of extraction socket in cases of immediate implants.

2. Socket shield technique is indicated in vertical fracture of teeth without pulpal pathologies, where preservation of the tissue and aesthetics is a priority.

3. To preserve papilla between the dental implants.

Contraindication

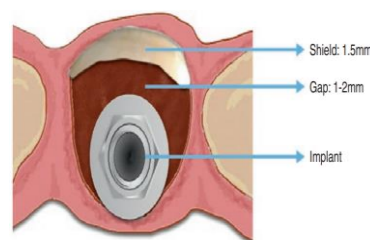
- Loss of buccal bone due to vertical fracture
- Loss of buccal bone due to periodontitis
- Caries on root fragment to be retained.
 - Teeth that are mobile.
 - Teeth that are present outside the arch

Diagnostic Tools for SST :

- ✓ IOPA
- ✓ CBCT

Guidelines for Preparation of the shield :

- ✓ Preparation of the shield requires extensive planning, any errors that occur due to improper planning of the shield can lead to failure in the long term.



Occlusal view of the dimensions of the shield, and the gap that must exist between the shield and the implant.²

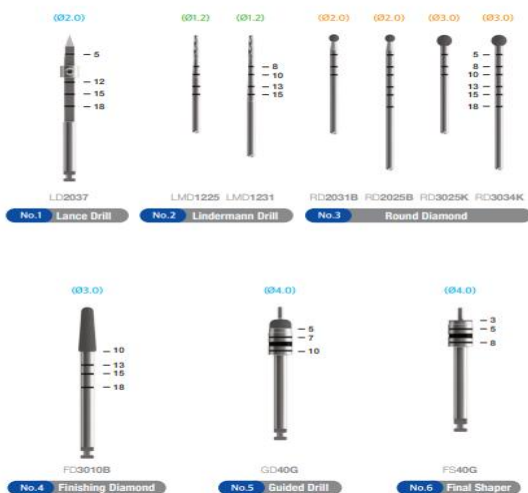
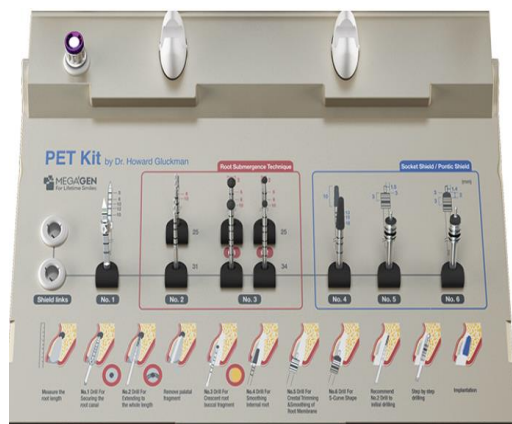
- ✓ While preparing the shield ,complete debridement of the shield must be done.
- ✓ The shield has to be stable through the procedure as any mobilization of the shield will lead to resorption or extrusion of the shield
- ✓ There should be no contact between the shield and the implant.
- ✓ The thickness of the shield plays a crucial role and it must not be made too thin as that would cause it to easily detach from the bone and must also not be extremely

thick as it would present as a hindrance while placing the implant

Instruments



Long shank carbide drill Round diamond Football shaped diamond



Clinical Steps of Surgical Technique

Under local anaesthesia, following procedure is carried out:

- Sectioning of the root (partial extraction).
- Shield preparation.
- Implant placement.
- Management of the gap.
- Suturing

First step is the sectioning of the root wherein a flap is raised, however research has shown that by doing so, it would cause the periosteum to separate from the bone and then cause resorption due to the lack of blood supply, thus a flapless approach is preferred.¹³⁻¹⁴

The choice of raising the flap would not affect the SST as a section of the root is left intact with its periodontal attachments.¹⁵

This procedure is done using a carbide bur with a short shank to first section the tooth and then a long shank carbide bur is used to section the buccal and palatal part of the root.

This sectioning can be done using the root canal space as a guide and an apex locator may be used to prevent damage to the bone.

The drill is made in a labial direction in order to achieve a clean section mesiodistally.

The palatal section is then extracted by placing an elevator between the palatal bone and the palatal section .The elevator must never be placed between the buccal section and the palatal section as it can cause fracture of the shield.

At no point, should the labial bone be perforated.

2) Preparation of the shield

After the palatal section of the root is extracted a gingival retractor should be placed in order to protect the soft tissues and preventing the tattooing of the soft tissue due to debris that is left behind.

A diamond round bur is first used to reduce the shield to level of crest of the bone. The thickness of the shield is reduced till it is 1.5mm.

While placing an implant in the mandibular anterior region the thickness of the shield should be less than 1.5mm to allow an implant that is narrow in its diameter to be placed.

The shield length must follow the contour of the labial bone and extend from the mesial to the distal line angle. The thickness of the shield in the middle must be thin in order to prevent any contact with the implant and also avoid any unnecessary pressure on the shield.¹⁵⁻¹⁶

A bevel or S-shaped profile on the inner side of the shield is given to accommodate the restorative components and give a good emergence profile when the crown is placed.

There should be no contact in between the temporary crown and the abutment with the prepared shield.



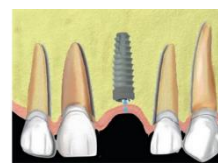
Trajectory for placing an implant based on the radial position of the tooth⁴

After the shield is prepared, any residue of the tooth must be removed by flushing the socket with saline and an IOPA can be taken to ensure all the remnants are removed.

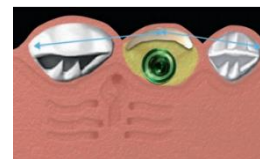
3) Placement of the implant:

In order to achieve optimum emergence in the final prosthesis it important to place a 3-D implant in the:

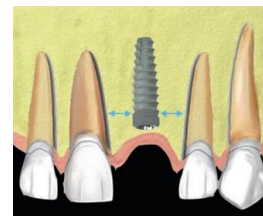
Coronoapical position⁴



Buccal-lingual position⁴



Mesial-distal position⁴



When an adequate amount of palatal bone is available then the osteotomy is 3-4mm apical to the crest of palatal bone.¹⁷ Gluckman et al. have suggested guidelines for selecting point of entry in the socket for immediate implant being placed¹⁸

Based on their classification for radial plane position of the tooth, the implant trajectory can be planned

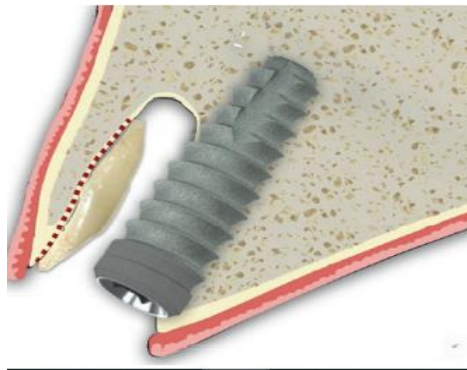
The osteotomy is always begun from the palatal wall of socket, it is never started

from the apex of the socket if the tooth is facially positioned and the labial bone is thin as this would lead to the implant being too close the shield.

The shield must not be perforated during the osteotomy with the drill.

A space of atleast 1-1.5mm must be present between the implant and shield.

In order to achieve proper primary stability from the periapical bone , the length of the implant should be 2-3 mm from the apex



Final position of the implant

4) Management of the space between the implant and the shield :

In order for new bone to form there should a blood clot in between the implant and shield.

A good seal must be crested with the temporary restoration or the healing abutment in order to prevent the soft tissue infill into the gap.¹⁹

In cases of the presence of a large gap in between the shield and the implant then a

alloplast may be used to enhance the bone formation as it provides itself as frame.

5) Closure :

In order to close the socket and protect the implant, the closure can be done in four ways :

- 1) Placing a healing abutment:
The easiest way to protect the impant is to use healing abutment when a temporary restoration is planned.²⁰⁻²²



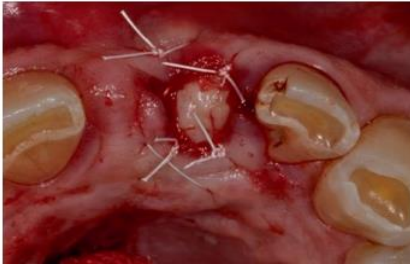
Healing abutment

2)Customized healing abutment :

This method can be used when a provisional restoration is not plannedand the customizing the healing abutment will lead to development of the soft tissue .²³



- 3). Placing a cover screw : if there is poor primary stability of the implant, the clinician can submerge the implant after which the seal can be achieved by taking a graft from the tuberosity or the palate. A seal is achieved with a piece of free gingival graft from the palate or tuberosity which is sutured around the periphery of the socket ²⁴



4.) Using a provisional crown that is screw retained :

If the occlusion is stable for providing a good fixed restoration then this method can be chosen provided there is primary stability of the implant. This method will also help in maintaining the contour of soft tissue for the final prosthesis .



Advantages

- a. Resorption of the lamellar bone can be avoided, if the implant is placed touch with the buccal root fragment and thereby preventing the shrinkage of the tissues and the bony structures
- b. Preservation of peri-implant tissues.
- c. buccal shield that is insitu will act a guide while placing the implant in correct position.
- d. Complete osseointegration can be achieved by this technique.
- e. Prevents formation of fibrous tissue around implant.

F. Minimally invasive

I . Reduces the need for graft materials

Disadvantages

- a. Due to developing or existing periodontal infections, resorption can be seen of the root fragment that has been retained
- b. Technique sensitive.
- c. If not handled with care, it can lead to the lamellar bone in the buccal area to be displaced.
- d. Long term presence of the buccal shield has not been found so far.

Complications:

1. Incomplete sectioning:
While sectioning of the root is being done sometimes the palatal root may get extracted without the apex.
This can be rectified by trimming the apex of the root with the help of a bur that has a long shank .
2. Mobility of the shield:
If the labial shield becomes mobile during sectioning of the tooth it is advised to completely extract the tooth and simply place an immediate implant .²⁵
3. Labial fenestration:
In case of a labial fenestration being created close to the apex ,an esthetic buccal flap can be made in order to access the fenestration and it can be grafted.
4. Inability to achieve stability of implant:

In case of poor stability of the implant , a provisional restoration can be made immediately so that the implant is

submerged inside and the socket can be sealed by using an free gingival graft.

5. Spinning implant:

A staged implant placement is done in case the stability of the implant is extremely poor and the implant is spinning and the osteotomy that was prepared can be filled using biomaterials.²⁵

CONCLUSION

The clinician should be specially trained and must have experienced clinical skills. The procedure requires a little more time and patience to avoid mobility in the shield.

The case selection is very important for the success of the procedure. The intactness of the shield has a crucial role in ensuring the success of the treatment.

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*- Post Graduate Student

++- Associate Professor

+++ -Professor

Department of Prosthodontics and Crown
& Bridge,

Manipal College of Dental Sciences

Mangalore.

Manipal Academy of Higher Education
(MAHE)

Special Considerations In Fabrication Of Single Complete Denture In Maxillary Arch - A Case Report

Dr. Saba Anjum*, Dr. Prakash Nidawani**, Dr. Girish Galagali***, Dr. Harsha R.H**, Dr. Ansu Elizabeth Blessan*

ABSTRACT: Controlling resorption and reducing discomfort is a major challenge in construction of a single complete denture (SCD). It is not a simple process; it requires complete understanding of necessary alterations needed in successful fabrication of tissue supported prosthesis against bone embedded natural dentition. Achieving harmonious occlusal contacts and harmonious natural occlusal plane in opposing natural teeth is primary objective of this restorative procedure to facilitate stability of single complete denture and thereby facilitate ease of mastication. Several other problems are also encountered during function and serviceability of denture while opposing natural teeth like, repeated fracture of denture base, fast wear of denture teeth etc. Reinforcement of denture base and denture teeth are also important considerations in this type of prosthetic rehabilitation procedure. This article discusses standard protocols and describes step by step fabrication process of maxillary single complete denture against partially edentulous mandibular jaw restored by fixed partial denture.

Key Words: Single CD, occlusal plane template, reinforcements of denture.

INTRODUCTION:

Edentulous maxilla opposing mandibular dentition in such situation unmodified mandibular dentition prevents occlusal balance during function leading to repeated denture fractures causing functional insufficiency, compromised esthetic and financial burden on its users for its repair or refabrication^{1,13}. Dentures opposing natural teeth leads to abrasion of the artificial teeth.² Recurrent Midline fracture is most common in both the upper and lower dentures (more than 60%) and loss of vertical dimension.¹³ Lower natural teeth many times have unfavorable tooth inclinations due to supraeruption, rotation, abrasion, fracture of teeth that will show undesirable directions of force on the upper denture will result in the inflammatory reactions or resorption of the

bone.⁵ If no attempt is made to modify the occlusal morphology of the natural teeth by planned alteration for achieving occlusal harmony then denture will receive forces that may exceed the physiologic tolerance of the maxillary residual ridge tissues^{3,4}. When the opposing natural dentition is not in a normal plane of occlusion George Monsoon proposed that mandibular teeth should be arranged to close around a sphere of 4-inch radius.^{6,7} Curve of Monsoon helps to achieve ideal curve of occlusion in which each cusp and incisal edge moves along the surface of a imaginary sphere with eight inch diameter having its center at the region of the glabella. Various tools and methods that have been described to evaluate and correct the occlusal plane namely Broderick's occlusal plane analyzer, Yurkstas metal

occlusal template and custom made occlusal plane template⁶ Reinforced dentures with metal bases are occasionally used in rehabilitation of edentulous patients most commonly in cases where there is more risk of fracture.⁸

DIAGNOSIS AND TREATMENT PLANNING:

CASE REPORT:

- A 68 years old male patient reported to Navodaya dental college dept Of prosthodontics with the chief complaint of broken maxillary denture and desired for new denture. Patient lost maxillary teeth since 2yrs and wearing denture since then. The present denture broken twice during this period. He has been on anti-hypertensives since a year. Old maxillary denture revealed multiple midline fractures with repairs having stained and worn out teeth.



Fig.1

- The denture was having dark brown stains and shiny tissue surfaces indicating vigorous brushing while cleaning his dentures with dentifrices. Intraoral examination

revealed edentulous maxillary arch and dentulous mandibular arch with anterior canine to canine porcelain fused to metal bridge, the remaining teeth were irregularly worn out, tipped with general gingival recession.



Fig.2

- Various treatment options including dental implants was explained to the patient and implant option was ruled out because of financial constraints and consent.
- Treatment plan was derived to fabricate a new metal base maxillary single complete denture after modifying lower irregular occlusal surfaces of natural teeth on cast by using occlusal template and transferring the corrected surface anatomy intraorally with clear acrylic splint and pressure indicating paste. Amalgam plugged on occlusal surface to increase the teeth wear resistance.

CLINICAL AND LAB PROCEDURES

- Primary impressions of maxillary and mandibular arch were made using impression compound and alginate

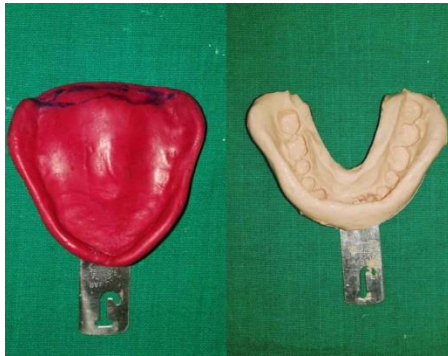


Fig.3

- and casts were obtained. Upper arch border molding & final impression was made



Fig.4

- to fabricate working cast record base and wax rim was fabricated on this cast and tentative jaw relation recording done. Upper working cast was mounted on semi adjustable

articulator using face bow with orbital pointer



Fig.5

- lower diagnostic cast related to the upper cast by interocclusal record medium zinc oxide eugenol at established vertical dimension and lower cast mounted
- Buccal and lingual position of lower teeth evaluated and decision to articulate central fossa of the denture tooth to buccal cusp of natural tooth was made

Occlusal plane correction of natural teeth using occlusal plane template (OPT-transparent acrylic plate having uniform convex lower surface) mounted on the articulator upper jaw member by replacing maxillary cast and OPT lowered till it touches the occlusal surface of lower teeth. The interfering cusps were reduced using sharp carver until uniform contact of OPT is achieved.



Fig.6

On the modified occlusal surface clear acrylic template was fabricated as per Bruce's technique.



Fig.7

Intra oral occlusal modifications done using clear acrylic template coated with pressure indicating paste as a guide.



Fig.8

Modified lower natural teeth impression was made with irreversible hydrocolloid and die stone working cast obtained. Against the lower working cast teeth arrangement was done in centric relation. Protrusive and lateral interocclusal records made at wax denture try in, which were used to program the articulator and upper posterior teeth were balanced. In the present case enough, horizontal overlap allowed freedom to balance in eccentric excursion and still maintain esthetics.



Fig.9

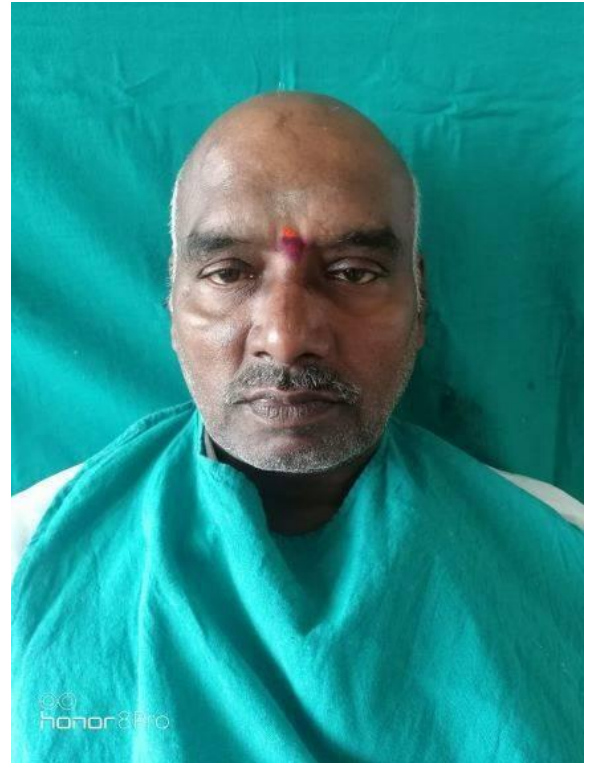
at wax denture try in stage maxillary metal denture base try in was done to confirm the adaptation and extensions.

Then final denture fabricated using compression molding technique, In the finished denture occlusal surface cavities were prepared for high copper amalgam. Two color centric and excursive articulating paper tracings marked and amalgam cavity outline prepared to include all tracing with minimum 5mm depth.



Fig.10

Once the condensed amalgam is in plastic state intraorally lower teeth closed in centric and eccentric movements carried out thus centric holding area and some excursions are engraved in amalgam functionally.



Pre-Treatment

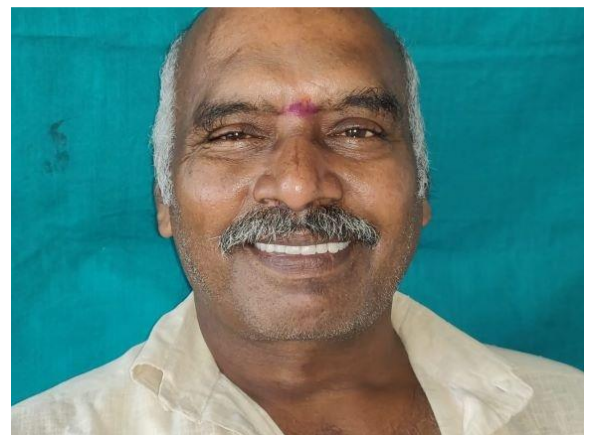


Fig no.11 post treatment

Post insertion instructions for proper hygiene maintenance is given to the patient and periodic recall was scheduled.

DISCUSSION

In spite of advancement in implant supported treatment options PMMA based single maxillary complete denture is first choice of treatment for many restorative dentists who treats such patients in Indian scenario.¹⁴

Age, general health compromises, lack of awareness of oral condition, additional time required, poor economic status, and fear of additional surgical procedures preclude patients from giving consent for implant supported treatment. This patient despite desiring for solution to present problems could not be taken up for implant supported prosthesis due to financial constraints, Considering the time and inconvenience involved along with money spent in frequent visit for denture repair option of providing reinforce to denture base was considered. many reinforcement techniques for denture bases like incorporating poly ethylene fiber, carbon fiber, rayon fiber, or addition of nano particles are reported in literature⁸ Metal base was chosen in this case which has following advantages over other materials like

1. Superior adaptation to tissues with low volume change
2. Ease of

3. Bacteriostatic surface – as ionization and oxidation surface no adhesion salivary mucin and bacterial enzymes
4. Stimulation to underlying tissues – temperature of food beverages and breathing air interchanges to underlying tissues.
5. More acceptable – can be cast in thinner sections with adequate strength unlike with resin base so increase more weight of metal can be neutralize by thin sections⁸

Disadvantage of unaesthetic appearance and non-adjustability was taken care by providing acrylic at borders and pps area. Although preferred occlusal materials are metal but are expensive and time consuming, less chair side time consuming, economical amalgam inserts chosen to reduce occlusal wear rate in the present case after acrylic teeth have been modified and balanced as in Fig.10 and the only disadvantage using amalgam stops is their esthetic unacceptance.^{3,9}

CONCLUSION:

The present case deals with oral rehabilitation of maxillary arch

- Reinforced denture base with cast metal frame incorporating metal plate and improve longevity of the prosthetic replacement at the same time prevent resorption of the underlying residual ridge

- Occlusal corrections of natural opposing arch using OPT Transferring jig using pressure indicating paste.
- Reinforcement modifications in occlusal surface material with amalgam plugs is been made to reduce the occlusal wear.

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IMPLANT PLACEMENT PROCEDURE –ONE STAGE VS TWO STAGE

Dr. Amritha Chandran*, Dr.Sunil Dhaded**

ABSTRACT: -Implants have been proven to be viable treatment options for the replacement of missing tooth .The procedure of placing an implant can have a direct role in the overall success of the implant. Implants can be placed penetrating the oral mucosa (1-stage procedure) or can be completely buried under the oral mucosa (2-stage procedure) during the healing phase of the bone at the implant surface.¹ This article is a review comparing one stage and two stage surgical implant placement and to evaluate whether a one stage procedure is as effective as the conventional two stage procedure.

Key words :- one stage procedure ,two stage procedure ,implants

INTRODUCTION :- The goal of modern dentistry is to restore the patient to normal contour ,function,comfort, esthetics ,speech and health,whether by removing caries from a tooth or replacing several teeth.²

What makes implant dentistry unique is the ability to achieve this goal ,regardless of the atrophy ,disease,or injury of the stomatognathic system .However the more teeth the patient is missing , the more challenging this task becomes .As a result of continued research ,diagnostic tools ,treatment planning ,implant designs ,materials and techniques ,predictable success is now a reality for the rehabilitation of many challenging clinical situations .

The increased need and use of implant related treatment results from the combined effect of several factors ,including

- Aging population living longer

- tooth loss related to age
- consequences of fixed prosthesis failure
- anatomic consequences of edentulism
- poor performances of removable partial dentures
- consequences of removable partial dentures
- Psychological aspects of tooth loss and needs and desires of aging baby boomers

8)Predicable long term results of implant supported prosthesis.

9)Advantages of implant supported restorations

10)Increased Public Awareness

Implant Procedure Techniques

Implants may be placed penetrating the oral mucosa (**1-stage procedure**) or can be completely buried under the oral mucosa (**2-stage procedure**) during the healing phase of the bone at the implant surface.

In oral implantology, different endosseous implant systems are currently used. Most implant systems consist of two parts, i.e. the implant which is submerged during a first surgical procedure, and the transmucosal part which is connected to the implant during a second surgical procedure. Therefore, these implant systems are collectively referred to as 'two-stage' systems.

'One-stage' systems consist of one part, which is inserted during a single surgical procedure. The transmucosal part of these implants is integrated to the implant.⁸ Well-documented long-term clinical studies have revealed that both implant types have good and predictable outcomes (Adell et al. 1990, Lindquist et al. 1996, Buser et al. 1999, Haas et al. 1996, Heydenrijk et al. 1998).

With a 2-stage procedure the risk of having unwanted loading onto the implants is minimized, but a second minor surgical intervention is needed to connect the healing abutments and more time is needed prior to start the prosthetic phase because of the wound-healing period required in relation to the second surgical intervention.¹

Among the advances in dental implant therapy, dental implant placement by using a one-stage surgical protocol, i.e., non-submerged implant placement, has been well accepted because of the shorter lag time

between placement and restoration, less surgical manipulation, and better esthetic results. Early soft tissue healing and maturation may be more critical for implants placed using a one-stage surgical protocol because healing complications and the accompanying inflammation may extend readily to the alveolar crest and negatively affect the developing osseointegration.⁴

SURGICAL PROCEDURE :-

There are two approaches for an implant surgery :-

- 1) Two- stage surgery
- 2) One - stage surgery

TWO STAGE SURGERY :-Two-stage surgery requires a two-piece implant system consisting of implant, which is submerged during the first surgical procedure, and the trans - mucosal abutment, which is connected to the implant during the second surgical procedure. The implant is inserted at or slightly below the bone crest in this technique .A low profile cover screw is then inserted into the implant body. The tissues are then approximated into the implant for primary closure .³

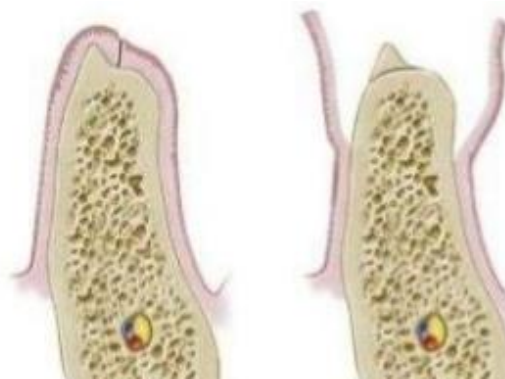
INDICATIONS OF TWO STAGE SURGERY:-

1. Reduced Primary implant stability
2. Compromised bone and mucosa

ADANTAGES OF TWO STAGE SURGERY:-

- 1) Direct observation of crestal bone volume before osteotomy
- 2) Direct observation of crestal bone during osteotomy preparation
- 3) Ability to bone graft the site at the time of implant placement.
- 4) Implant body healing at or below the crest of bone ,which reduces risk of early loading during initial bone healing
- 5) Local hygiene issues or anaerobic bacterial infiltration are not critical factors during initial healing
- 6) Ability to deliver a soft tissue borne transitional appliance in the esthetic zone.

TWO STAGE SUBMERGED IMPLANT PLACEMENT



ONE STAGE SURGERY :- A one stage surgery uses a similar incision and reflection technique to observe directly the crestal bone volume .However at the conclusion of the implant surgery,a permucosal healing

element (PME) is placed into the implant body .The implant body also is usually placed slightly above the crest of the bone .The soft tissue is then placed around the PME.³

INDICATIONS OF ONE STAGE SURGERY :-

1. Sufficient primary implant stability.
2. Minimal risk of infection/no inflammation at the site

CONTRAINDICATIONS OF ONE STAGE SURGERY:-

One-stage implants are preferably not being inserted under the following circumstance⁷:

1. In combination with an augmentation or guided bone regeneration procedure that requires the wound to close tightly to prevent infection.
2. If the abutment interferes with a functional or esthetical design of the suprastructure;
3. To prevent undesirable loading of the implants during the osseointegration period when the temporary suprastructure can not be effectively adjusted.

ADVANTAGES OF ONE STAGE SURGERY

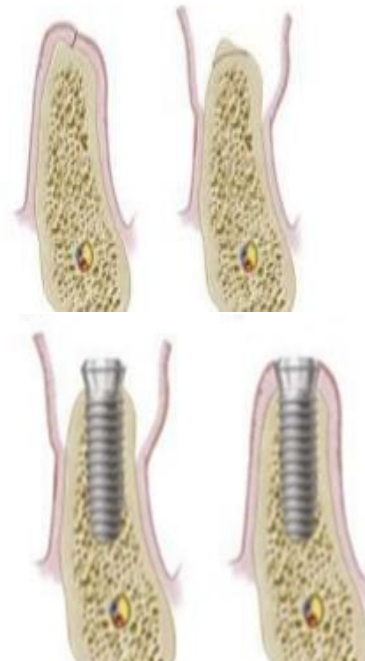
- 1) The soft tissue matures while the bone interface is healing .This permits the restoration to be fabricated with complete

assessment of the soft tissue profile

- 2) Only one surgical procedure required ,making it convenient for patient especially medically compromised patients⁸ .
- 3) Less chair side time per patient and overall reduced treatment cost.⁶
- 4) The prosthetic phase can start earlier because there is no wound-healing period involved related to a second surgical procedure⁸.
- 5) The abutment to implant connection is placed above the crest of bone .This higher location of the implant abutment connection reduces some of the early crestal bone loss in a developing implant interface .
- 6) Due to less crestal bone loss more favourable crown- to -implant length ratio.⁶
- 7) Maintenance of pre operative width of keratinized mucosa as the wound margin can adapt to the implant collar
- 8) The higher profile implant body also allows the restoring dentist to attach the prosthetic abutment with greater ease and tactile ability, which further simplifies the procedure.³

Due to these significant clinical advantages, the non-submerged approach will become more important in implant dentistry in the near future.

ONE STAGE IMPLANT PLACEMENT PROCEDURE



DISCUSSION

The widespread use of osseointegrated implants has resulted in an increasing percentage of an adult population with implant supported prosthesis⁹ .This review articles compares the different procedures of implant placement .In a two stage implant placement procedure an initial insertion of the implant is done and the prosthetic loading procedures are instituted after a period of 4-6 months .Although time tested and predictable two stage implant suffer from limitations of protracted time of

procedures and an inevitable loss of tissues during second stage of the surgery⁹. To overcome these difficulties single stage implants were introduced with the advantage of patient acceptance and shortened procedure time however if unnecessary occlusal forces are applied, there could be severe bone loss and failure of implant in one stage procedures too. As suggested both placement of implants has its own advantage. If the clinical situation favours a good primary stability and minimal or no inflammation at the implant site, one stage implant could be a great alternative to the conventional two stage surgical procedure.

CONCLUSION

In the early curve, the protocol for implant placement was specific in its requirement of a conventional two stage surgical procedure. However over a period of time, with new researches and its applications in clinical scenario, many surgeons have adopted a one stage approach. The type of surgery chosen totally hinges on the clinician depending on various parameters such as the type and quality of bone and the soft tissue characteristics encountered at the time of implant placement for success of the implant in long run.

It is, therefore, necessary for the clinician to be able to clearly distinguish areas where these implants may be successfully restored without any undesirable post-operative sequelae.

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*-Postgraduate student

** -Professor and HOD

Department of Prosthodontics, Crown,
Bridge and Implantology
AME's Dental college and Hospital,
Raichur

Awareness of COVID-19 among dental professionals working at Karnataka state government hospitals and its impact on dental health services of patients - A cross-sectional survey

Dr. Patil Anandkumar*, Dr. Shah Rutvi. BDS**, Dr. Shapeti Suresh⁺, Dr. Gulshetty Manoj kumar⁺⁺, Dr. Hogepatil Sayali**.

Abstract:

Context: Health professionals are at a high risk for developing infection and being potential carriers of the disease owing to the widespread transmission of COVID-19.

Aim: To evaluate awareness of COVID-19 among dental health professionals working in Karnataka state government hospitals and its impact on dental services towards the treatment and prevention.

Settings and Design: A cross-sectional questionnaire study

Materials and method: A survey was undertaken among the dental professionals working in Karnataka state government hospitals. The questionnaire was validated and comprised of three sections namely demographic details, awareness of dental professionals towards COVID-19 and its impact on dental health services offered.

Statistical analysis used: The obtained data was collected and was statistically analysed using SPSS software (version 20.0 Chicago IL, USA). Using chi-square test, the association between the variables was evaluated and a p-value below 0.05 was considered as statistically significant.

Results: All the participating professionals exhibited high level of awareness against COVID-19. Nearly 73.91% professionals were assigned COVID-19 duties, however only 33.04% had attended a training programme on the management of these patients. About 65.22% of the respondents stated that PPE kits and sanitisers provided by the government were not adequate.

Conclusions: Dental professionals had adequate knowledge and awareness about COVID -19, however many of them were not adequately trained to manage and treat such kind of patients. COVID-19 has impacted dental health services utilization by patients and the overall social, psychological well-being of dental health professionals.

Key-words: COVID-19, Dental professionals, Impact, Awareness

Key Message: Due to COVID-19, emphasis should be laid on a training program and sufficient number of PPE kits and sanitizers should be made available to the professionals to maintain

the safety and health. Urgent government attention is required to address the anxiety and stress faced by dental health professionals.

Introduction:

In December 2019, there was an outbreak of cases of pneumonia with unknown origin in Wuhan, China, which was designated by the scientists as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹ It was declared as a Public Health Emergency of International Concern² by WHO due to its unrestrained spread and the outbreak was termed as COVID-19. COVID-19 is highly infectious and the main clinical symptoms are fever, non-productive cough, myalgia, pneumonia and fatigue, whereas the symptoms less common are headache, haemoptysis, diarrhoea and sputum development.^{3,4} Age and comorbid conditions have been identified as risk factors for poor outcome of the disease.⁴

Predominantly the transmission is through contact spread via droplets, even though airborne transmission has not been exempted.^{5,6} According to the guidelines issued by Occupational Safety and Health Administration (OSHA), dental health professionals are at a higher exposure risk category as they work in close vicinity to the oral cavity and are exposed to a wide range of aerosol generating procedures.⁷ Moreover, in a dental office transmission may also occur by touching contaminated work surfaces through indirect contact.⁸ The standard infection control measures used in routine dental office might not be effective to prevent the spread of COVID-19, especially in cases when patients in the incubation period are unaware of the

infection, or do not disclose the information.⁹

Considering these factors, a proper understanding of symptoms, modes of transmission, exposure, methods of prevention, use of personal protective equipment, history taking and patient treatment is mandatory to develop protocols for dental professionals to identify cases and prevent further spread of infection to the patients and health care providers.⁸ Dental health professionals should update their knowledge and follow standard infection control practices to prevent the transmission of infection.⁸ The dental institutions in India were directed by the health authorities to suspend general non-emergency dental care while offering only emergency dental services.¹⁰

Hence, it is crucial to assess how dental emergency institutions respond to the changes in utilization of health services due to the COVID-19 pandemic.⁶ In order to promote management of COVID-19 outbreak in India, there is a vital need to understand health professionals and public's awareness regarding the outbreak. To assure final success, people's adherence to the standard control measures is essential, which is mainly affected by their knowledge, awareness, attitudes, and practices (KAP) pertaining to COVID-19 in compliance with KAP theory.¹¹

In this study, we aimed to assess the Knowledge, Attitude, and Practice towards COVID-19 of dentists working in

Karnataka state government hospitals and also to assess the impact of pandemic on the utilization of dental health services by patients.

Methodology:

A comprehensive cross-sectional survey was undertaken to evaluate the awareness and impact of COVID-19 among the dental health professionals working in state government hospitals. After obtaining ethical approval from the institutional review board, the questionnaire was validated by a pilot study. The prepared questionnaire was distributed amongst 20 dental healthcare professionals to assess the validity and effectiveness of the survey. The necessary changes were made, after receipt of the inputs and the final survey form was distributed.

The self-prepared questionnaire comprising of 26 questions was distributed by a google form link which was circulated using social media platforms like “WhatsApp” and “Facebook” among the various dental health professionals working in Karnataka state run government hospitals. The participants were restricted to one state, and the survey link was distributed amongst dental professionals working in state. Dentists who agreed to participate in the survey, were encouraged to fill the questionnaire via clicking the link. The link included a brief introduction and statements of maintaining confidentiality and notes for filling the questionnaire.

The survey constituted of three parts. **Section one:** consisted of the demographic profile, qualification and experience of the dental professionals. Whereas **section two:** included ten questions on the

awareness of dental professionals, (AW1-AW4) regarding the symptoms, modes of transmission and exposure of COVID-19, (AW5-AW7) on the methods of prevention to curb the spread of infection and (AW8-AW10) regarding patient treatment, data entry and payment option. **Section three:** included questions on the impact of COVID-19 on dental professionals and on health services imparted to the patients. It constituted of 16 questions, pertaining to the average percentage of emergency procedure dental patients before and after COVID-19, workshop/training programme attended, assignment of COVID-19 duties, use of personal protective equipment's and sanitisers, impact of COVID-19 on the financial stability and on the other domains of personal, social and family life of the individuals.

The obtained data was collected and was analysed statistically using SPSS software (version 20.0 Chicago IL, USA). Also, comparison of the gender, qualification of the participants and experience was done with the level of awareness and on the impact of COVID-19. Using chi-square test, the association between the variables was evaluated and a p-value below 0.05 was considered as statistically significant.

Results:

A total of 115 dental professionals participated in the survey. The study population constituted of 39.13% (45) male and 60.87% (70) female participants. According to the qualifications, 54.78% were BDS and 45.22% were MDS practitioners. Among the respondents, more than one third (43.48%) had an experience of 0 - 10 years, 19.13% had an experience

of 10 - 15 years and 37.39% had an experience of above 15 years (Table 1).

Table 2 shows the awareness of dental professionals working in state government hospitals regarding COVID-19. All participating dental professionals were aware of the COVID-19 infectious disease. Also, 100% of the respondents were aware of the possible routes of transmission and stated that dental health professionals are at a higher risk of exposure. Amongst them 99.13% were aware of the symptoms and the isolation period involved.

With regard to the prevention of infection, 96.52% of the participants stated that the use of personal protective equipment (PPE) and 95.65% agreed that frequent hand sanitisation can help curb the transmission of infection. Responding to a question on patient treatment, all the participants emphasized that the dentist should take proper medical and travel history prior to consultation. Also, majority of dentists (97.39%) stated that dental personnel with flu-like symptoms should not be permitted to work with patient and 99.13% of them preferred digital method over conventional for consultation, data entry and payment (Table 2).

When comparison of gender was done with the awareness, female participants showed higher awareness compared to males when asked regarding the denial of work of dental personnel with flu-like symptoms. The difference was statistically significant using the chi-square test ($P = 0.0290$). Whereas, no statistically significant difference was found with respect to other questions (Table 3) and on comparing qualification

of the participants and years of practise with awareness.

Table 4 shows the impact of COVID-19 on dental professionals and on health services imparted to the patients. About 94.78% of the respondents noted a decrease in the number of patients reporting to the health centre per day and 81.74% stated that the average percentage of emergency procedure dental patients declined to less than 30% after COVID-19. With respect to workshop/training programme attended, 66.96% of the population had not attended any training programme on the management of COVID-19 patient, whereas 53.91% of the study population had undergone a training programme on safe donning and doffing of PPE. However, 73.91% of the professionals in state run government hospitals were assigned COVID duties, pertaining to swab collection (37.65%) and isolation ward monitoring(36.47%). They managed the emergency procedure dental patients by telephonic consultation and postponement of appointment.

Furthermore, the response of 65.22% participants showed that PPE kits and sanitisers provided by the government were not adequate, and there was no change observed in the average use of PPE kit following COVID-19 by 80.00% of the dentists. About 82.61% of the dentists were not willing to treat non-emergency patients with proper preventive measures if allowed, 52.17% felt sometimes anxious and stressed of contracting the disease on duty. COVID-19 affected the personal, social and family life of 82.61% people and financial stability of 29.57% of the respondents. Majority of the health professionals said

that a person known to them had been infected and cured and in addition they also knew a person who was infected and died of the disease. All of participants felt that the awareness of the general public is very important to curb the transmission of infection (Table 4).

When the comparison of the impact was done with the qualification and gender of the professionals, no statistically significant difference was found.

Furthermore, when comparing the impact with years of experience, statistically significant difference was observed when asked regarding the training program attended. Majority of individuals with more than 15 years of experience had attended a training program and the least was attended by dentists with 10-15 years of experience (P 0.045). When it came to assignment of COVID duties, dentists with 0-10 years of experience handled maximum duties (P 0.038). Also a wide range of dentists with 0-10 years of experience stated that there was no change observed in the average use of PPE kit following COVID-19 (P 0.030). Whereas, majority of the dentists with experience of above 15 years stated that PPE kits and sanitisers provided by government were not adequate (P 0.000) (Table 5).

Discussion:

Health professionals are at high risk for developing infection and being potential carriers of the disease owing to the widespread transmission of COVID-19. However, the repercussions of COVID-19 on the dental professionals working in various government hospitals in Karnataka state, India and its impact on dental

services offered to the patients has not been previously evaluated. So, the present study emphasizes on the awareness of COVID-19 among dental professionals and its impact on dental health services offered. The results of the study will be helpful to public health decision makers and health professionals, in identifying the potential problems encountered by the dental health care workers, overcome them and develop a strategy aimed at patient care and prevention of spread of infection.

The findings of the present study showed that, all the participating professionals exhibited high level of awareness against COVID-19. Wherein, all the practising dentists were aware of the infection, possible routes of transmission and chances of exposure. Whereas, 99.13% of the respondents showed awareness regarding the symptoms caused and the isolation period involved. Also, more than 95% of the study population showed awareness when asked regarding preventive measures, history taking, patient treatment, data entry and modes of payment.

A similar study conducted by Khader Y et al ¹² stated that majority of dentists were aware of COVID-19 symptoms, identification of high risk patient, modes of transmission and preventive measures which were similar to the results of the present study. Also, 96.2% of the dentists were aware of frequent hand sanitisation and 92.9% showed awareness regarding the use of personal protective equipment's, which was similar to the results of our study in which 95.65% and 96.52% of the dental professionals showed awareness respectively.

Coming to the impact of COVID-19, the findings of the present study showed that there was a decrease in the number of patients reporting to the health centre per day and the average percentage of emergency procedure dental patients declined to less than 30% after COVID-19. The results of this study are similar to a study done by Huaqiu Guo et al, which stated a 38% decrease in patients requiring emergency dental care at the beginning of the epidemic and the decline in non-emergency cases to three-tenth of the pre epidemic period.⁶

In the present study, nearly two third of the dentists had not attended any training programme on the management of COVID-19 patient. However, a wide range of professionals (73.91%) were assigned COVID duties pertaining to swab collection and isolation ward monitoring. They handled the emergency procedure dental patients by telephonic consultation and postponement of appointment. New strategies like tele-dentistry can help health professionals assist patients with no additional risk of cross infection. It can also establish a balance between the safety of healthcare workers along with providing optimal dental treatment to patients in need of emergency intervention.⁸

The results of the study showed that PPE kits and sanitisers provided by the government were not adequate and due to which there was no change observed in the average use of PPE kit following COVID-19. A wide range of dental professionals were not willing to treat non-emergency patients, the reason for this can be attributed to the stress and anxiousness seen among the professionals of contracting the disease

on duty. This findings are similar to a study done by Ahmed MA et al ¹³, which stated that 78% of the dental practitioners were stressed and anxious by the impact of COVID-19.

Also, participants of the present study stated that COVID has affected all three domains of their personal, social and family life. Along with emphasizing on the awareness of general public to curb the transmission of infection.

According to CDC guidelines, dental professionals should gain knowledge regarding the infection prevention and control (IPC). Healthcare workers dealing with the suspected or confirmed COVID-19 cases, should be given clear instructions and undergo training to use personal protective equipment (PPE) like face mask, protective eye glasses, face shield, gloves and protective clothing.⁷

This survey shows the awareness and impact of COVID-19 among the participants which will be helpful in developing a strategy aimed at patient care and prevention of transmission of infection. The current survey also emphasis on the need of a workshop/training program pertaining to the management of COVID-19 patient, usage of PPE and an increase in the number of PPE kits and sanitisers provided by the government.

Conclusion:

1. Dental professionals working at Karnataka state government hospitals have adequate knowledge and awareness about COVID -19, however many of them are not adequately trained to manage and treat such kind of patients.

2. Dentists emphasised on the importance of awareness and knowledge among general public about COVID-19 to control the spread of infection.

3. To develop a treatment protocol aimed at providing optimum patient care and prevention of spread of infection, along with maintaining the safety of health care professionals.

4. Emphasis should be laid on a training program regarding the management of COVID-19 patient and use of PPE.

5. Sufficient number of PPE kits and sanitizers should be made available to the health care professionals, to help them provide efficient patient care.

6. COVID-19 has impacted overall dental health services utilization by patients, limiting to only emergency dental treatment procedures.

7. COVID-19 has impacted the overall social, psychological well-being of dental health professionals which requires urgent government attention to address anxiety and stress faced by dental health professionals working in government hospitals.

Acknowledgement: The authors are grateful to the dental health officers of Karnataka for their cooperation and assistance.

Tables:

Table 1: Demographic profile, qualification and experience of the dental professionals.

Profile	No of participants	Percentage
Gender		
Male	45	39.13
Female	70	60.87
Qualifications		
BDS	63	54.78
MDS	52	45.22
Experience		
0 - 10 years	50	43.48
10 - 15 years	22	19.13
Above 15 years	43	37.39
Total	115	100.00

Table 2: Awareness of dental professionals working in state government hospitals regarding COVID-19

Questions regarding awareness	Yes %	No %
AW1. Are you aware of the latest pandemic infectious disease called COVID-19?	100.00	0.00
AW2. Do you agree that it causes illness that could range from common cold to more severe respiratory problems like pneumonia?	99.13	0.87
AW3. Do you agree that it can transmit through direct contact with oral fluids and blood, contact between droplets or aerosols and through indirect contact with contaminated surfaces?	100.00	0.00
AW4. Do you think that dental health professionals are at high risk of exposure due to their work involving persistent exposure to blood, saliva and face to face communication with patients?	100.00	0.00
AW5. Person if exposed to someone who has been diagnosed with the COVID-19 virus, should be isolated in a safe location immediately for a period of 14-21 days.	99.13	0.87
AW6. Can PPE like mask, dental goggle, face shield and gloves prevent the spread of infection?	96.52	3.48
AW7. Can frequent hand sanitisation by using soap or alcohol based hand rub prevent the infection?	95.65	4.35
AW8. Before consulting the patient, should the dentist take proper medical or travel history?	100.00	0.00
AW9. Dental personnel with flu-like symptoms should not be permitted to work with the patient.	97.39	2.61
AW10. Should digital method be preferred for consultation, data entry and payment option?	99.13	0.87

Table 3: Comparison of male and female respondents with awareness by using chi-square test

Questions	Male	%	Female	%	Total	%	Chi-square	p-value
AW1	45	100.00	70	100.00	115	100.00	-	-
AW2	44	97.78	70	100.00	114	99.13	1.5690	0.2100
AW3	45	100.00	70	100.00	115	100.00	-	-
AW4	45	100.00	70	100.00	115	100.00	-	-
AW5	45	100.00	69	98.57	114	99.13	0.6480	0.4210
AW6	44	97.78	67	95.71	111	96.52	0.3470	0.5560
AW7	44	97.78	66	94.29	110	95.65	0.8030	0.3700
AW8	45	100.00	70	100.00	115	100.00	-	-
AW9	42	93.33	70	100.00	112	97.39	4.7920	0.0290*
AW10	45	100.00	69	98.57	114	99.13	0.6480	0.4210

*p<0.05

Table 4: Impact of COVID-19 on dental professionals and on health services imparted to the patients

Impact	No of professionals	Percentage
Average number of dental patients visiting your health centre per day after COVID-19		
Increased	4	3.48
Decreased	109	94.78
No change	2	1.74
Average percentage of emergency procedure dental patients visiting your health centre per day before COVID-19		
Less than 30%	40	34.78
Between 30-60%	54	46.96
Above 60%	21	18.26
Average percentage of emergency procedure dental patients visiting your health centre per day after COVID-19		
Less than 30%	94	81.74
Between 30-60%	18	15.65
Above 60%	3	2.61
Any formal awareness and training programme to prevent, identify, manage and refer COVID-19 has been given?		
Yes	38	33.04
No	77	66.96

Have you undergone any workshop/training programme regarding safe donning and doffing of PPE?		
Yes	62	53.91
No	53	46.09
Have you been assigned any COVID-19 duty?		
Yes	85	73.91
No	30	26.09
If yes, what type of duty is assigned?		
Awareness programme for public	15	17.65
Field surveys	7	8.24
Isolation ward monitoring duty	31	36.47
Swab collection	32	37.65
If yes, how you managed dental treatment procedures of emergency /non-emergency patients?		
Alternate staff	16	18.82
Not attended	8	9.41
Postponed appointment	30	35.29
Telephonic consultation	32	37.65
Are enough number of preventive PPE kits, sanitizers provided by government?		
Adequate	40	34.78
Inadequate	75	65.22
Has the average use of PPE kit for dental examination and treatment procedures changed after COVID-19?		
Increased	13	11.30
Decreased	10	8.70
No change	92	80.00
Are you ready / willing to treat non-emergency patients/procedures with proper preventive protocol if allowed?		
Yes	20	17.39
No	95	82.61
Do you feel anxious and stressed of contracting disease on duty?		
Yes	10	8.70
Some times	60	52.17
No	45	39.13
Has COVID affected your financial stability?		
Yes	34	29.57
No	81	70.43
Does COVID affect your		

Personal life	2	1.74
Family life	5	4.35
Social life	13	11.30
All	95	82.61
Did any of your known person infected and died of COVID-19 disease?		
No	22	19.13
Infected but cured	48	41.74
Infected and died	8	6.96
Both B & C	37	32.17
Do you feel awareness of public is very much required to control COVID-19		
Yes	115	100.00
No	0	0.00
Total	115	100.00

Table 5: Comparison of the years of practice of professionals with the impact of COVID-19

Impact	0-10yrs	%	10-15yrs	%	>15yrs	%	Chi-square	p-value
Any formal awareness and training programme to prevent, identify, management, referral of COVID-19 has been given?								
Yes	16	42.11	3	7.89	19	50.00	6.1830	.045*
No	34	44.16	19	24.68	24	31.17		
Have you been assigned any COVID-19 duty?								
Yes	19	63.33	4	13.33	7	23.33	6.5380	.038*
No	31	36.47	18	21.18	36	42.35		
Are enough number of preventive PPE kits, sanitizers provided by government?								
Adequate	29	72.50	5	12.50	6	15.00	21.5150	.000*

Inadequate	21	28.00	17	22.67	37	49.33		
Has the average use of PPE kit for dental examination and treatment procedures changed after COVID-19?								
Increased	6	46.15	6	46.15	1	7.69	10.7080	.030*
Decreased	3	30.00	3	30.00	4	40.00		
No change	41	44.57	13	14.13	38	41.30		

*p<0.05

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- *- Professor and Head of the Department,
**- Post Graduate Student
- Department of Prosthodontics and Crown and Bridge,
KAHER'S KLE V.K. Institute of Dental Sciences, Belagavi-590010. Karnataka, India
- + - Deputy Registrar,
Public Health Foundation of India,
IIPH, SIHFW Premises, Leprosy Hospital Compound, 1 st Cross, Magadi road, Bengaluru- 560023.
- ++- PGDPHM Student,
Public Health Foundation of India, IIPH Bengaluru campus, Bengaluru- 560023.

Fabrication of palatal salivary reservoir denture for a patient suffering from radiation-induced xerostomia

Dr. Soniya Joseph*, Dr. Pragati Kaurani**, Dr. Narendra Padiyar⁺, Dr. Devendra Pal Singh⁺⁺, Dr. Sudhir Meena**, Dr. Ajay Gupta⁺⁺⁺, Dr. Hemant Sharma⁺⁺⁺

ABSTRACT

Xerostomia is a debilitating condition, especially in the presence of complete dentures. Radiation is known to be one of the etiologies of xerostomia, and radiation-induced xerostomia may be irreversible. In such cases, it is necessary to provide symptomatic treatment. For completely edentulous patients wearing dentures, the presence of saliva is vital because it is required for the retention and normal functioning of a denture. In the absence of saliva, the oral mucous membranes may develop erythema and sore spots, and the patient may feel discomfort when dentures are in function. Hence, salivary substitutes are prescribed for symptomatic treatment. One efficient way to ensure slow and continuous release of salivary substitute is to incorporate a salivary reservoir in the denture. This will facilitate the lubrication of the oral environment, and aid in success of the prosthesis. This case report describes a method of fabricating salivary reservoir in maxillary denture in a patient suffering from radiation-induced xerostomia.

Keywords- Xerostomia, Salivary reservoir, maxillary complete denture

INTRODUCTION

Xerostomia is defined as a subjective complaint of dry mouth that may result from a decrease in the production of saliva¹. Saliva enhances taste, speech and swallowing and facilitates irrigation, lubrication and protection of the mucous membranes in the upper digestive tract. Xerostomia can occur due to side effects of drugs, Sjogren's Syndrome, anxiety, depression. Radiation therapy is considered one of the major causes of xerostomia in patients undergoing treatment.² The degree of xerostomia is directly proportional to the radiation dose administered and volume of salivary gland exposed to radiation^{3,4}. The presence of saliva as a thin film between the dentures

and the oral mucosa aids in retention of the dentures, and a decrease in saliva can cause inflammation and ulceration in the oral cavity. Hence, complete dentures are often poorly tolerated in patients with xerostomia⁵. Several symptomatic treatment options are available. Changes in dietary pattern, patient counselling, lifestyle modifications, salivary stimulants, and use of salivary substitutes are some of the common treatment modalities. From a prosthodontic aspect, a salivary reservoir denture is an effective solution in edentulous patients with xerostomia to deliver salivary substitute consistently into the patient's mouth⁵.

This article describes a simple technique for fabrication and designing of a

maxillary salivary reservoir complete denture for a patient with xerostomia secondary to radiation therapy.

CASE REPORT

An 80-year-old patient reported to the Department of Prosthodontics at Mahatma Gandhi Dental College and Hospital, Jaipur with a chief complaint of inability to eat. The patient also complained of difficulty in swallowing and experienced dryness in mouth. The patient gave history of radiation therapy done two months ago for Hodgkin's lymphoma. Prior to the radiation therapy, he had undergone total extraction of teeth. He had a history of diabetes, and was under medication for the same. Intraoral examination revealed high well rounded completely edentulous maxillary and mandibular ridges, dryness of mouth and diffuse erythematous spots. The patient was diagnosed as a case of radiation-induced xerostomia, with completely edentulous arches. It was decided to construct a complete denture with salivary reservoir in the maxilla containing salivary substitute to relieve xerostomia and aid the patient in mastication.

Procedure

1) Steps in fabrication of conventional complete denture were similar up to the try-in stage (Fig 1A).

2) After trial insertion was done, the reservoir walls and lid rim were built on the palatal surface of denture base with sprue wax (Fig 1B), the lid was fabricated tentatively with modelling wax, and trial denture was inserted again. The patient was asked to pronounce linguodental and linguoalveolar (alveolar and sibilant)

sounds, and it was verified that the reservoir didn't cause any interference with phonetics. A groove was made on the external surface of the lid rim using a Lecron carver which facilitated attachment for the flexible lid of the reservoir.

3) The trial denture was waxed-up, invested, and processed (Fig. 1C), and finished and polished (Fig. 1D) in the conventional manner.

4) The palatal surface of the denture was duplicated using alginate to obtain a second working cast made of Type III Dental stone, and the reservoir space was blocked out with the help of dental plaster (Fig 1E)

5) A thermoplastic sheet (3A Medes, easy-vac gasket) was adapted on the duplicated cast with the help of a vacuum former, the excess sheet was trimmed until it only adapted around the region of the rim to form the lid of the reservoir (Fig 1F)

6) A release hole was made on the most dependent portion of the thermoplastic sheet using a straight fissure bur. This facilitated the slow and continuous release of the salivary substitute.

7) To ensure salivary substitute doesn't leak around the edges of the lid, the lid was sealed around the reservoir with self-cure acrylic, and was finished and polished. The reservoir was filled with salivary substitute (Wet mouth, ICPA) using a calibrated syringe through the release hole.

8) The salivary substitute would be released when tongue creates pressure in the anterior portion of the palate. The functional maxillary salivary reservoir

complete denture was then inserted (Fig. 1G and H).

9) Postinsertion instructions were given to the patient for maintenance and hygiene. The patient was instructed on how to refill the reservoir with salivary substitute, and was asked to make a conscious effort to consume at least eight glasses of water, and lemon juice and milk. Follow up was scheduled on the next day, and regular recall visits were planned every month.

Discussion

The prevalence of xerostomia with patients receiving radiotherapy for head and neck cancer was 100% and studies show that the prevalence increases with age⁶. Several authors have recommended many approaches to fabricate reservoir dentures in either the maxillary denture or mandibular denture. Sinclair et al⁷ used cobalt samarium magnets to connect the lower and upper part of the mandibular reservoir denture. However, the procedure required exhaustive laboratory steps. AR Mendoza et al⁸ described a reservoir denture that splits into two sections – a clear acrylic base section which contains the reservoirs and a pink acrylic upper section which contains the denture teeth. It provides constant salivary flow for the patient. Verma et al⁹ used a similar method of fabricating a salivary reservoir where the acrylic base and denture teeth were two different parts joined with the help of precision buttons. Hirvikingas et al¹⁰ modified the Vissink method of fabricating salivary reservoir and used a Gerber attachment. However, the precision attachment increased the cost of the treatment. In the current case, a reservoir denture was fabricated that had minimal

laboratory procedures, and refilling the salivary substitute into the reservoir did not seem cumbersome for the geriatric patient.

LIMITATIONS AND DISADVANTAGES

- 1) Required additional laboratory procedures
- 2) Patient has to manually refill the reservoir at regular intervals
- 3) A physiologic method to stimulate saliva needs to be devised

Conclusion

This is a simple method of fabricating a salivary reservoir and also an economic option for the management of xerostomia. The patient was satisfied with the results as was noted in the follow-up appointments.



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* - III-year Resident

** - Professor

+ - Head of Department

++ - Reader

+++ - Senior Lecturer

Department of Prosthodontics and Crown and Bridge,

Mahatma Gandhi Dental College and Hospital,

Jaipur