History of Face Bows

MRS. S. J. NAGDA, M.D.S.*

Face Bow is a device which records in three planes (Anteropost, erior, lateral and vertical), the position of maxilla in relation to two points on the cranium, namely the glenoid fossa. More specially, it relates the maxilla to the intercondylar line, and hence, it is commonly assumed, to the horizontal axis about which opening movements of the mandible takes place.

The history of face bow dates back to Bonwill 1860, Balkwell (1866) and Heys (1880) when it began to be realised that in full denture prosthesis it was important to mount the plaster cast in a articulator in a given positonal relationship to the condylar position.

According to Bonwill, the distance from center of each condyle to a medium incisal point of lower teeth is 10 cms. He used this standard for mounting the cast on the articulator. Bonwill did not mention, however, at what level below the condylar mechanism, the occlusal plane should be situated.

Balkwill devised the methods that were an improvement on Bonwill's. In 1866, Balkwill demonstrated an apparatus with which he could measure the angle formed by occlusal plane or teeth and a plane passing through lines extending from the condyles to the incisal line of lower teeth. The angle varied from 22-30°. He could also determine the approximate distance from condyle to front of the gums.

Another apparatus for locating the plaster casts on the articulator was constructed by Heys in 1880. The apparatus was known as a caliper. Only the medium incisal point was located in relation to its distance from the two condyles. There was no control of the proper orientation of occlusal plane.

In 1890, Walker invented the chinometer a new type of instrument with which it would have been possible to obtain a relatively good value for the position of the lower cast in relation to the condylar mechanism better than all previous apparatus but it was an exceedingly complicated apparatus.

Snow in 1907, constructed an instrument which has become the prototype for all later constructions of face bows. Snow's face bow in spite of its very simple construction, was epoch making in prosthetic dentistry.

Snow determined the position of the plaster casts on the articulator not only with regard to the distance of the medium incisal point from the condyles but all other points on the occlusal plane were given their correct position in relation to the condyles.

But the whole problem was not solved and it was also important to ascertain at which level in the articulator, the occlusal plane should be placed. For this purpose, average level has been indicated in many articulators. This is marked by means of a groove in the incisal pin. If in a full denture case, the border of the upper occlusal rim is placed on a level with this grove, the occlusal plane will be about 3.5 cm below a horizontal plane passing through the intercondylar shaft. But in this way, individual deviation which may naturally occur were not taken into consideration.

Snow attempted to give the occlusal plane an individual position also in this third dimension. In an order to achieve this, he fixed a bite fork in the upper occlusal rim in such a way that the handle when the rim was placed in the patient's mouth, was parallel with a plane extending from the bottom of the glenoid fossa and passing through the anterior nasal spine. This plane cannot be determined on a living person but it approximately corresponds to the time drawn from upper part of the tragus to the lower edge of the nostril.

In American literature, this plane is known as Bromell Plane, in Europe as The Camper Plane. During recent years, there has been a growing tendency to employ a plane that corresponds to what is known as the Frankfurt Plane.

On the face bow, a point is attached, the end of which touches the lowest point of the infra-orbital margin when mounting on the articulator, the end of the point is placed on a level with the intercondylar shaft.

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A Finite Element Analysis of Stresses in Endodontically treated Teeth restored with Three Post Materials and the effect of varying Coronal and loading Angulations on Radicular Dentin and Alveolar Bone

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INTRODUCTION

In restoring endodontically treated teeth, when insufficient coronal tooth structure remains to retain a crown, the use of root canal space may be required for retention of the core and subsequent restoration[1].

Clinical longevity of the dowel-and-core restoration can be influenced by many factors, some of which are dowel materials, and magnitude and direction of occlusal load[1].

As the techniques developed to restore the coronal portion of endodontically treated tooth, interest of researchers has expanded to study the stresses induced in reconstructed teeth in function. Knowledge of kinds of stresses normal dental structures must withstand, is important. The ability to perform stress analysis on reconstructed teeth is of substantial importance in optimal prostheses designs[2].

Stress distribution by endodontic posts especially in cases having malocclusion in anterior segment deserves careful scrutiny. Besides base metal alloy posts and cores, stainless-steel and fiber-reinforced composite resin posts with composite resin cores are gaining popularity. A comprehensive stress analysis of these posts will give a good insight regarding the post behaviour with respect to the stresses exerted on the tooth structure supporting the post and the alveolar bone in which the tooth is embedded.

There are various methods by which stresses can be analysed. Finite Element Analysis is one of the most widely used method in today's world. It is mathematical method that allows complex structures to be drawn and divided into smaller segments. Various loading conditions can then be applied and stress distribution plotted.

Therefore, Finite Element Analysis was used to study the stresses in endodontically treated teeth restored with post and core and a full coverage crown.

The objectives of the study were to evaluate the stresses

1. Using three post materials viz: base metal alloy, stainless-steel, and fiber reinforced composite resin.
2. At three location viz: post-dentin interface, radicular dentin and alveolar bone.
3. Under horizontal and oblique loading.

MATERIALS AND METHOD:

A 2 dimensional Finite Element model of maxillary central incissor in mid-labiolingual cross-section was constructed using NISA[3] general purpose Finite Element program developed by EMRC (Enginnering Mechanics Research Corporation), Michigan. NISA stands for Numerically Integreated element for System Analysis. The dimensions were drawn from standard texts and previous studies[4]. Cement layer between post and dentin was not modelled, and was treated as part of the dentin because of its thinness in Young's modulus of elasticity of dentin and cement. Cementum was also not modelled. All other structures including periodontal ligament were considered linear elastic[5]. Porcelain crown was modelled over all cores. Table I shows the material properties used in the models.

Three models were fabricated for each type of post material - In the first model, the coronal axis was in line with the long axis of the root. In the second model, coronal axis was at an angle of 15° with respect to the long axis of the root. In the third model, it was at an angle of 25° with respect to the long axis of the root.

Load of 1N was applied on the lingual surface at 90° to the long axis of the root. In the first model, the load was applied at 70° to the long axis, in the second model, at 55° to the long axis and in the third model, at 45° to the long axis of the root. The supplementary angle to the load in the third model is 135° which is the interincisal angle in class I occlusion as given by Steiner[6]. Fig.1 shows the models of maxillary central incisor with three coronal angulations and directions of load application.

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RESULTS:

The observations were divided into following sections for three coronal angulations :-

1. Observation of stresses in the models with cast post and core with porcelain crown.
2. Observation of stresses in the models restored with prefabricated stainless-steel post and composite resin core with porcelain crown.
3. Obsevation of stresses in the models restored with fiber-reinforced composite resin post and composite resin core with porcelain crown.

Each of these observations were further divided according to loading angulations -

1. Horizontal loading
2. Oblique loading

The stresses were observed for each angle of loading -

1. At post-dentin interface
2. In the radicular dentin
3. In the alveolar bone.

Table II shows maximum stresses exerted by three post materials with different coronal angulations on horozontal loading; Table III shows maximum stresses by three post materials with different coronal angulations on oblique loading.

TABLE I
MATERIAL PROPERTIES USED IN THE MODELS:

Material	Modulus of Elasticity (GPa)	Poisson's Ratio
Dentin	18.60	0.30
Periodontal ligament	$68.9E^{-3}$	0.40
Cortical Bone	13.70	0.30
Gutta Percha	$0.96E^{-3}$	0.40
Stainless Steel	200.0	0.30
Base Metal Alloy	200.0	0.30
Composite resin	16.6	0.24
Ceramic	69.0	0.28
Fiber-reinforced composite resin	15.0	0.28

TABLE II
MAXIMUM STRESSES EXERTED AFTER HORIZONTAL LOADING BY THREE POST DESIGNS WITH THREE DIFFERENT CORONAL ANGULATIONS

Type of Post	Coronal Angulation	Post-Dentin Interface (MPa)		Radicular Dentin (MPa)		Alveolar Bone (MPa)	
		Oppsite side	Same side	Oppsite side	Same side	Oppsite side	Same side
Cast Post	0	0.90	0.84	0.34	0.34	0.32	0.30
	15	0.90	0.90	0.38	0.38	0.32	0.32
	25	0.88	0.88	0.33	0.33	0.35	0.35
Stainless Steel Post	0	0.90	0.90	0.34	0.34	0.34	0.34
	15	0.91	0.91	0.32	0.32	0.32	0.32
	25	0.79	0.79	0.28	0.28	0.28	0.28
Fibre-Reinforced Composite Post	0	0.36	0.32	0.47	0.47	0.34	0.34
	15	0.33	0.33	0.48	0.48	0.44	0.44
	25	0.29	0.29	0.40	0.40	0.40	0.40

TABLE III
MAXIMUM STRESSES EXERTED AFTER OBLIQUE LOADING BY THREE POST DESIGNS WITH THREE DIFFERENT CORONAL ANGULATIONS

Type of Post	Coronal Angulation	Post-Dentin Interface (MPa)		Radicular Dentin (MPa)		Alveolar Bone (MPa)	
		Oppsite side	Same side	Oppsite side	Same side	Oppsite side	Same side
Cast Post	0	0.80	0.57	0.32	0.28	0.32	0.28
	15	0.54	0.32	0.20	0.18	0.23	0.18
	25	0.27	0.15	0.10	0.10	0.15	0.10
Stainless	0	0.80	0.69	0.26	0.25	0.34	0.34
Steel Post	15	0.60	0.38	0.20	0.14	0.32	0.22
	25	0.32	0.10	0.05	0.05	0.15	0.10
Fibre-	0	0.25	0.25	0.38	0.34	0.42	0.38
Reinforced	15	0.16	0.12	0.24	0.16	0.28	0.24
Composite Post	25	0.13	0.05	0.10	0.14	0.14	0.10

DISCUSSION:

The present study examined the stress distribution patterns along the post-dentin interface, in the radicular dentin and in the alveolar bone using three types of posts and cores viz: cast post and core, stainless steel post and composite resin core, and fiber-reinforced composite resin post and composite resin core. Models were fabricated with their coronal axis at different angles to the long axis of the root.

Results reveal that maximum stresses occurred at the post-dentin interface. As we go away from this interface, the magnitude of stresses decrease. The difference in the modulus of elasticity of the post material and dentin play a significant role in the pattern of stress distribution. Above was true for the models restored with cast post and stainless post. (fig. 2, 4) For fiber-reinforced composite post, maximum stresses were rather observed in radicular dentin instead at post-dentin interface. (Fig. 6) This could again be because of the similarity of the modulus of elasticity between the post material and the dentin.

When the stresses were compared among three models of the same post material, the magnitude of stresses significantly decreased in the models whose coronal axis was changed by 25°. (Fig. 8) Slightly higher stresses were observed in the models with change in the coronal angulation by 15°. This was true for oblique loading. The magnitude of stresses remained fairly constant in all the models of the same post material upon horizontal loading. It was higher than in the models with oblique loading for any given loading angulation. (Fig. 3, 5, 7,9)

Stresses in alveolar bone remained constant in the range of 0.1-0.4 MPa for all the post materials and loadings.

CONCLUSION:

Following conclusions were drawn from the Finite Element Stress Analysis study of the finite element models of Maxillary Central Incisor :-

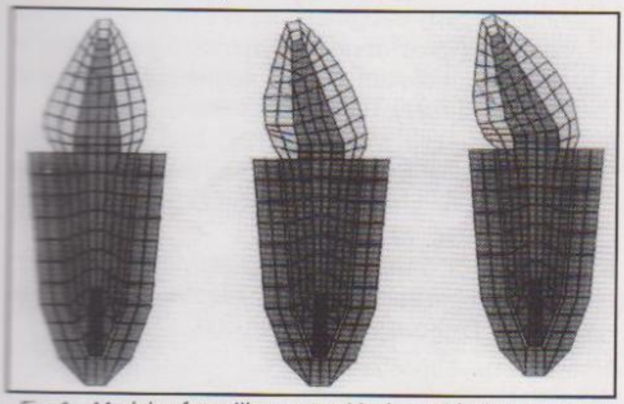

Fig. 1 : Models of maxillary central incisor with three coronal angulations and directions of load application.

Pattern of Stress distribution in models with Cast Post and Core

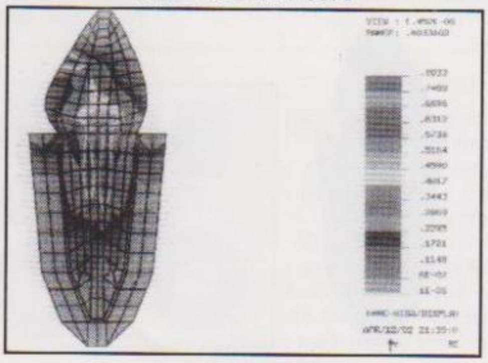

Fig. 2 : Oblique Loading

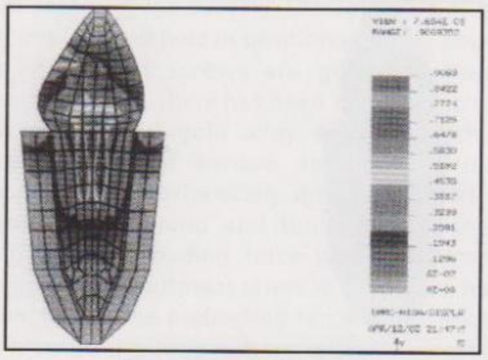

Fig. 3 : Horizontal Loading

Pattern of Stress distribution in models with Stainless Steel Post and Composite resin Core

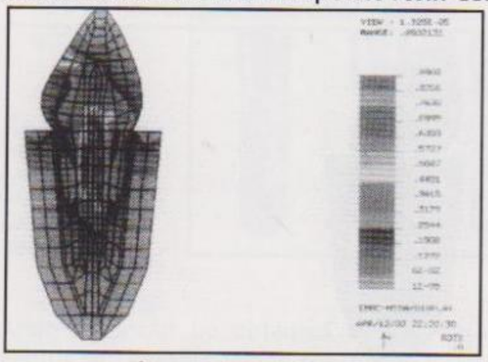

Fig. 4 : Oblique Loading

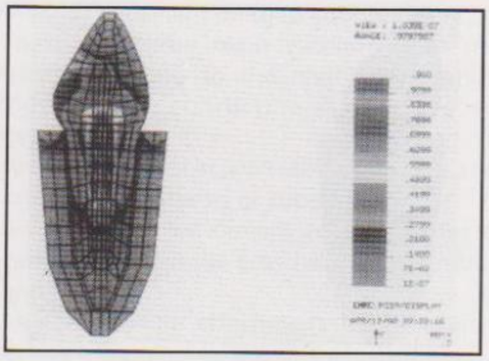

Fig. 5 : Horizontal Loading

Pattern of Stress distribution in models with Fiber-reinforced Resin Post and Composite Resin Core

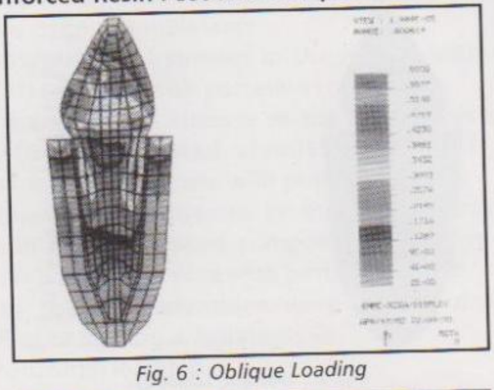

Fig. 6 : Oblique Loading

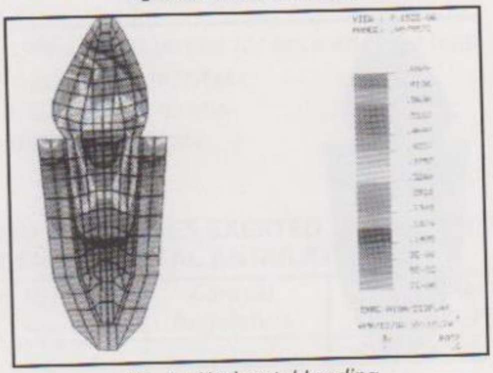

Fig. 7 : Horizontal Loading

Pattern of Stress distribution in models with Fiber-reinforced resin post and composite resin core with change in coronal angulation by 25°

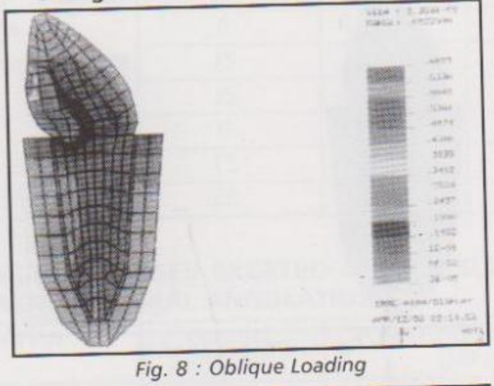

Fig. 8 : Oblique Loading

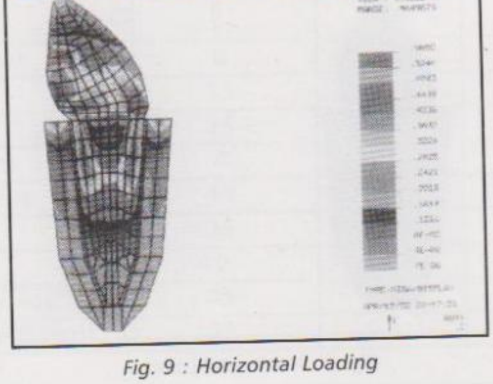

Fig. 9 : Horizontal Loading

1. When metal posts were used, stresses were concentrated at the Post-Dentin interface.
2. The magnitude and overall pattern of stress distribution was similar between the tapered cast post and preformed parallel-sided stainless steel post.
3. Fiber-reinforced composite post caused a more even pattern of stress distribution throughout the model of tooth.
4. Fiber-reinforced composite resin post reduced the magnitude of stresses at the post dentin interface and in the radicular dentin.
5. Fiber-reinforced composite post could be recommended for restoration of endodontically treated teeth as they show reduced stress magnitude.
6. Change in coronal angulation did not affect the magnitude of stresses and pattern of stress distribution in the alveolar bone, however, it reduced the magnitude of stresses at the post-dentin interface and redicular dentin.
7. Whenever possible, an attempt should be made to alter the coronal axis in an endodontically treated tooth to obtain an ideal interincisal angle so as to minimize undue stresses in the surrounding dentin.

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Application of Abutments in Implantology

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ABSTRACT

The implant success depends on the prosthetic phase as much as on the surgical phase. The number and variety of abutments available have been the direct result of the need to better orient the implant to the occlusal plane to facilitate prosthetic therapy.

Different abutments are available for different prosthetic applications. Implant position and angulation may require different abutments to allow optimum esthetics. Lack of intermaxillary space may preclude traditional abutments and require special or custom abutments.

This article intends to highlight the application of the various prosthetic abutments.

INTRODUCTION

The last few decades have seen tremendous changes towards perfecting the dental implant. Implant standardization has been achieved due to significant clinical and fundamental research as well as improved engineering and implant mechanics. Now the need is to shift our focus to alter the design of the abutment available for various applications in restorative aspects of implantology.

DEFINITION :

The abutment is the portion of the implant that supports and/or retains a prosthesis or implant superstructure[1].

The abutment is made of titanium and is available in the following sizes : 3.0,4.0,5.5,7.0,8.5 and 10.0 mm in length. Each abutment cylinder size has a corresponding abutment screw for use with that particular size. Use the depth gauge to measure the depth of soft tissue between the fixture head and gingival margin. Abutment components consist of the abutment cylinder, abutment screw and "O"-ring; the old type of abutment did not have an "O"-ring[2]. (Fig 1)

The retention system of the prosthesis should be designed before surgery. The surgical phase should aim at providing the best possible substructure to protect the long-term performance of the prosthesis.

Key Words : Implant abutment.

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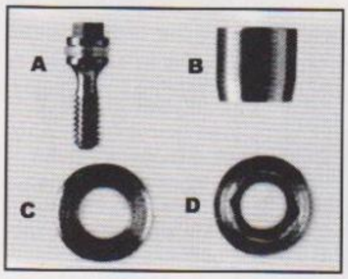


Fig. 1 : Abutment screw (A) holds the abutment (B) to the implant. The abutment has a circular (rotational) surface (C) that connects with the prosthesis and a female hex (nonrotational) surface (D) that interlocks with the male hex of the implant.

At second-stage surgery, the abutment is placed on the implant and held in position with the abutment screw. Abutment screws are generally made of titanium; however, there has been a recent increase in the use of special gold alloy screws, which offer greater control of torque application (usually electronically or mechanically driven) to reduce the incidence of loosening and thus increase the pre-loading force.(Preloading force is derived from the tightening of an abutment screw to bring two surfaces together.)When the preloading force of the abutment screw is sufficient, the resultant lateral occlusal forces are distributed directly to the abutment-implant interface rather than to the abutment screw.[3] (Fig 2)

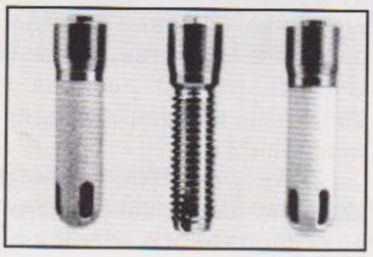


Fig. 2 : A variety of abutments are manufactured to interface with any implant design and surface coating.

Abutments can be obtained with a variety of base widths and heights, which contribute to esthetics by improving emergence profiles and allowing placement of abutment margins subgingivally.

There are three main categories of implant abutment, according to the method by which the prosthesis or superstructure is retained to the abutment[1]:

1. An abutment for screw retention uses a screw to retain the prosthesis or superstructure;
2. An abutment for cement retention uses dental cement to retain the prosthesis or superstructure; and
3. An abutment for attachment uses an attachment device to retain a removable prosthesis.

Each of the three abutment types may be further classified as straight or angled abutments, describing the axial relationship between the implant body and the abutment.

Angled abutments are used only to improve the path of insertion of the prosthesis or the final esthetic result. Angled abutments are fabricated in two pieces and are weaker in design than a one-piece post[1]. (Fig 3)

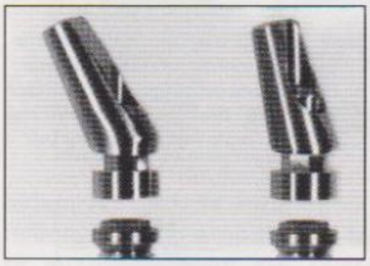


Fig. 3 : The two-part angulated abutment.

Implant placed at an angle often requires an angled abutment.

The inclinations range from 10 to35 degrees. This change in angulation eliminates prosthetic compromise in most situations. The angulated abutment has 12 facets and 12 positions of angulation in a 360-degree circle.[4]

All angulated abutments provide the required nonrotating interface with the implant.

Abutments can be obtained from the manufacturer in machined form or can be custom-cast by a laboratory using manufactured gold or plastic components. The advantage of custom-cast abutments is that they can be tailor-made precisely to the situation at hand so that directions and dimensions not available from standard designs are producible[5].

One piece / Two piece abutment: One piece abutment has no antirotational device; whereas Two piece abutment has an anti-rotational device.

SEVERAL FACTORS GOVERN OUR CHOICE OF ABUTMENT

Implant position and angulation may require different abutments to allow optimum esthetics. Lack of intermaxillary space may preclude traditional abutments and require special or custom abutments. The number and variety of abutments available have been the direct result of the need to better orient the implant to the occlusal plane to facilitate prosthetic therapy.[4]

THE MEMORY ABUTMENT :

Ideal for all those situations where the implants are not parallel or not inserted in the desired angle. A unique abutment, because only one abutment can be used for all angles. They can simply be adjusted to any desired angle up to $\pm 15°$ by cooling it with a special cooling spray. Cooling the abutment intra-orally is possible by using the "memory cooling aid". The functioning of this abutment is based on the use of a shape-memory alloy ball-joint.

Abutment selection criteria are based on:

- Orientation of Implant - angulated implants need angulated abutments.
- Esthetic demand
  In anterior region, ceramic abutment is preferred where ceramic can be directly fired on abutment to eliminate metal display. Moreover in the anterior region, angled abutment can be used which can accommodate more ceramic mass.
- Type of restoration
  For an overdenture, Dalla-bona attachments are preferred.
  An ideal abutment should lock into the implant with antirotational features and transmit the masticatory load within the confines of the implant body

UCLA ABUTMENT :

The UCLA(University of California, Los Angeles) abutment, fits directly on top of either the implant fixtures intraorally or the laboratory implant fixture analogues, which are placed in the master cast .The plastic pattern is used to develop the wax pattern for the final restoration, which will connect directly to the implant fixture .i.e. UCLA is a plastic castable sleeve. It was made to simplify the complicated prosthetic rehabilitation of Nobel Biocare implant. This abutment is available for all implant systems.

The UCLA abutment has been designed by John Beumer, Wynn Hornburg, and Peter E. Staubli[6]. (Fig 4a, b and c)

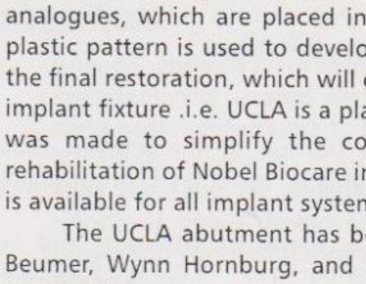


Fig. 4a : The figure shows an anterior UCLA gold cylinder (UCLA) and porcelain-fused-to-metal crown in cross-section. An access channel (AC) maintains entrance to the abutment screw.

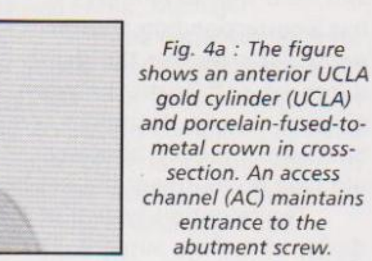


Fig. 4b : The porcelain extends to within approximately 1.5mm of the head of the implant, which maximizes esthetics.

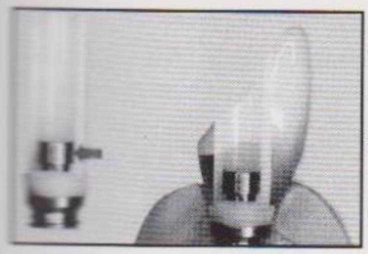


Fig. 4c : Originally the UCLA cylinder was made of plastic, as shown in cross-section (left, arrow) and superimposed on the finished porcelain restoration (right). The waxup was completed on the plastic cylinder, which was invested and cast in gold.

The subgingival placement of the restoration not only helped with interocclusal distance limitations but also provided improved esthetics. Beginning the restoration in a more apical position not only allowed the emergence profile through the soft tissue to be more gradual and natural in appearance but it could also be in porcelain instead of the usual titanium cylinder.

The UCLA castable abutment has a shoulder in the apical region, which extends occlusally 0.75mm. The shoulder design is advantageous because it provides adequate bulk of porcelain at the finish line without overbuilding the restoration.

Lewis et al. described the use of the UCLA abutment to overcome moderate or severe angulation problems. This abutment provides at least 3 mm additional space incisogingivally by connection to the fixture at the osseous crest level. This extra space will allow the making of a larger screw opening, which can be placed entirely on the lingual surface of an anterior restoration for acceptable function and esthetics. The lingual opening can then be restored with light-cured composite resin.[7]

When the UCLA cast gold abutment was introduced, there was some concern about the effect of the difference in electric potential between the gold and titanium; however, this factor has not proven to have any measurable negative effect.[3]

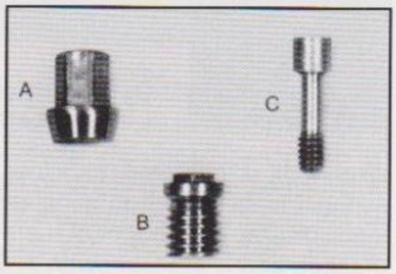
Two of the more commonly used anterior single tooth abutments are the UCLA abutment system and the Cera One system (Nobel Biocare). In clinical situations where the prosthetic restoration will result in a modified ridge-lap design, the UCLA abutment may be indicated to allow retrievability for optimal maintenance and hygiene access.

CERA ONE ABUTMENT

The most frequently used abutment for single-tooth restorations is the CeraOne abutment.

The CeraOne abutment was originally designed for anterior maxillary single-tooth cementable porcelain restorations. With the Cera One system, the crown is cemented in a nonretrievable manner. The cap is made of densely sintered semitranslucent aluminum oxide, which is designed to be fused with porcelain and cemented permanently to the abutment. Porcelain is fused directly to the ceramic cap, which provides considerable resistance to lateral force.[3] (Fig 5a,b and c).

Fig. 5a : The male hex of the implant (B) provides a onrotating interface with the CeraOne abutment (A). The gold alloy abutment screw (C) holds the abutment to the implant.



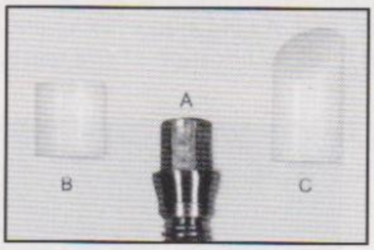
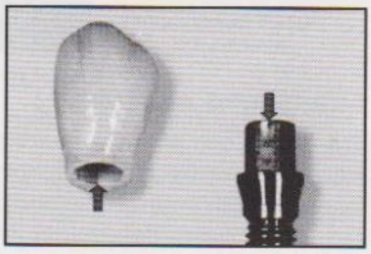


Fig. 5b : A ceramic cap, available in a cylindrical form (B) for the posterior arch and a tapered form (C) for the anterior arch, fits over the CeraOne abutment (A).

Fig. 5c : The internal parallel hex walls (left arrow) of the porcelain restoration provide sufficient retention with final cementation over the 3.61-mm parallel hex walls of the abutment (right, arrow).



UMA ABUTMENT :

(Universal Modification Abutment)

It has been designed to incorporate the advantages of a tapered cone section with the advantages of a hex section on the base of the cone. Recommended for applications such as,

- Telescopic copings with or without screw,
- Bridge reconstructions and
- Bar retained overdentures.

  It is used for :
  - retrievable prosthesis,
  - copings.

The UMA design is made to standardize and economize the implant industry and to eliminate the large amount of non-interchangeable components between the different implant companies[6]. (Fig 6)

ESTHETICONE ABUTMENT:

The EsthetiCone abutment is designed to be used in multiple-implant situations if the traditional abutment might cause esthetic compromise with the metal

Fig. 6 : UMA abutment with Castable sleeve and Occlusal screw.

display. It is designed to allow esthetic veneering material to be placed subgingivally, thereby avoiding metal display. The abutment is made of surgical-grade titanium and is available with 1, 2 and 3 mm collars. The depth of the implant determines the size of the abutment that must be used. A gold alloy cylinder and a gold screw are used in the fabrication of the metal frameworks[4]. (Fig 7)

Fig. 7 : EsthetiCone abutments.

MIRUSCONE ABUTMENT :

The MirusCone abutments are designed for multiple-implant, screw-retained restorations. They are available with 1mm, 2 mm and 3 mm collars. The soft-tissue thickness determines the appropriate collar height. In the posterior region, it is not critical to begin the restoration significantly subgingivally for esthetic reasons, and therefore a collar is selected so as to allow the restoration to begin anywhere from approximately 1 mm beneath the gingival margin to 1 mm above.

The MirusCone abutment is designed for situations where interocclusal distance is minimal but the advantages of a titanium abutment are desired. Since wide-platform implants are to be used in the posterior region where interocclusal limitations are often a concern, the MirusCone is the abutment of choice when determining an appropriate abutment for multiple-implant restorations on the wide-platform implant[4]. (Fig 8)

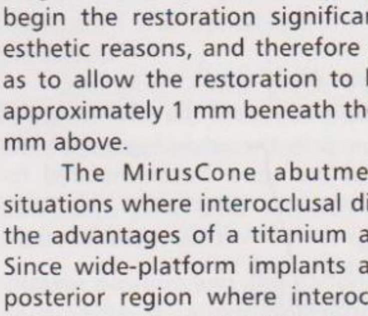


Fig. 8 : Multiple-implant restorations utilize MirusCone abutments.

OCTA ABUTMENT :

In aesthetically demanding locations of the dentition, the replacement of a single tooth by means of an oral implant is often difficult because of technical limitations of the abutment systems used. The Octa abutment of the ITI (The International Team of Implantologists) Dental Implant System presents a novel development to overcome these limitations. (Fig 9)

Fig. 9 : The Octa abutment.

OVERDENTURE ABUTMENTS :

Overdentures have been used with a wide variety of implant systems. The overdenture provides additional retention and stability over a conventional denture. The implant-retained overdenture has been found to provide improved masticatory function and comfort for many patients unable to use conventional complete dentures. Overdentures usually involve the incorporation of various attachment systems when they are used with implants. Yet the patient can remove the prosthesis at any time. The methods used to provide retention for overdentures are the bar attachments, ball attachments and magnets.

BAR ATTACHMENTS :

There are two groups of bar attachments: bar units and bar joints. Both types provide retention for an overdenture while splinting the abutments. The bar unit provides rigid fixation while the bar joint provides rotational, resilient, or combined movement to the overdenture. Both types could be used with implants. Some implant systems have their own bar joint components specifically manufactured for use with that particular system.

In bar joint systems the overdenture is supported in part by the mucosal tissues of the ridges. Thus, it is important that the borders of the overdenture be properly extended to provide stability and retention present with conventional dentures in addition to the retention and stability provided by the attachment system. The principle of the bar joint system is to provide retention of the overdenture against vertical dislodging forces. When the overdenture is functionally loaded during occlusion, there is a shared distribution of the occlusal forces between the mucosa and the bar joint. Rotational movements of the overdenture in the frontal and sagittal planes are permitted by the rotation of the sleeve about the bar. However, these movements are guided by the bar joint system eliminating any excessive, undesirable movements against the mucosal tissues.

In most cases, the bar is placed in the anterior region. The bar should be placed directly over or slightly lingual to the crest of the ridge in a straight, horizontal alignment. In the anterior region, the bar should be perpendicular to a line bisecting the angle formed by the posterior alveolar ridges. (Fig 10) While the arch form (i.e., V-shaped arch) may limit the use of the bar joint system depending on the position of the remaining natural teeth, the flexibility in the placement of the implant fixtures could allow for satisfactory alignment of the bar. Even so, there may be situations where the bar cannot be aligned adequately, negating the use of a bar attachment. In these cases, the use of individual abutments to retain an overdenture with or without some other attachment system (i.e., magnets) would be feasible.

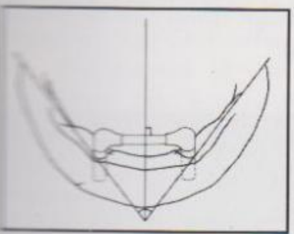


Fig. 10 : Schematic view illustrating the position of a bar joint attached to two implants.

There should be at least 2 mm of space existing between the inferior surface of the bar and the gingival tissues of the alveolar ridge. However, it has been stated that there is no disadvantage to having the bar in direct pressure-free contact with the ridge as long as regular oral hygiene is maintained by the patient.

The majority of the bar joint systems presently available have plastic bar forms. They can be easily adjusted to fulfill the desired form and can be waxed to the copings. The entire assembly can then be cast as a single unit with a metal alloy designated by the manufacturer as being compatible with the copings.

Metal or nylon sleeves can be used with these bar joint systems. The flanges of the sleeve flex over the bar when the overdenture is seated to provide the retention for the system. The metal sleeves are adjustable to allow for flexibility in controlling the degree of retention. However, they can be difficult to replace or repair. The nylon sleeves are not adjustable but can be replaced easily.[7] (Fig 11)

In the O-ring system: retention is controlled by the elasticity of the rubbers. Color coded rings are available for retention.

'O' ring attachments are available in 1mm and 3 mm lengths. The attachments are utilized with two or

Fig. 11 : Bar - Bar constructed where anterior - posterior and lateral stability is required. Plastic clips with metal housing in denture.

more implants for overdenture retention and have the advantage of being resilient in all planes of motion. The abutments are screwed into the implants with at least 1mm of the base protruding above the tissue. A gold-plated stainless steel ring, which retains the O ring, is processed into the denture either in the laboratory or at chairside with cold-cure acrylic. When O rings are to be processed into the denture in the laboratory, transfer pins are utilized for taking the impression and making the model.

ADVANTAGES OF O-RING ATTACHMENTS :

- ease of use,
- hygiene,
- maintenance,
- low cost and
- possible elimination of a superstructure bar.

DISADVANTAGES INCLUDE :

- wear of the O-rings with gradual loss of retention, and
- the need for periodic replacement.[8]

The Dalla-bona system : It is a simple stud attachment making an excellent overdenture attachment, available in a resilient and non-resilient series. It is useful when there is minimal vertical space and where rotation, resilience and retention are desired. It consists of a single-piece male stud soldered to the coping and a single-unit female processed within the denture. It is available in two types: cylindrical and spherical.[9] (Fig 12)

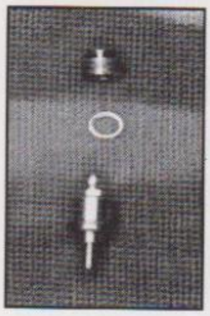


Fig. 12 : The figure shows : (Dalla-bona system)
• Male part of the abutment,
• Metal spacer (to prevent acrylic from entering the female socket)
• Female part-with 4 leaves which can be adjusted as per the patients requirement for activation or deactivation.

MAGNETS :

Magnetically retained overdentures have become very popular with the various implant systems. Magnets can be used with virtually any implant system.

The system basically consists of a magnet and a keeper[7].

An in vitro study conducted by Tokuhisa et al. suggested that -

- Ball/O-ring attachment could be advantageous for implant-supported overdentures with regard to optimizing stress and minimizing denture movement.[10]

APIC COMBO ABUTMENT:

(Asia Pacific Implant Centre)

- Achieves the dual roles of impression coping and permanent abutment.
- Pure titanium allows ease of modification with burs.
- Allows drastic angle modification thereby disposing of the need to use angulated abutment.
- Prominent flat facet prevents rotation of single implant crown.
- Stainless steel abutment screw gives good strength that resists screw deformation and breakage. (Fig 13)

Fig. 13 : The APIC Combo Abutment.

THE PROCERA ABUTMENT---THE FIFTH GENERATION ABUTMENT FOR DENTAL IMPLANTS[11]

Recently, custom abutments in titanium have entered, where an abutment can be designed by a computer. The Procera abutment (Nobel Biocare, Sweden), provides the clinician with the opportunity to obtain an "abutment solution for every situation."[4]

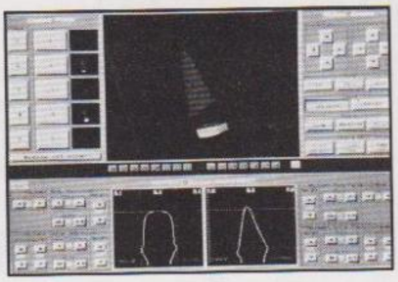
Implant abutments created with the Procera system were introduced in 1998. These abutments were designed to allow the use of an internal counter torque device to protect the implant-bone interface while the abutment screw is tightened. The external surface could now be modified as required by the restorative dentist. The modified screw design makes insertion of the head of the screw drivers easier. The countertorque device has been improved to fit different sizes of implants and different lengths of abutments[11].

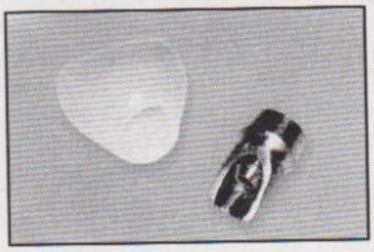
The Procera abutment is individually designed using the computer-assisted dental design (CADD) technique or a special waxup technique. With the CADD technique, an impression is taken at the implant level, and a cast is fabricated. The position of the hex of the implant and the implant angulation are determined by means of a special T-bar. This information is transferred to a computer. The dental technician creates the abutment on a computer screen in a three-dimensional pattern, and the data are then sent to the factory for fabrication of the Procera abutment using a milling machine. This technique allows the fabrication of abutment profiles adapted to specific clinical situations. After try-in of the abutment, a crown restoration is created.

The versatility of Procera Abutment has dramatically increased the number of options available to clinicians to solve the space, alignment and angulation conditions that are present in implant treatment.

Procera Abutment enables us to create custom abutment to match our patients specific needs once the implant is in place. Procera Abutment is created through computer aided design using the technique of Procera. (Fig 14a and 14b).

Fig. 14 : The figure shows :
a. Procera abutment being designed using the computer-assisted dental design technique.





b. Procera abutment and AllCeram crown.

ADVANTAGES OF THE PROCERA ABUTMENT :

The Procera abutment created by the CADD program mates precisely with the implant-bearing surface. The abutment allows development of the ideal emergence profile and a machined external surface. The custom abutment accommodates cementable prosthetics and can be directly linked to Procera AllCeram restorations. Through the CADD program the positioning of the finish line at the exact location for esthetics and the proper restoration contours is possible.[4]

THE ATLANTIS PERMANENT HEALING ABUTMENT:

Frustrated with existing tooth implant-abutment methods, Dr. Julian Osorio, a Boston prosthodontist, formulated an abutment concept that would fit the exact geometry of the patient's mouth. His goal was to create a process that would make implants accessible to mainstream dentistry. Osorio founded Atlantis Components in 1996, with a product that has changed implant dentistry - The Atlantis Permanent Healing Abutment.

To create his product, Dr. Osorio turned to the world of CAD/CAM technology and Geomagic Studio, which makes it possible to take output from 3D scanners and digitally duplicate the shape, textures and color of real-world objects, including the cast of a patient's mouth.

The Atlantis process begins with scanning a cast of the patient's mouth provided by the dentist. Geomagic Studio is used to create surfaces from the scanned point cloud data. The surfaces are then imported into CAD software.

The surface of the teeth is used as reference geometry for accurate modeling of abutment. Surfacing the dental anatomy in Geomagic Studio allows to modify CAD models in context, thus accurately producing an abutment that fits into the patient's mouth with no further adjustments.

With the Atlantis abutment, the result is much more predictable because it is customized to the exact fit of the patient's mouth.

Unlike other dental implants, the Bicon System, requires only two parts. There are no screws, torque drivers, impression posts or special copings. Instead of screws joining the implant to the abutment, a 1.5° locking taper joins the Bicon implant to the Bicon abutment. The metal to metal contact means that there is no rotation and no bacterial leakage once the abutment is properly tapped into the implant. The real cost and time savings of the BICON Implant occurs at the second stage surgery. Once we uncover the implant, we can tap the abutment into the implant. After the abutment is in place, take an impression and cement a crown. Before the final seating, we can rotate the abutment 360° and tap it into the implant in any position. Because of Bicon's elegant design, it has a greater surface area for its size, enabling the use of shorter implants, which reduce the need for bone grafting procedures. Also, Bicon's design provides for 360° of universal abutment positioning. This allows for the use of cemented crowns, as well as the screwless and cementless Bicon Integrated Abutment Crown, assuring natural looking gum lines and a beautiful smile. The System has:

- Angled abutments
- 15• 0-ring abutments
- Snap-on components

The 1.5 degree tapered post of the Bicon abutment locks into the implant with friction. It is the metal-to-metal contact of the post against the implant wall that makes a secure, reliable, and bacterially-sealed connection[12].

Some abutments, such as those supplied by Bicon, are referred to as cold welded or Morse-taper design. Because the posts have a well-machined 5-degree taper, tapping on them creates an intimate relationship with the implant, which resists rotation and even removal[5]. (Fig 15)

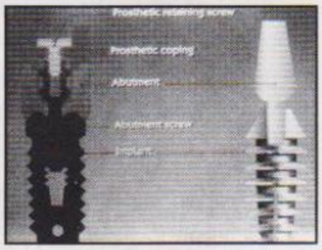


Fig. 15 : Comparison of the Bicon Implant with conventional implant components.

Thus, implant dentistry, which many consider to be difficult, becomes a simple and predictable treatment with the Bicon. Two factors make this possible - simple implant placement techniques, and a simple prosthetic design involving only one component.

Bicon's initial research was completed in 1968 at the Batelle Memorial Institute in Columbus, Ohio with funding from the United States Department of Defense. Early designs used high density aluminum oxide as the implant material. However, this ceramic was found to be too brittle. In 1981, one year before Professor Branemark's visit to Toronto, Thomas Driskell, the inventor of the Bicon implant, introduced the Titanodont Implant System - made from titanium. Then in 1985, he introduced his third design, the DB Precision Implant System which is the same 1.5°, bacterially-sealed, locking taper connection design used today by Bicon.

Whether Thomas Driskell knew that his system would enjoy continuous clinical use into the 21st century or not, his unique design coupled with Bicon's revolutionary clinical techniques continue to lead the trends of the implant market. Bicon has passed the test of time, while other systems are continuously undergoing revisions as they attempt to achieve the clinical benefits inherent in Bicon's design.

The CerAdapt abutment system was developed to simplify the most challenging esthetic implant restorations. The abutment is an all-ceramic alternative to metal abutments. The CerAdapt abutment is a premachined, precision-milled abutment made to fit the implant hex. It is made of densely sintered 99.8%pure aluminum oxide. Particles of aluminum oxide are pressed into the desired shape and subjected to sintering temperatures of 2050°C. During sintering, the aluminum oxide shrinks, resulting in a pore-free, strong, wear-resistant, stable bioceramic material. Andersson and Oden showed flexural strengths of 690 MPa and demonstrate that the abutment can withstand tremendous loads without fracturing. This abutment is nonmetallic, noncorrosive, and biocompatible, and it develops a mucosa barrier similar to that of titanium abutments. The soft-tissue response is excellent.

The CerAdapt abutment has unique optical qualities. It is tooth colored and has light-diffusion properties through the abutment and through the surrounding tissue. These benefits offer several advantages over similar metallic abutments and clearly make it easier to achieve a more natural and esthetic implant crown.[4]

The CerAdapt abutment is a ceramic abutment that has further improved the esthetic outcome for single-tooth restorations. The CerAdapt abutment is individually designed by grinding. The finishing line as well as the angulation can be altered, depending on individual needs. (Fig 16a, b and c).

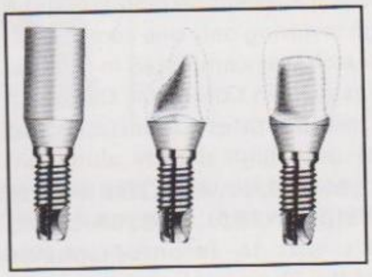


Fig. 16 : The figures show :
a. CerAdapt abutment.
b. Minimum height of the CerAdapt abutment
c. Try-in of prepared CerAdapt abutment.

Use of the CerAdapt abutment is indicated in the following three situations in particular :

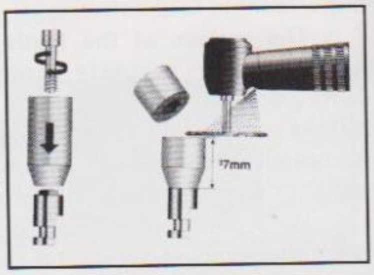
1. An implant that was placed too superficially, resulting in exposed titanium at the buccal aspect
2. An implant with excessively buccal placement and thin peri-implant mucosa, resulting in a "shining-through" effect of the titanium abutment
3. A slight disangulation of the implant, resulting in a need to correct the direction of the implant pillar to create a harmonious embrasure and anatomy of the crown restoration.

These ceramic abutments, which were introduced in 1993, were developed for both single crowns and fixed partial dentures (FPD), and they were specially intended for situations when patients and clinicians had specific esthetic demands. The CerAdapt abutment is a cylinder (12 mm high and 6 mm in diameter) obtained through a technique using densely sintered and highly purified alumina. Alumina has been used for the fabrication of CerAdapt abutments because of the good mechanical properties and the esthetic possibilities for crowns and FPDs when using densely sintered alumina as a core material.[13]

However, the use of the CerAdapt abutment is limited. Because of the limited strength of the material, this abutment should not be used in molar areas or in patients demonstrating excessive chewing and biting forces or bruxism[14].

TiAdapt abutment is another abutment that can be prepared extraorally, adjusted clinically, and affixed to the implant with a screw. One advantage of the TiAdapt abutment is its strength, compared with the CerAdapt, combined with the potential for individual design in shape and form. The increased strength implies that more material can be removed from the abutment, allowing more flexibility than the CerAdapt abutment[14]. (Fig 17a, b).

Fig. 17 : The figure shows :
a. TiAdapt abutment for the regular platform.
b. Try-in of the prepared TiAdapt abutment before impression making.



AurAdapt abutment ,is an abutment fabricated of a gold alloy. Using this abutment as a base, a waxup is made and cast. Finally, porcelain is baked on the gold alloy abutment. A disadvantage with the AurAdapt abutment is that gold is brought down to the implant level, thus interfering with the soft and hard tissue[14].

The increasing number of abutments has led to more complex treatment protocols and the need for a large inventory of components. The recently introduced Multi-Unit abutment is a solution to these problems and facilitates abutment selection. The Multi-Unit abutment can be used in most clinical situations and replaces the Standard, EsthetiCone, and MirusCone abutments.

Another feature of the Multi-Unit abutment is simplified connection of abutment to implant hex; the Multi-Unit abutment does not have an internal hex that must match the hex of the implant.

The Multi-Unit abutment also has a premounted plastic abutment holder to facilitate proper placement of the abutment to the implant head. The premounted holder allows the abutment to serve as a one-piece abutment. The abutment is positioned at the implant head, and the abutment holder serves as a manual screwdriver. When the abutment is seated, the plastic holder is removed by a bending movement before final tightening using the torque control.(Fig 18)

Fig. 18 : The plastic holder can be removed easily with a bending movement.

The abutment screw of the Multi-Unit abutment is made of a titanium alloy, which imparts increased screw joint stability and pillar strength. It also yields lower screw friction and higher screw strength, leading to an increase in preload of 15% to 20% compared with that obtained with the MirusCone abutment.

The Multi-Unit abutment is available in seven lengths for each platform, from a 1-to 9-mm collar. The total height of the 1-mm Multi-Unit abutment, including the gold cylinder and the UniGrip prosthetic screw, is 5.05 mm. The Multi-Unit abutment allows for a disangulation of as much as 40 degrees between the long axis of the implants. In situations with greater disangulation, the Angulated abutment is used14.

CONCLUSION :

It appears that the quest for an ideal prosthetic abutment/implant connection is still on. No single abutment fulfills the criteria in all possible situations. Choice of multi-abutment system is the order of the day. To achieve the best of the prosthetic results it is essential to have sound knowledge of different abutment systems and establish a rapport between technician and restorative dentist.

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An Evaluation of Masticatory Efficiency in Partially Edentulous Patients pre and post Fixed Prosthodontic Rehabilitation - An Electromyographic and Spectrophotometric Study

SINGH S. K. *, PARKASH H. **, JAIN V. ***, SHAH N. ****, BHATIA M. *****, SINGH N. ******

ABSTRACT

Electromyography was used to evaluate the muscle activity of Anterior Temporalis and Masseter muscle in patients with a missing mandibular first molar on one side and intact dentition on the other side before and after fixed prosthodontic rehabilitation. In the same patients masticatory efficiency was also evaluated by Spectrophotometry. For the study 10 patients were selected, irrespective of sex, within the age range of 17 -35 years. Before rehabilitation electromyographic recording was carried out to determine muscle activity of anterior temporalis and masseter muscle bilaterally simultaneously during rest and while chewing carrot as test food material. Three consecutive recording were made at two minute interval to prevent muscle fatigue and average values was taken. Masticatory efficiency was also recorded before prosthodontic rehabilitation. After that three unit fixed partial denture was fabricated in centric occlusion for all the patients. Three months after prosthodontic rehabilitation EMG and spectrophotometric analysis was repeated and compared with previous values.

The mean and standard deviation for all the ten patients showed an increase in muscular activity of temporalis and masseter after 3 months of rehabilitation. Spectrophotometric analysis also revealed marked improvement in masticatory efficiency after rehabilitation.

INTRODUCTION

One of the most complex and critical neurophysiologic mechanisms in human motor functions is mastication. Each tooth is highly specialized in dental arch according to its function. Permanent first molars are the most important units of mastication as they bear the maximum stresses during function. They are considered the "key to occlusion" as they help to establish the occlusion. However, permanent first molars are often lost at an early age, specially the mandibular 1st molars, since they are first to erupt , and therefore are exposed to the oral environment for longer period of time. Due to its distal position to the deciduous molars, it is often perceived to be a milk tooth and hence neglected. The result is often extensive caries necessitating its extraction[1].

When a lost single tooth is not replaced, occlusal balance is disturbed. The consequences may be supra-occlusion of the opposing tooth or teeth, tilting of the adjacent teeth, defective proximal contacts, leading to dental caries, injury to the periodontium with resultant derangement of occlusion. Loss of teeth and occlusal disharmony reduces the masticatory efficiency significantly.

Masticatory efficiency is defined as the number of masticatory strokes required to reduce the food to certain particle size[2], where as masticatory performance is determined by counting the particle size distribution of food when chewed for given number of strokes. Agerberg and Carlsson[3] found gradual decline in the masticatory efficiency proportionate with the number of missing teeth. Albarcktsson, Blomberg and Branemark[4] found that positive changes occurred in chewing pattern following restoration of posterior occlusion. Jemt, Hedgard, and Wickberg[5] made similar observations. Masticatory efficiency has also been tested by fractional sieving, computer assisted image processing[6], and by calorimety. Fractional sieving employs sieves of various gradations (sizes) to measure the particle size of the chewed food. However, it is time consuming and laborious. Dahlberg[7] introduced colorimetric method by evaluating surface area of the chewed particles of raw carrots. Yurktas and Manly[8] subsequently used this method. However, they found it is unsuitable for subjects wearing complete dentures. The main requirement of an ideal test material for studying masticatory efficiency with colorimetry is that, it should be preferably a natural food, and the natural dye should have characteristic wavelength. Further, it should not absorb or stain the oral mucosa and the material should be unaffected by water and saliva. If these requirements are met, the spectrophotometric analysis will be easy, reliable and simplified.

Electromyography has been used to record muscle activity (Masseter and Temporalis muscle)

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during chewing and maximal biting. Tanaka[9] devised a possible method of measuring masticatory efficiency, where he evaluated masticatory efficiency by using "Inter jaw positional EMG". Observation of the inter jaw positional EMG enabled the understanding of the appearances of each chewing cycle comminutes. It is said that changes in the number of natural teeth or replacement with fixed prosthodontic rehabilitation could influence muscle activity and therefore masticatory function[10].

The maintenance and restoration of masticatory efficiency is an important aspect of dental restorative procedures, yet surprisingly, little information is available regarding the factors influencing this important oral function. There are very few studies in which the masticatory activity and muscle response in partially edentulous patients have been undertaken to measure masticatory efficiency before and after fixed prosthodontic rehabilitation. Therefore, the present study was conducted to evaluate and compare the activity of anterior temporalis and masseter muscles by electromyography and the masticatory efficiency by spectrophotometry in patients with missing mandibular first molar, pre and post fixed prosthodontic rehabilitation.

AIMS AND OBJECTIVES

To evaluate and compare the muscle activity of Anterior Temporalis and Masseter muscle in-patients with a missing mandibular first molar on one side and intact dentition on the other side before and after fixed prosthodontic rehabilitation by electromyography.

To evaluate and compare the masticatory efficiency by spectrophotometry in the same patients before and after fixed prosthodontic rehabilitation.

MATERIALS AND METHODS

A total of 10 patients were selected for the study. The patients were selected irrespective of sex with age range of 17-35 years. All these patients had intact natural dentition upto 2nd mandibular molar except for missing mandibular 1st molar on one side, and good oral hygiene. These patients were Partially edentulous from 3-6 months. Patients having malocclusion or any other para functional habit were not included in the study.

Electromyographic muscle activity of anterior temporalis and masseter muscle was recorded for each subject on the side having intact dentition and on the side having missing mandibular 1st molar. The electromyographic recording was performed with 8-channel electromyograph. The Electromyograph was standardized for each patient i.e. sensitivity - 200μv/div, sweep speed (Time base) = 5 second, frequency range -20Hz -1kHz and electrode impedence checking level -$<16k\Omega$.

The electromyographic silver chloride bipolar surface electrodes were placed close to the anterior border of hairline. The reference electrodes were placed 25mm away from the body electrodes, while an earth electrode was placed on the forehead in the midline. One body electrode and one reference electrode for each muscle was used. There were total of 8-surface electrodes for both Temporalis and Masseter muscle bilaterally.

Electromyographic recording was carried out simultaneously during rest position and on chewing from preferred side (unilaterally). Three consecutive recording were undertaken for each patient at two-minute interval to prevent muscle fatigue. Any irregular or spurious traces were omitted and the measurement repeated. Quantitative values were taken by measuring the amplitude from base to peak of the recorded graph using computer assisted programming (Medelec, Synergy, UK) Mean value of the amplitude were quantified, analyzed and computed.

Masticatory efficiency was evaluated by spectrophotometer. Patient was asked to chew one piece (10 gm) of carrot in 20 strokes from the affected side and another piece from the contralateral side without swallowing. After chewing, all the chewed part of carrot and saliva produced during the process was collected in a graduated cylinder and distilled water was added to make up the volume to 25 ml. It was filtered, then one ml of sample was taken to the spectrophotometer at 530nm.

The optical density (OD) of the carrot sample was obtained and the result expressed as optical density (OD) $\propto$ and Concentration of the solution (C). The same procedure was followed for the opposite side with intact natural dentition.

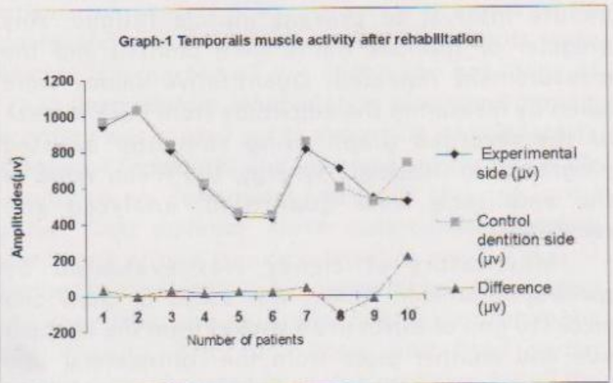
Three unit fixed partial denture was used to replace unilateral missing mandibular first molar. Three month after rehabilitation masticatory efficiency and muscle activity was evaluated and compared with pre rehabilitation recordings.

The data thus obtained was analyzed statistically using descriptive statistics (Mean $\pm$ SD) for each and every variable. To study the difference among the groups paired sample t-test was applied.

RESULTS

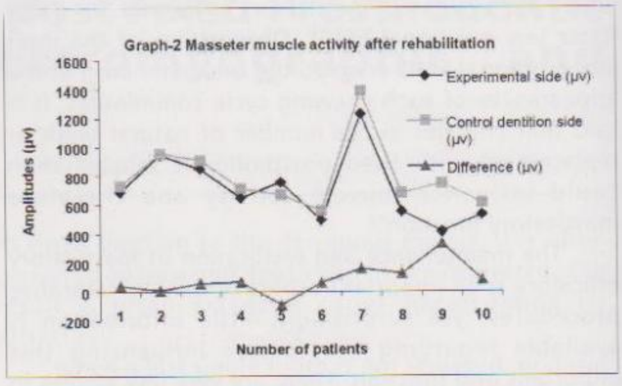
Before rehabilitation muscle activity of Temporalis and Masseter muscle was evaluated, on experimental side (missing mandibular 1st molar side), control side (intact natural dentition side) and compared. On comparison Temporalis and masseter muscle activity was reduced on the experimental side in all the patients. Masticatory efficiency was also reduced on experimental side.

Three months after rehabilitation with fixed partial denture the muscle activity of Temporalis and masseter was recorded and compared. (Graph - 1, 2) The muscle contraction level was increased in all the patients in comparison to pre rehabilitation muscle activity. In three patients muscle contraction level of Temporalis was even higher on experimental side in comparison to control side. On statistical analysis significant change was observed in Temporalis and Masseter muscle on experimental side but the difference on control side was non-significant for both the muscles. (Table I). Three month after rehabilitation

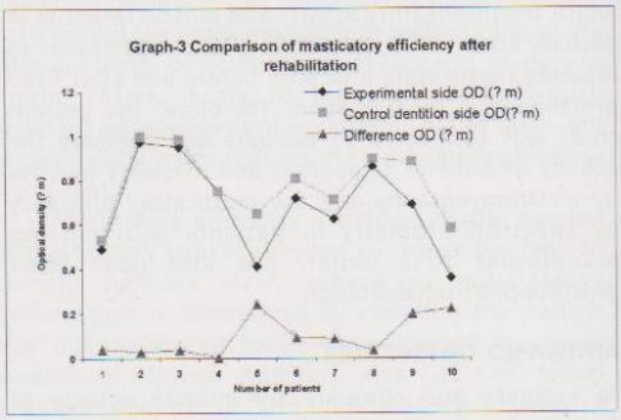


Graph-1 Temporalis muscle activity after rehabilitation

masticatory efficiency was also significantly increased in all the patients (Graph 3, Table 2).



Graph-2 Masseter muscle activity after rehabilitation



Graph-3 Comparison of masticatory efficiency after rehabilitation

TABLE I : COMPARISON OF PRE AND POST REHABILITATION CHANGES IN MUSCLE ACTIVITY OF TEMPORALIS AND MASSETER

Variable	Pre Rehabilitation		Post Rehabilitation		Significance
	Mean difference (Amp. µv)	SD (±) (Amp. µv)	Mean difference (Amp. µv)	SD (±) (Amp. µv)	
Temporalis experimental side	565.36	233.47	683.80	211.31	0.000 ***
Temporalis control side	670.74	232.80	709.31	209.73	0.265 ns
Masseter experimental side	616.54	286.05	711.99	245.01	0.005 *
Masseter control side	727.91	296.72	855.61	277.53	0.088 ns

*** = P<0.000, * = p<0.05, ns = Non significant.

TABLE II : COMPARATIVE STATISTICS OF PRE AND POST REHABILITATION CHANGES IN MASTICATORY EFFICIENCY

Variable	Pre Rehabilitation		Post Rehabilitation		Significance
	Mean OD (ηm)	SD (±) OD (ηm)	Mean OD (ηm)	SD (±) OD (ηm)	
Experimental side	0.694	0.749	0.885	0.752	0.003**
Control side	0.884	0.698	0.994	0.675	0.046*

**P<0.01= Highly significant, * = p0.05 * = Significant.

DISCUSSION:

Mastication is one of the main functions of the stomatognathic system. Number of posterior tooth contact and the neuromuscular coordination of the masticatory muscles are essential to a harmonious functional relationship in the masticatory system. The number and location of tooth contacts influence masticatory movements, muscle activity and masticatory efficiency[10].

The study was undertaken to evaluate pre and post rehabilitation masticatory efficiency in partially edentulous patients by electromyography and spectrophotometry.

The body and reference electrodes were placed 25 mm apart to reduce the chances of impedence. Earth electrode was placed on the forehead in the midline as it is stated by the various authors, that the earth electrode should be as close as possible to the muscles to be tested. Moller[11] suggested that, the bipolar surface electrodes with reference electrodes placed 25mm apart from the body electrodes, reduced the noise picked up by the unipolar technique. Jacobs and Van Sternberghe[12] had used similar method in their study.

In resting position of the mandible, the elevator muscle and their antagonistic depressor muscles remains in a resting state of postural contraction, especially the anterior belly of Temporalis[13] remains in a minimum tonic contraction as it was observed in this study. The height of the burst or mean amplitude was negligible as compared to the muscle activity at the time of chewing. Masseter muscle showed no muscle activity at rest on both the sides.

It was observed that during function there was marked decrease in muscle activity of both Temporalis and Masseter muscle as compared to the muscle activity on intact dentition side before rehabilitation. Hashimoto[14] in his study showed this difference may be due to the fact that the subjects with missing dentition on one side and intact dentition on the other side had the habit of chewing from the side having intact dentition. Therefore these patients have better neuromuscular coordination on frequently used side as compared to the missing tooth side, hence increased masticatory efficiency on the intact dentition side. Masseter muscle activity was affected more than that of Temporalis on the experimental side before rehabilitation. Nagasawa and Hiromichi[15] observed similar finding.

Post rehabilitation muscle activity showed that there was marked increase in masticatory muscle activity of both anterior Temporalis and Masseter muscle as compared to pre rehabilitation muscle activity. Reason behind the improved masticatory muscle activity was probably because of the adaptive changes in neuromuscular component of masticatory muscles after replacing mandibular 1st molar. Three months period seems to be adequate for the neuromuscular component of masticatory system to adapt. Another major cause for improved masticatory muscle activity could be an increase in number of posterior tooth contact after replacement of missing mandibular 1st Molar, as observed by Moller[11] that the fewer the occlusal contacts, the less was the amount of elevator muscle activity. Our result confirmed to the previous study conducted by Al Quran and Lyons[16].

Nagasawa and Hiromichi[15] evaluated the masticatory efficiency by using fractional sieving method. They found that the number of strokes and total time of chewing was markedly reduced after rehabilitation of missing tooth. This method is not very accurate and scientific method to calculate masticatory performance. So we used spectrophotometric analysis to find out masticatory efficiency. The concentration of the filtrate and transmittance of the solution was the criteria for calculation of the masticatory efficiency, which was obtained as optical density (OD) $\propto$ m. To exclude any chances of bias, contralateral intact dentition was taken as a control to compare the efficiency in the same individual. After rehabilitation all the patients showed marked increase in masticatory efficiency on the experimental side,

Woda, Vigeron and Kay[17] stated that during unilateral mastication working as well as non-working side contacts performed the chewing of food. This brings out the differences between the chewing and non-chewing sides (functional) and the working and nonworking sides.

Masticatory efficiency is influenced by dentition, age, development of neuromuscular functional pattern of jaw movement, number of occluding pairs of teeth, voluntary movement of chewing cycle and type of test food as reported in the literature[18, 19].

It was found that the muscle activity of Temporalis and Masseter and the masticatory efficiency were in direct correlation. Our finding was found to be in agreement with the findings of Tanaka[10].

SUMMARY AND CONCLUSIONS:

The following conclusions were drawn from this study:

1. The activity of both anterior Temporalis and Masseter muscle were decreased on experimental (missing mandibular 1st molar) side as compared to the control side (intact dentition) before rehabilitation.

2. Post rehabilitation there was an increase in both the Temporalis and Masseter muscle activity in all the patients.
3. Post rehabilitation, Masseter muscle showed greater increases in muscle activity than that of Temporalis.
4. During rest, Temporalis muscle was at minimum tonic contraction (average Amp 90μv) whereas Masseter muscle showed no contraction of the muscle bilaterally.
5. Spectrophotometric analysis showed that masticatory efficiency was also lower on experimental side as compared to the control side before rehabilitation
6. Post rehabilitation spectrophotometric analysis showed that there was significant improvement in masticatory efficiency on experimental side but there was no significant change observed on the control side.

It is recommended that future studies may be conducted with a larger sample size, longer follow up and in subjects with multiple missing teeth to study the effects of missing teeth on masticatory efficiency and muscle activity. Further, different methods of EMG analysis can be carried out in terms of rhythm, cycle and turns of amplitude of the contracting muscles for selected duration of time for precise evaluation of changes in the neuromuscular behavior.

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Prosthodontic Management of A Case of Parkinson's Disease - A Case Report

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ABSTRACT

Parkinson's disease is an idiopathic disorder of the central nervous system characterized by resting tremors, muscular rigidity, slow and decreased movements. It is the fourth most common neurodegenerative disorder.

Oral rehabilitation of these patients requires special care as the removable prosthesis cannot be guaranteed to function properly because of the diminished adaptive skills and poor muscle control by the patient.

This clinical report describes fabrication of a new prosthesis for a patient suffering from Parkinson's disease by using certain modified techniques in order to fulfill the above-mentioned requirements. The modifications followed were:

(1) Obtaining the primary impression by functionally corrected existing denture.

(2) Combining final impression and jaw relation procedures in one appointment by using a custom tray with detachable handles and occlusal rims.

(3) Incorporating grid strengthener in the processed denture.

INTRODUCTION

Parkinson's disease (PD) is an idiopathic, slowly progressive degenerative disorder of the neurons that produce dopamine. It is characterized by resting tremors, muscular rigidity, slow and decreased movement and postural instability. PD is a major cause of disability, social isolation, loss of self-esteem and depression.

It may be either primary or secondary[3]. Primary PD is characterized by degeneration of dopaminergic neurons of substantia nigra. Secondary PD is associated with the loss or interference with the action of the dopamine in basal ganglia due to other central nervous system diseases (eg. Post viral encephalitis, sub cortical strokes etc.) But regardless of the etiology, striatal dopamine deficiency leads to impaired ability to control the smooth movement of the skeletal muscles.

Key Words : Parkinson's disease.

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CLINICAL FEATURES:

i. Resting tremor of the hands that begins with weakness or rigidity.

ii. Muscle rigidity and hypokinesia may cause great difficulty when performing basic activities of daily living, such as preparing food, dressing etc. As the rigidity progresses, movement becomes slow (bradykinesia) and decreased (hypokinesia) and difficult to initiate (akinesia).

iii. As the Parkinson's disease progresses patient exhibits facial impassiveness; i.e. face becomes mask like, with mouth open, and diminished blinking.

iv. The classic unilateral "pill rolling rest tremor" of the fingers usually decreases with voluntary movement and hand writing changes.

v. Cog-wheel type of rigidity i.e., patient shows decreased arm swing with walking. A stooped, unstable posture causes great difficulty in balance, to compensate the patients head tends to lean forward on the trunk (Fig 1), the knees and hips are bent and the arms are flexed at the elbows. Patient find it difficult to initiate walking, once they do begin walking, they tend to walk uncontrollably faster and faster to keep from falling. When the center of gravity is displaced there may be tendency to fall forward/ backward. Tongue may dislodge the mandibular denture, facial muscles that are rigid or uncontrollable may prevent a maxillary denture from maintaining a retentive seal.

Fig 1. : To compensate for a stooped, unstable posture, the patient's head tends to lean forward on the trunk.

As the disease progresses, patients show a marked decline in functional status, a decreased ability to perform daily tasks, and participate in social activities.

Oral rehabilitation of these patients requires special care as the removable prosthesis cannot be guaranteed to function properly because of the diminished adaptive skills and poor muscle control by the patient.

Whenever possible correcting the existing prosthesis or duplication technique is advisable. However, if new prosthesis has to be given the Prosthodontist has to modify the conventional procedures keeping in mind certain objectives. i.e., decreasing the time and number of appointments, improving the quality of the prosthesis so as to prevent any damage to the denture due to poor muscle control etc.

This clinical report describes fabrication of a new prosthesis for a patient suffering from Parkinson's disease by using certain modified techniques in order to fulfill the above-mentioned requirements.

CASE - REPORT

A 69-year-old female patient was referred to our Department, K.L.E.s Institute of Dental Sciences, Belgaum for the prosthetic assessment of her dentures and its related problems. History revealed that patient was wearing dentures since 9 years, on examination the patient had favorable maxillary ridge and unfavourable mandibular ridge. Patient had ill-fitting dentures with decreased vertical dimension attrited teeth, and no proper occlusion.

A new set of complete denture was planned for the patient with certain modifications. The modifications followed were;

i. Obtaining the primary impression by functionally corrected existing denture
ii. Combining final impression and jaw relation procedures in one appointment by using custom tray with detachable handles and occlusal rims[1]
iii. Incorporating grid strengthener in the processed denture[5].

PROCEDURE

Borders of the existing dentures were adjusted in the patient's mouth for proper extension. Primary cast was obtained by making the functional impression with this corrected denture, using tissue-conditioning material as the impression material[6]. The advantage of this technique is to get the special tray with its borders almost similar to the extensions of the final denture.

Materials required for fabricating maxillary and mandibular custom trays with detachable handles and occlusal rims on it were Tin foil, pins and sleeves. For this purpose 8-pins (male portions) and 12 sleeves (female portion) were cut to about 6 mm segments. Acrylic resin was mixed and adapted on the primary cast to make custom tray in the usual manner. Before acrylic resin set two pins were inserted in anterior region and two in posterior region (Fig 2). Surveyor was used for this so as to make the long axis of all the four pins vertical and parallel to each other.

Once the acrylic sets, the tray was covered with tin foil, sleeves were placed on the anterior two pins and handles were made (Fig 3). After setting handles were separated from the tray. Similarly the tray was again covered with one more tin foil, sleeves were placed on all the four pins and now the occlusal rim was fabricated on it.

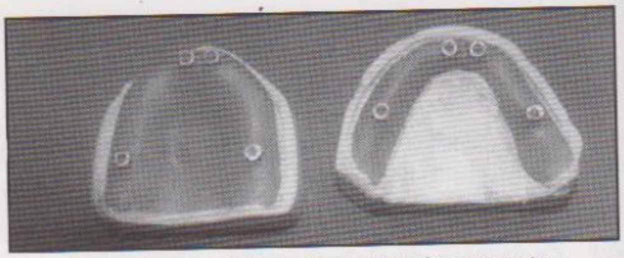

Fig 2. : Four parallel pins inserted in the custom tray in contact with palatal slope of the maxillary ridge and lingual surface of mandibular ridge.

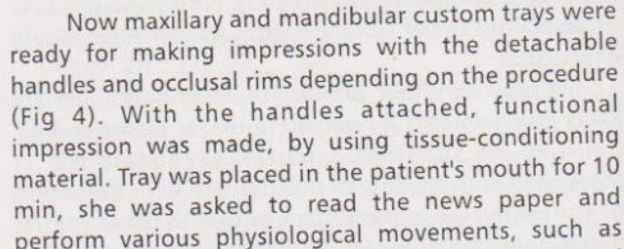

Fig 3. : Custom tray with handles in position.

Now maxillary and mandibular custom trays were ready for making impressions with the detachable handles and occlusal rims depending on the procedure (Fig 4). With the handles attached, functional impression was made, by using tissue-conditioning material. Tray was placed in the patient's mouth for 10 min, she was asked to read the news paper and perform various physiological movements, such as sucking, grinning, licking, swallowing etc.[2,7] (Fig 5 and 6). Any excess material that interferd with the placement of occlusal rims was removed. Final impression was made with Polyvinyl Siloxane (light body) impression material.

Now the handles were removed and occlusal rims were attached, vertical and centric jaw relation records were established in usual manner. Occlusal rims were removed from patient mouth.

Fig 4. : Custom tray with handle and occlusal rim.

Fig 5. : Making the patient to perform various physiological movements to obtain functional impression.

Fig 6. : Maxillary and mandibular functional impressions.

Base plates and final impressions from occlusal rims were separated and handles were reattached, impressions were poured, reference grooves made on the base of the cast and mounting was done with the record block in place.

Teeth arrangement was completed by taking the guidance from the copy cast made by pouring the reversible hydrocolloid impression of the polished surface and teeth of existing denture.

Trial dentures were checked in the patient's mouth for esthetics, occlusion, border extensions, midline and was ready for processing.

INCORPORATING THE STAINLESS STEEL GRID

For this purpose the master cast was duplicated using irreversible hydrocolloid impression material, and was poured with cold cure resin to get a rigid cast surface (Fig 7). Stainless steel grid was adapted properly on this rigid cast and margins of the grid were properly finished.

Dewaxing was completed in the usual manner. At the packing stage, first trial closure was done by placing an adapted shellac base plate on the master cast. At the end of first trial closure the shellac base plate was removed and metal grid was placed in that space. Second trial closure was done to confirm the proper placement of grid.

Denture was processed in the usual manner. It was finished (fig 8), polished, and checked in the patient's mouth for proper occlusion, retention, border extension and inserted (Fig 9a and 9b). Recall visits were planned.

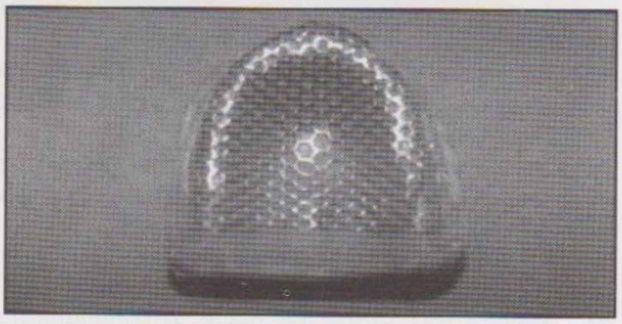

Fig 7. : Adapted stainless steel grid on the rigid (acrylic) cast.

Fig 8. : The finished denture.

Fig 9a and 9b. : Patient before and after the treatment.

DISCUSSION

In these patients removable prosthesis are appropriate to restore function. To minimize problems with adaptation, ill fitting, "Old friend" prosthesis should be modified or improved whenever possible. Tissue conditioners are recommended for functional relines where only vertical dimension has to be changed.

If possible copy or duplication technique should be used in order to retain the learned muscle control of the familiar dentures. But this has got its own limitations such as; repeating the design fault, facial form is seldom fully restored etc. Giving the new denture offers more efficient and flexible way of producing maximal base extension, which in turn offers maximum physical retention and stability.

Factors to be considered before giving any dental treatment in a parkinson's disease patient are;

i. Patient should be seated and raised in dental chair carefully to prevent falls and orthostatic hypotension[4].
ii. Dental treatment should be planned depending on the time of the day when the patient takes medications.
iii. Clinical appointments should be short and less in number.
iv. Every effort should be made to communicate with the patient directly even when communication is difficult.
v. Patients and caregivers must be informed that success with dentures depends to a large degree on appropriate muscle function, which controls and stabilizes the prosthesis during periods of rest and use.

CONCLUSION

The success of complete denture depends on wearers ability to control dentures with their oral musculature. Even with the best technique removable prosthesis cannot be guaranteed to function properly in these patients because of diminishing adaptive skills.

Clinician must provide competent and timely care to patient with Parkinson's disease by understanding the disease, its treatment and its impact on patient's physical and cognitive ability.

The technique described here is a relatively drastic departure from the usual procedure. With these techniques it is possible to give complete dentures to patients in four visits and with shorter appointments each time. This technique may increase the laboratory time but reduces the clinical time to a great extent, without compromising the basic principles of complete denture construction. This technique can be used to achieve best possible results in all medically compromised elderly patients who need replacement of dentures.

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Prosthodontic Rehabilitation of Partial Anodontia - A Case Report

REETA JAIN, M.D.S. *

ABSTRACT

Partial anodontia is characterized by congenitally missing one or more teeth in either or both dentitions. The condition affects the aesthetics and functional capability of the patient. This article discusses a case report of 33 years old male patient with multiple missing teeth which was managed by endodontic and fixed prosthodontic approach and satisfactory results were achieved.

INTRODUCTION

Congenital absence of teeth may be of two types, total and partial. Total anodontia is a condition in which all the teeth are missing and usually involves both the deciduous and permanent dentition. It is a rare condition and occurs commonly in conjuction with generalized systemic disturbances, like hereditary anhidrotic dysplasia. A case of male patient with true partial anodontia is managed by a conbined endodontic and fixed prosthodontic approach.

CASE REPORT

A 33 year old male patient who was aware of his missing and irregular teeth for many years reported in the O.P.D. of the Dept. of Prosthodontics, Govt. Dental College, Rohtak with chief complaint of missing teeth, hampering looks, impaired speech, difficulty in chewing and psychosocial problems.

PAST HISTORY

The patient was normal. His parents and children were also normal. But his grandmother had a similar condition. He had visited to many private practitioners and Govt. Hospitals before coming to Dental College, Rohtak. But he didn't take any treatment prior to this.

EXAMINATION

Extraoral : Extraoral examination revealed symmetric face, straight profile and eversion of lower lip. He had no signs of abnormalities of hair, eye, ear, sweat and tear secretions TMJ movement showed clicking on both sides. (Fig. 1)

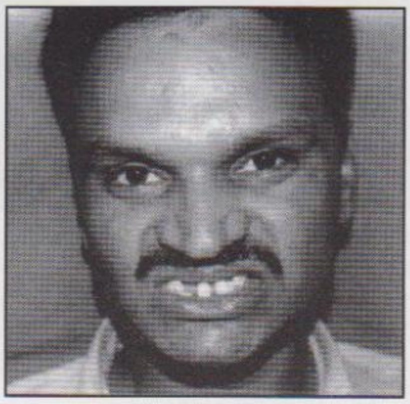

Fig. 1 : Facial View of the Patient.

Intraoral : Intraoral examination revealed the presence of 16 teeth only. In the maxillary arch, only 9 teeth were present. (Fig. 2) Maxillary right lateral incisor was severely distally inclined and discolored. In mandibular arch, only 7 teeth were present (Fig. 3). All the teeth were not well aligned and there was no occlusion at all. (Fig. 4)

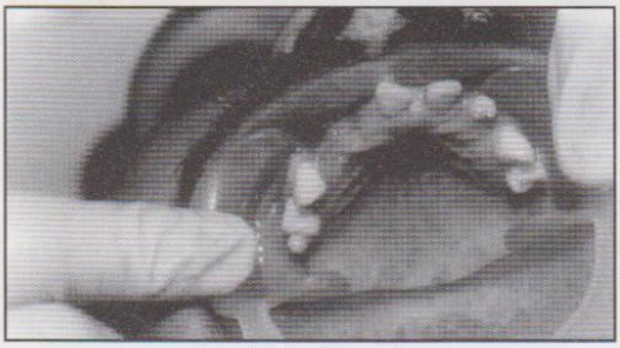

Fig. 2 : Maxillary arch.

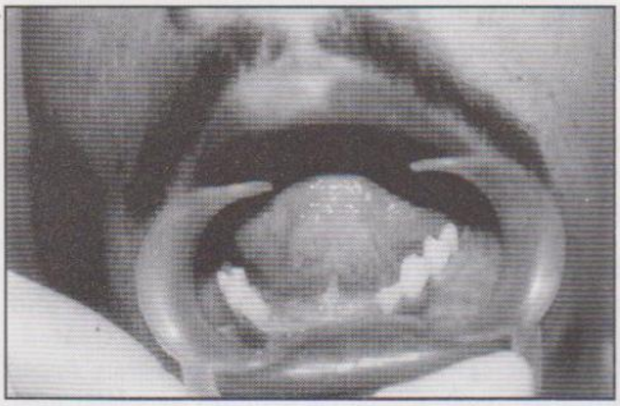

Fig. 3 : Mandibular arch.

Key Words : Partial anodontia, fixed prosthesis.

This paper was presented in World Congress on Prosthodontics & 31st IPS Congress at New Delhi.

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Fig. 4 : Intraoral view showing occlusion.

RADIOGRAPHIC EXAMINATION

Orthopantomogram revealed none of the teeth were impacted and no other skeletal abnormalities (Fig. 5). Intraoral periapical X-ray of maxillary right lateral incisor showed periapical pathology.

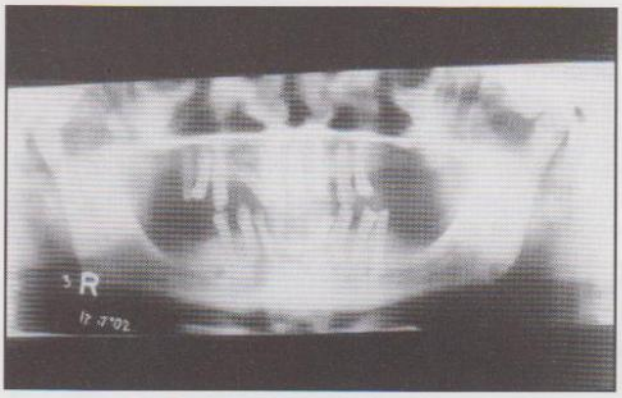

Fig. 5 : Pre-operative panoramic x-ray.

TREATMENT PLAN

The prosthodontic considerations which had an immediate bearing on the treatment plan were :

1. Number and condition of remaining teeth.
2. Finalizing the teeth to be extracted or restored.
3. Estimating the inter occlusal distance.
4. Patient's desire
5. A cost effective and easy to maintain design.
6. Easy patient acceptance towards prosthesis.

Based on the above-mentioned prosthodontic considerations, it was decided that the maxillary and mandibular arch would be restored by fixed prosthesis.

STEPS IN REHABILITATION

Maxillary right lateral incisor was extracted and remaining teeth were endodontically treated. Diagnostic casts were made. First temporary upper and lower removable partial dentures were fabricated and inserted to restore the lost vertical dimension. RPD's were given for one month. After one month, teeth preparations were done and impressions were made with elastomeric impression materials (Fig. 6, 7). Master casts were prepared. Face bow transfer was done to mount maxillary cast on semi-adjustable whip-mix articulator. Then centric-relation was recorded at an established vertical dimension. Mandibular cast was also mounted. Provisional fixed dentures were fabricated and cemented. Single unit fixed prosthesis was cemented in the lower arch and two fixed partial dentures (one right and one left) were placed in maxillary arch. Provisional fixed prostheses were given for one month. After one month, temporary fixed prostheses were replaced with the porcelain fixed prostheses (Fig. 8, 9) and patient was kept on periodic recalls at an interval of 24 hrs, 48 hrs, one week, one month, 3 months and 6 months. He was very much comfortable with this fixed prosthesis. (fig. 10)

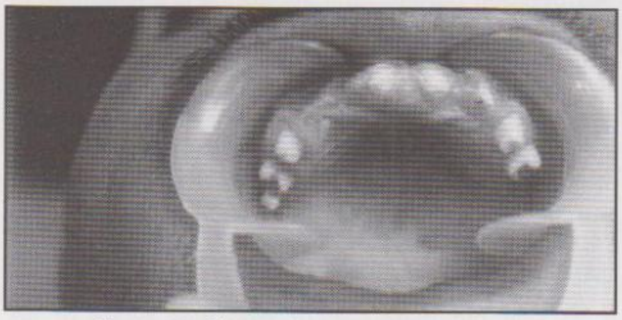

Fig. 6 : Maxillary arch with teeth preparation.

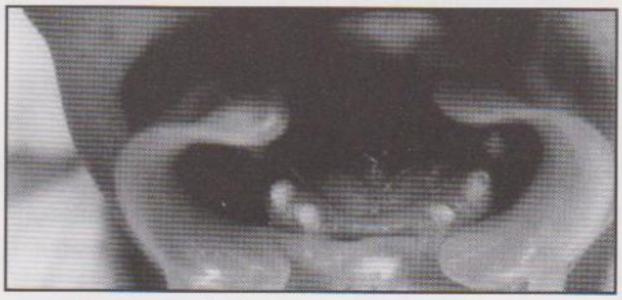

Fig. 7 : Mandibular arch with teeth preparation.

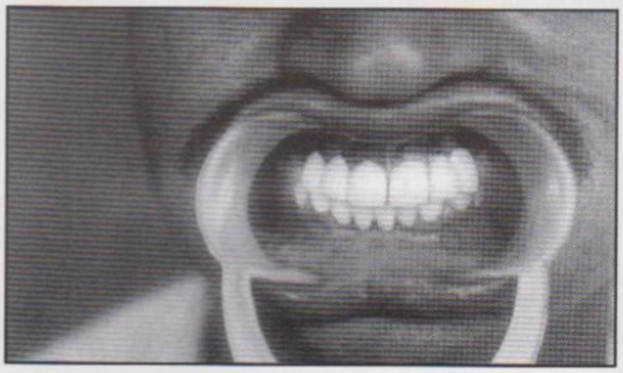

Fig. 8 : Intraoral view with metal-ceramic fixed prosthesis.

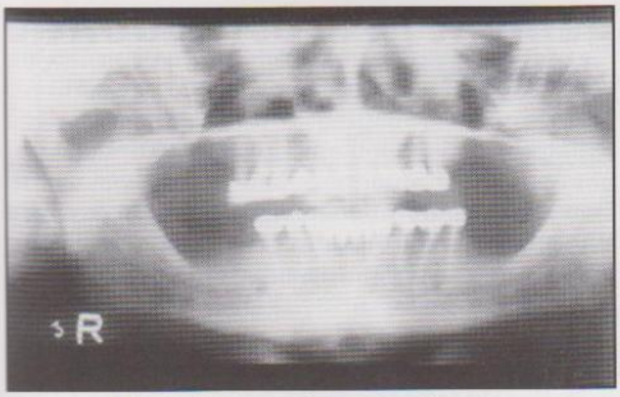

Fig. 9 : Post-operative panoramic x-ray.

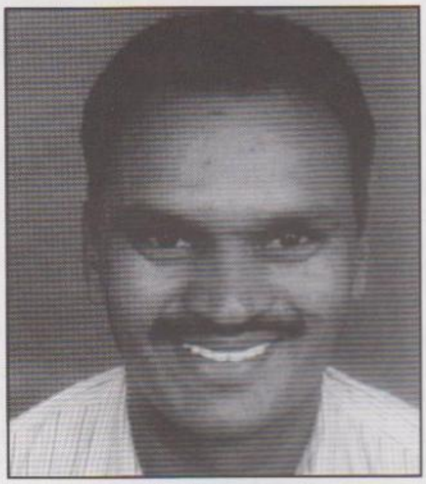

Fig. 10 : Restored smile.

DISCUSSION

Severe hypodontia is thought to be caused by hereditary and environmental factors. It has a population incidence of 0.3% in the permanent dentition, being much rare in the deciduous dentition. Hypodontia of permanent teeth has an approximately equal frequency in upper and lower jaws. In Europeans, the mandibular second premolar is usually found to be the tooth most frequently absent after third molar followed by the maxillary lateral incisor and second premolar. Hypodontia of maxillary central incisors or of canines or first molars is rare, occurring principally in cases of severe hypodontia. Severe hypodontia is frequently associated with delay in development and a relative lack of alveolar growth resulting in an increased freeway space (Graveley and Johnson 1971). The facial appearance may mimic that of edentulous person, with mandibular protrusion and lip eversion on occlusion. Occasionally there is a reduction in masticatory ability. The missing and deformed teeth together with the facial appearance can lead to considerable psychological disturbance.

The management of patients with severe hypodontia presents considerable difficulties and a suitable treatment plan is must. Overdentures are the most desirable treatment option for these patients. Crum has provided an excellent overview of the advantages of conventional overdenture. But in this case, patient was not willing for removable type of prosthesis at all. That's why, fixed treatment option was choosen for this patient, Fixed prosthodontic rehabilitation of this case not only improved function and esthetics dramatically but also psychologically boosted the morale of the patient.

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Gagging - Causes and Management in Prosthodontic Treatment : A Review of Literature

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ABSTRACT

The gag reflex is a complex physiologic phenomenon. The function of the reflex is protective in nature. When the reflex is abnormally active, the dentist may be presented with a bewildering and frustrating problem in various dental procedures. This paper reviews various causes and methods to minimize gag reflex, so that various oral procedures can be executed effectively.

INTRODUCTION

Every dentist and most dental students and paradental personnel have had experience with the patient whose gag reflex is abnormally active. Gagging[4] has been defined as an ejectory constriction of the muscles of the pharyngeal sphincter. It is a normal protective reflex designed to protect the airway and remove irritant material from the posterior oropharynx and upper G.I.T. Gagging reactions range from mild choking to violent, uncontrolled retching which may/may not precede vomiting' Feintuch[8] has described clinically the graphic description of a patient with gag reflex. "As the body trembles and footrest is stamped, large tears roll down from the eyes. The face of the victim takes on the hue of apoplectic purple and the patient gasps for breath, at the same time attempting to eject the introduce from his mouth and his insides with them". When spasmodic contraction of respiratory muscles occur during retching, air is forced through the closed glottis, producing the characteristic retching sound. In addition, chest muscles are in fixation and thoracic inlet muscles are contracting. This causes impediment of the venous return, dilating the veins of the head and neck, with flushing and congestion of the face.

PATHOPHYSIOLOGY/MECHANISM OF GAGGING:

When stimulation occurs on the soft palate and or posterior third of the tongue, afferent impulses are transmitted to a center in the medulla oblongata.

Key Words : Gagging, pathophsiology, causes, management.

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From this center, efferent impulses arise and are transmitted resulting in the spasmodic and uncoordinated movements of gagging. (Table I & Table II)

NOTE :

Center in the medulla oblongata is very close to the vomiting, swallowing, salivating and cardiac center, explaining why gagging may be accompanied by additional reflex activity. (drooling, tearing etc.)

TABLE I

Sensory nerves for Afferent pathways to center in medulla:

C.N.	Area Supplied
V (Trigeminal)	Lips, Buccal surfaces of cheek, Anterior 2/3 of tongue, soft palate, sublingual region.
IX (Glassopharyngeal)	Posterior 1/3rd of tongue, posterior of pharynx.
X (Vagus)	Epiglottis, Pharynx, Larynx above vocal cords.

TABLE II

Sensory nerves for efferent pathways from reflex centre in medulla:

V (Trigeminal)	Muscles of mastication, Mylohyoid, Tensor palatini
VII (Facial)	Muscles of the lips
IX,X,XI (Pharyngeal plexus)	Fauces, palate, pharynx
X (Vagus)	Larynx
XII (Hypoglossal)	Tongue

Note : IX is peculiar in that it's afferent fibres both elicit and inhibit the reflex.

CAUSES :

Several authors propose a number of general classifications of causes which include extra oral and intraoral, physiologic and iatrogenic factors.

I SYSTEMIC DISORDER :

The patients general health is often related to dental health with some impact on the gagging reflex.

Chronic conditions, such as, deviated septum, nasal polyps, or sinusitis, blocked nasal passages increase the likelihood of the gag reflex.

Chronic problems of gastrointestinal tract may increase irritability, lower the threshold for excitation of the oral cavity, and contribute to nausea and gagging. Alcoholism, Chronic gastritis and carcinoma of stomach, peptic ulcer and cholecystitis are related to chronic gastro intestinal irritability and gagging. Inflammation of the pharynx is a hypersensitive gag reflex. This condition is common in persons who drink and smoke excessively. Medications that the patient may be taking are another consideration if they produce nausea as a side effect.

II PSYCHOLOGIC FACTORS:

Discussing the psychologic aspects of gagging, Bartlett[8] states that such psychosomatic reaction may be active or passive. An active reaction is due to factors that currently have some functional purpose in the patient's life situation. For various psychologic reasons, patients may gag to gain attention from the dentist, to avoid treatment, and or to avoid the outcome of treatment. In contrast, a passive reaction is the result for various reasons, the causes of which are no longer functionally important.

Wright[8] concluded that one third of the patients reported the problem as being most acute in the morning during oral hygiene and insertion of dentures. This might occur from lack of habituation to stimulation from the denture since it was not worn at night.

Kramer and Braham[5], stated that "fear" is almost always the underlying factor influencing the psychologic gagger.

III PHYSIOLOGIC FACTORS:

Visual, auditory and factory stimuli are extraoral factors that can elicit the gag reflex, while dental prostheses and performance of dental procedures represent intraoral stimuli

(a) **Extraoral Stimuli :** The mere sight of a mouth mirror or impression tray is stimulus enough to cause some patients to gag.
Landa[1] observed a deaf patient suffer a spasm of gagging while viewing gagging of another patient.

(b) **Intraoral Stimuli :** Landa states that posterior part of palate and upper surface of the posterior one third of the tongue are the most sensitive regions in the entire oral cavity. Tactile stimulation of the oral tissues inevitably occurs when executing various dental procedures. In the dental literature, various biomechanical aspects of dental prosthesis are suggested as causing the gag reflex. These biomechanical aspect related to gagging are inadequate post dam, over extended posterior borders, disharmonious occlusion, poor retention, surface finish of acrylic resin and inadequate free way space. An under extended prosthesis also may contribute to a gagging problem. Inadequately extended borders that result in poor retention produce an unstable prosthesis. Movement of such prostheses may stimulate tickling sensation and elicit a gag. Krol[4] stated that inadequate free way space may cause gagging related to complete dentures and his explanation suggested that the elevator muscles do not relax normally if the occlusal vertical dimension exceeds the rest vertical dimension. This may cause a spasm that sets in action a chain of swallowing muscle responses. One possible sequence would involve a spasm of the tensor palatini muscles, which produces sensation when the maxillary denture seems to extend too far backward. The tensor palatini muscles slightly depresses the soft palate and presses it against the posterior border of the denture, producing gag reflex.

IV IATROGENIC FACTORS:

In the otherwise non gagging patient, poor execution of intra oral procedures may elicit gag reflex. Sensitive tissues may be stimulated as a result of rough or careless technique and temperature extremes of instruments.

MANAGEMENT:

Effective management of gagging depends over treating the cause and not merely the symptoms treatments falls into following categories, namely (1) Psychologic intervention (2) Prosthodontic management (3) Pharmacologic measures (4) Surgical intervention (5) Accupressure and Accupunture.

(1) PSYCHOLOGIC INTERVENTION

The spectrum of suggested approaches runs from a gentle manner to psychotherapy. Psychotherapy includes hypnosis, behavior management procedure of systemic desensitizing, covert reinforcement modelling fear reduction.

Many recommended clinical techniques are directed at diverting the patients attention from the gagging stimuli. Landa[1] suggested that the dentist engage the patient in conversation on some topic of special interest. Kovats[9] reported a technique that has the patient breathe audibly through the nose and at the same time, rhythmically tap the right foot on the floor. By concentrating on these activities the patient's attention may be diverted away form the gagging stimulus. Faigenblum[9] stated that vomiting is impossible during apnea. To control gagging the patient should be instructed to prolong the expiratory effort at the expense of inspiration. This will produce a state of apnea and discourage gagging. A similar technique was described by Krol[4] to divert attention, the patient is instructed to raise his or her leg and hold it in the air. As the patient's muscles become increasingly fatigued, more and more conscious effort is required to hold the leg up. At the point where the patient has difficulty carrying on conversation, intraoral procedures may be attempted.

PROSTHODONTIC MANAGEMENT:

Prosthodontic approach to the patient with the gagging problem involve technical modifications to render the prosthesis more acceptable to the patient.

Excess thickness, overextension or inadequate postdam should be corrected before more radical modifications in the prosthesis are made.

The smooth, shiny surface of a complete denture is objectionable to some patients. From his clinical experience, Jordan[9] suggests that a matte finish is more acceptable to patients than a glossy surface. Krol[9] discussed the importance of "Freeway" space to the gag reflex. In all instances, an increase in the interocclusal distance resolved the gagging problem. To avoid substandard impressions because of gagging, Brokin[3] outlined an impression technique for edentulous patients. A primary impression is obtained by pouring Kerr impression wax. The pliable nature of the wax allows reseating of the tray and border molding until desirable results are obtained. A technique that employs ordinary marbles was reported by Singer[7] as an effective approach to overcoming a patient's inability to tolerate complete dentures.

At the first appointment, the patient was asked to place five marbles in his mouth one at a time and at his leisure. The patient was further instructed to keep the marbles in his mouth continuously for 1 week, except when eating and sleeping. After 1 week patient's ability to tolerate the marbles was evaluated, and he was reassured that he would be able to tolerate denture. At the third visit modeling compound impression were made, refined and completed. At the fourth visit, the lower base tray was inserted along with three marbles in the mouth, and a "training bead" was placed on the lingual aspect of the base tray to maintain proper tongue position (Fig. 1) During the fifth visit the use of marbles was discontinued, and at the sixth visit, jaw records were made and the occlusion rims marked. The completed dentures were inserted at the seventh visit. Singer admits that patient's motivation is an indispensable component of the marble technique. It appears that his approach presents definite medicolegal risks in the event of aspiration by the patient.

Fig.1 : Training Bead - Marble technique.

PHARMACOLOGIC MEASURES :

The drugs used to control gagging maybe classified as peripherally acting or centrally acting drugs. Peripherally acting drugs are topical and local anesthetics. The rationale for the use of these drugs is that if the afferent impulses from sensitive oral tissues are eliminated the reflex of gagging will not take place. Centrally acting drugs categorized as antihistamines, sedatives and tranquilizers, parasympatholytics, and central nervous system depressants. Pharmacologic intervention offers only a short-term solution, aspecially for severe, chronic problems.

SURGICAL CORRECTIONS :

Leslie[10] reported a surgical technique to relieve gagging for the patient unable to tolerate complete dentures. The basis for this technique stems from the observation that persistent gagging results from an atonic and relaxed soft palate, which is found in the nervous patient. To correct this situation, Leslie advocated an operation to shorten and tighten the soft palate.

ACCUPUNCTURE :

Ear acupuncture[10] was selected because there is specific, recognized anti-gagging point on ear (fig 2) and needles are not disturbed during access to the mouth for dental treatment. Needles are out of the patient line of vision. Technique involves the insertion of fine single use disposable needle of 7 mm and inserting into anti-gagging point of each ear to depth 3 mm. The needle manipulated for 30 sec prior to carrying out treatment.

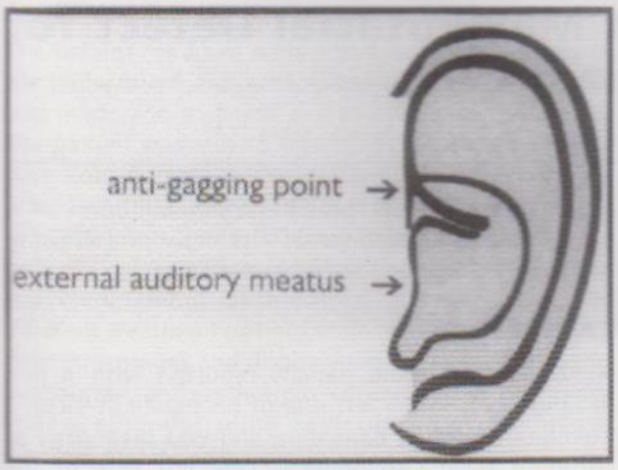

Fig. 2 : Anti - gagging point.

ACCUPRESSURE CAVES :

Accupressure caves[10-] are sensitive points in the human body that feel soreness distention, (otherwise known as "Suan Zhang") when an deep pressure is applied for five to twently minutes. These points are.

1. Left and Right concave area at medial aspect of the forearm (NEIGUAN)
2. Concave area between First & Second metacarpal bones (HEGU) (fig 3)

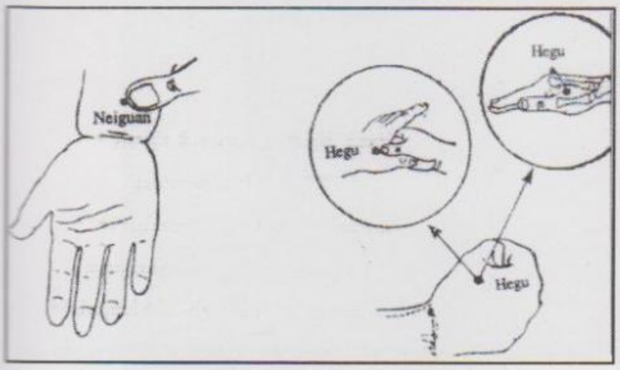

Fig. 3 : Accupressure caves.

SUMMARY AND CONCLUSION:

The most serious problem associated with the strong potential with an overactive gag reflex is the strong potential for compromised treatment and it presents as a challenge to the capability of a dentist. Many techniques are available for controlling the exaggerated gag reflex and no single technique will solve each patients problem.

The conscious mind of the patient must be regarded by the dentist as the primary factors for the inhibition of gagging. Building a relation based on confidence is more valuable than applying most medicaments.

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Prosthetic Rehabilitation of Maxillofacial Defect for A Postoperative Cancer Patient

Shobha Rodrigues, M.D.S.*, Ramanand Shetty, M.D.S.**, D. R. Prithviraj, M.D.S.***, Vidya Shenoy, M.D.S.****

ABSTRACT

The eradication of malignant tissue requires removal by surgery or destruction by radiation. If the malignancy involves the head and neck region it frequently leaves the patient with severe facial deformity. This aggravates the patient's psychological depression, besides impairing function, speech and Aesthetics.

The successful rehabilitation of such a patient requires the concerted and team effort of various disciplines of Dentistry as well as other health professionals. The Prosthodontist also has a major role to play in their rehabilitation. Different treatment modalities using various techniques and materials may be employed in the successful management of these patients.

This clinical report describes the prosthetic management of a patient with carcinoma of the maxilla following radiation and hemimaxillectomy.

INTRODUCTION

The discovery that one is suffering from a malignant disease is devastating for both the patient and his family. Higher incidences of these malignancies in the head and neck region have been noted among elderly patients with prevalence three times more in men than in women. Early detection increases the chances of cure; unfortunately only about 35% of those diagnosed have curable disease at the time of diagnosis.

Treatment options are same as treatment of other cancer of the head and neck including surgery, radiation therapy and Chemotherapy. Unfortunately, most of these methods result in unwanted or incapacitating defects requiring immediate short or long term management or rehabilitation procedures. Reconstruction after surgical treatment can be accomplished either surgically or prosthetically. Prosthetic rehabilitation has considerable advantages, for example, prosthesis offers the clinician and the patient means to observe the healing wound for recurrence of the disease, aesthetic superiority, technical simplicity and inexpensive care. This clinical report describes the prosthetic rehabilitation of a patient with Carcinoma of the maxilla following radiation therapy and hemimaxillectomy.

CASE REPORT:

A 56 year old male patient reported with a non healing ulcer on the left side of his palate at Victoria Memorial Hospital, Bangalore and was diagnosed as suffering from Carcinoma of the left side of the maxilla.

History revealed smoking 2 or more packs of bidis/ day, and a habitual tobacco chewer for many years. He also gave a history of weight loss, headache and difficulty in swallowing. Patient underwent hemi-maxillectomy of the left side and was referred to the Postgraduate department of Prosthodontics, GDC Bangalore for possible prosthetic rehabilitation.

Fig. 1 : Pre-operative View.

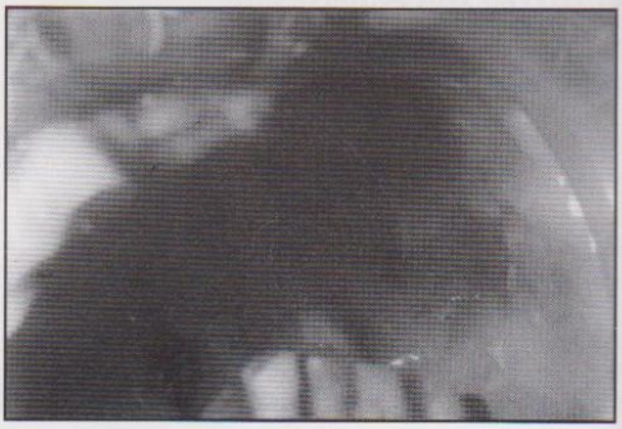

Fig. 2 : Intra Oral View.

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TREATMENT:

The patient reported with post hemi-maxillectomy to the department and a complete review of his history was made and a clinical oral examination completed. The patient was able to take fluids or solids by mouth with considerable difficulty. Deglutition and speech was almost impossible. The defect was covered with a split thickness graft reflected from the cheek. The patient was partially edentulous in the maxilla with a full complement of teeth in the mandible. The different treatment options were presented along with their advantages and disadvantages. Due to feasibility, availability and economic constraints a one-piece hollow obturator using heat cure acrylic resin was planned and subsequently fabricated.[1, 3]

STEPS IN REHABILITATION:

Initial impression was made with irreversible hydrocolloid in stock tray, but as the defect was too large, a primary cast was poured and outline for a custom tray made.

1. Border moulding was done and the final impression was made in alginate. (As shown in figure : 3). As the defect areas was sufficiently large and without any undercuts, no blocking with gauze was done.

Fig. 3 : Final Impression.

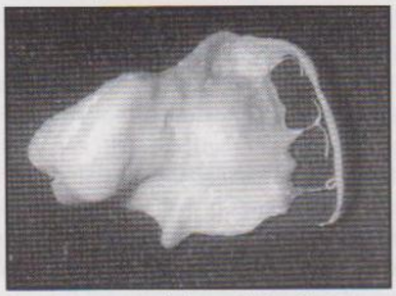

Fig. 4 : Extra Oral view of the Obturator.

2. Denture base was fabricated, vertical dimension and centric relation recorded and the casts were mounted on the articulator.
3. Teeth were arranged; trial taken and posterior palatal seal area was recorded.
4. To aid in retention C- clasps on the 13, 15, 16 and a continuous bar passively resting over the tissues on the normal side were made. The denture was flasked in the conventional manner and a shim was fabricated to construct a hollow bulb.

SHIM FABRICATION:

The cavity in the mould (replica of the defect) was lined with one thickness regular base plate wax.

Three widely separated notches are cut in the wax, which reached the underlying stone of the master cast, to facilitate proper positioning of the shim.

One thickness of base plate wax is placed in the top half of the flask over the defect area.

Auto polymerising Acrylic resin is adapted over the wax relief in the defect area.

The flask was closed and the resin was allowed to cure.

Flask was reopened and wax flushed out with a stream of boiling water.

The shim was correctly repositioned with the help of the three stops.

Heat cure Acrylic resin was packed into the defect and the shim correctly repositioned.

The denture was cured, deflasked, finished and polished in the conventional manner.

The prosthesis was then inserted in the mouth and checked for accuracy and retention. Patient's speech and masticatory ability was improved. Appearance was just satisfactory.

The patient was instructed on home care and prosthesis maintenance

To sanitize the wound the patient was instructed to gently remove any exudates with a wet cotton tip with 1% hydrogen peroxide once a day. In addition placement of the prosthesis was demonstrated and patient scheduled for the first adjustment (3 days after delivery)

At the first adjustment appointment treatment included observation of the surgical wound to ensure health of the tissues, adjustment of the prosthesis to resolve pressure areas on the tissue and emphasis on hygiene regarding prosthesis maintenance and home care.

Fig. 5 : Introral view of the Obturator.

Fig. 6 : Post-operative View.

After the first adjustment patient was placed on a 3 month recall for evaluation of the prosthesis and observation for recurrence.

SUMMARY:

The Prosthodontist has a major role in the rehabilitation of a patient who has undergone radical surgery.

Surgical reconstruction may be complex and be dictated by the patient's physical condition, recurrence of the lesion and readiness to go in for another surgery. Successful rehabilitation of a patient with an acquired defect of the palate requires the concerted and team effort of various disciplines of dentistry as well as other professionals. This clinical report describes prosthetic rehabilitation of a patient with carcinoma of the maxilla following radiation and hemimaxillectomy.

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Abstract

MOVEMENT OF TEETH ADJACENT TO POSTERIOR BOUNDED EDENTULOUS SPACES

Purpose : *This retrospective study analyzed the change in distance between teeth adjacent to a bounded edentulous space over a period of time.*

Material & Methods : *Sectromic treatment record data on patients treated at the Kaiser Permanents Dental care programme in Portland, ore, were used in this investigation. The focus of the analysis was 116 intreated bounded edentulous spaces. For each treatment, 7 variables were studied! Patient age, sex, missing tooth number and date of extraction, radiograph data, distal probing depth of the tooth immediately anterior to the edentulous space (at or with in 6 months of extraction) and merial probing depth of the immediately posterior tooth (at or within 6 months of extraction). Pre-extraction and all subsequent radiographies were scanned and digitized, with use of there images, distance between the anterior and posterior abutments were recorded. A pre-extraction measurement for each situation served as a baseline value. One investigator made all measurements. The change in the distance between the teeth was evaluated with linear spline regression analysis.*

Results : *The mean time between baseline and the final radiograph was 6.5 months, the mean change in the distance between teeth was greatest during the first 2 years after extraction but did not exceed 1 mm per year. After the initial 2 year period, little change in distance occur in most situation. Bounded edentulous spaces in the mandibular molar region exhibited the greatest change in distance between the abutment teeth. Probing depths, age and sex were not significantly associated with the distance change between teeth.*

Conclusion : *Within the limitations of this study, it was determined that teeth adjacent to a bounded edentulour space move gradually and only a minimal distance during the first 2 years after extraction.*

- J.P.D. Feb 2002 Vol. 87, Issue 2

Enhancing appearnace in Complete Dentures using Magnet retained Cheek Plumpers

NAVITA VERMA, B.D.S. *, VIDYA CHITRE, M.D.S. **, MEENA ARAS, M.D.S. ***

ABSTRACT

Loss of teeth brings in its wake the crippling disabilities related to loss of masticatory function but perhaps the facial disfigurement associated with the loss of teeth has a greater psychological effect on the individual.

Presented herein, is an innovative technique of plumping the cheeks by using cheek plumper which are attached to the conventional complete denture using magnets. The insides of the plumpers are made hollow so that they are lightweight in addition to allowing easy cleansibility. Perhaps their greatest advantage lies in the fact that they are completely detachable and hence can be inserted as well as removed from the mouth independent from the prosthesis and hence are most useful to patients with limited mouth opening.

CLINICALY RELEVENT STATEMENTS:

- Magnet retained cheek plumper prosthesis help to enhance facial appearance by supporting the slumped cheeks.
- Perhaps their greatest advantage lies in the fact that they are completely detachable and hence can be inserted as well as removed from the mouth independent from the prosthesis and hence are most useful to patients with limited mouth opening.

INTRODUCTION:

Loss of teeth brings in its wake the crippling disabilities related to loss of masticatory function but perhaps the facial disfigurement associated with the loss of teeth has a greater psychological effect on the individual.

Replacement of missing teeth with a complete denture helps improve the masticatory function, in addition to providing support to the lips and to a limited extent to the cheeks as well. Addition of excessive amount of denture base resin to plump the cheek will unnecessarily make the dentures heavy and decrease patient comfort. This problem is compounded especially if the patient has a limited mouth opening.

Key Words : Masticatory function, Cheek lifting appliance, Magnet retained cheek plumpers.

Presented at the 5th Goa State IDA Conference held in October 2003.

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CHEEK PLUMPER:

In order to mimic the fullness of the cheeks, a cheek plumper is often used. Also known as the cheek lifting appliance, It is variously cited in literature for providing support to the cheek wherever and whenever deficient.[1-4] This is basically a prosthesis for supporting and plumping the cheek to provide a youthful appearance. It is especially useful in young patients who have lost all their teeth and part of the maxillary bone as a result of a traumatic injury. Its use in Maxillofacial Prosthodontics is well documented.[3,4]

However it can also be used in patients who have an unusually excessive slumping of the cheeks as a result of teeth loss.

A Conventional cheek plumper would be a part of the complete maxillary denture prosthesis forming single unit prosthesis with extensions on either side in the region of the polished buccal surfaces of the denture and are continuous with the rest of the denture.

DISADVANTAGES OF CONVENTIONAL CHEEK PLUMPERS:

- The conventional cheek plumper if not made hollow could add excessive weight to the upper denture thus bringing it down by force of gravity
- The buccal extension could interfere with masetter muscle and the coronoid process of the mandible and hence destabilize the upper denture especially during eating.
- The extensions could result in muscle fatigue and the only way to relieve it would be for the patient to remove the upper denture which might not always be desirable.
- The excessive mediolateral width of the denture in the region of the cheek plumper could result in difficulty in inserting the denture and this would be more of a problem for patients with smaller mouth opening.

CASE REPORT:

A 40-year-old female patient with no history of trauma presented to the dental clinic for complete dentures.

She desired dentures not only for their functional purpose but also to enhance her appearance.

History - the patient presented with a markedly low self-esteem and was extremely low on morale. She had lost her teeth gradually over a period of 5 years as they were mobile. She was edentulous for a period of two years.

On investigating the patient presented pictures of herself at the time of her wedding. She had a remarkably full face and since then her cheeks had completely slumped in. This left a major psychological impact on the patient.

On examination one of the major findings was excessive slumping of the cheeks and small oral aperture restricting the opening into the mouth (figure 1 and figure 2 and figure 3 respectively). Intra oral finding revealed resorbed maxillary and mandibular ridges.

Fig. 1 : Patient presentation - side View.

Fig. 2 : Patient presentation - front View.

Fig. 3 : Small Oral Aperture.

TREATMENT PLAN

Accordingly a treatment plan was formulated. The patient needed complete dentures with some form of cheek support.

The small oral aperture hindered easy placement and removal of a stock impression tray hence it was perceived that a conventional complete denture with buccal extension to support the cheek would not be easily inserted into the mouth. Moreover the fact tha the ridges were resorbed precluded the use o conventional cheek plumpers, as the weight of th prosthesis would result in loss of retention an stability of the maxillary denture with buccal extensio to support the cheeks. The limited mouth openin and the fact that the ridges were resorbed preclude the use of conventional cheek plumpers hence a ne design would be required:

- To support the cheeks as well as not add to th weight of the prosthesis
- Not hinder the insertion and removal of th prosthesis

MAGNET RETAINED CHEEK PLUMPERS

A complete denture with buccal extension to suppo the cheeks that could be detached from the comple denture at the time of insertion and reattached to t complete denture inside the mouth and at the sa time be hollow so as to not weigh down the prosthe was the need of the hour. The use of magnets to h the individual buccal extension on the left and ri buccal polished surfaces inside the mouth w thought to be an ideal solution. The use of magn would allow detaching the buccal extension from complete dentures at the time of insertion a removal of the denture and be reattached into per alignment inside the mouth by force of magn attraction, thus requiring limited dexterity on part of the patient.

Magnets are being used in successfully in dentistry in the field of Orthodontics and Removable Prosthodontics.[5, 6] Over the last century, significant advances have been made in the development of magnetic materials. These advances have quickly transferred into dental application.[7] The main reason for their popularity is related to their small size and strong attractive forces, which allow them to be placed in the prosthesis without being obtrusive in the mouth. The main magnetic material used in dentistry is the rare earth material neodymium iron boron, which is the most powerful commercially available magnetic material; other materials include the RE alloy samarium - cobalt.[8]

Magnets are easy to incorporate into a denture and can simplify both clinical and technical procedures. Various devices such as springs, suction caps, clips and studs all have been used to retain complete and partial removable dentures within the mouth. As regards this case, an attempt was made to retain two prosthetic parts to one another rather than to the denture bearing area.[7]

PROCEDURE:

Considering the resorbed nature of the ridge a few subtle considerations were made. Upper and lower impressions were made using the admix impression technique using elastomeric light body as the final impression material.[9]

The occlusal scheme was decided keeping in mind need for decreased trauma to the lower ridge and esthetics. Hence maxillary anatomic teeth were used for the purpose of esthetics. These occluded with lower non-anatomic teeth to decrease transfer of harmful stresses to the resorbed lower ridge.[10]

At the try-in stage, cheek plumper were made in wax as separate portions on the buccal surface of the complete trial denture. They were superficially attached to the buccal surfaces on the right and left side and tried in the mouth to determine the amount of desired cheek support appropriate for comfort, function and esthetic (figure 4). Once this was determined, they were again separated from the complete denture and hollowed from the inside. Clinical magnets being beyond the affordability of the patient, a decision was made to use stereo/radio magnets that are known for their powerful magnetic attraction. The higher chances of corrosion and loss of magnetic properties were explained to the patient. Stud shaped magnets were then placed into each of the hollowed buccal extension. Corresponding to this buccal extension, hollowed cavities were made on the

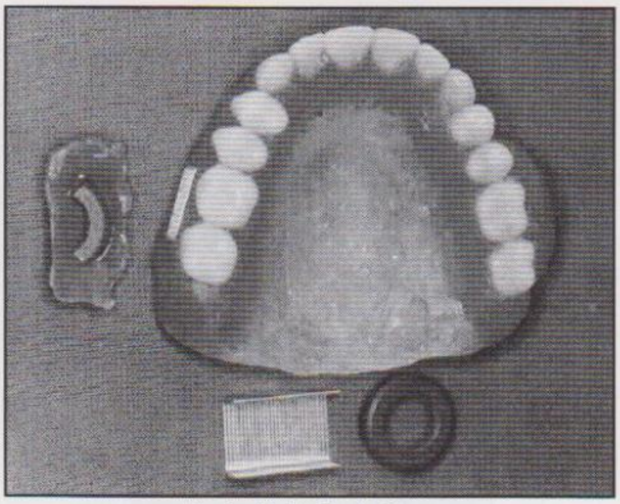

Fig. 4 : At the Try-in Stage.

buccal surface of the denture on the right and left side approximately in the cervical region of 2nd premolar and molars. Magnets were placed in these cavities taking care to align the poles properly with the magnets in the buccal extension of the respective side to allow strong attractive forces between the magnet in the polished buccal surface of the denture and intaglio surface of the buccal extension. Considering the high corrosion potential of these magnets, they were encased in steel casing within the buccal polished surface of the denture.[11] (Figure 5)

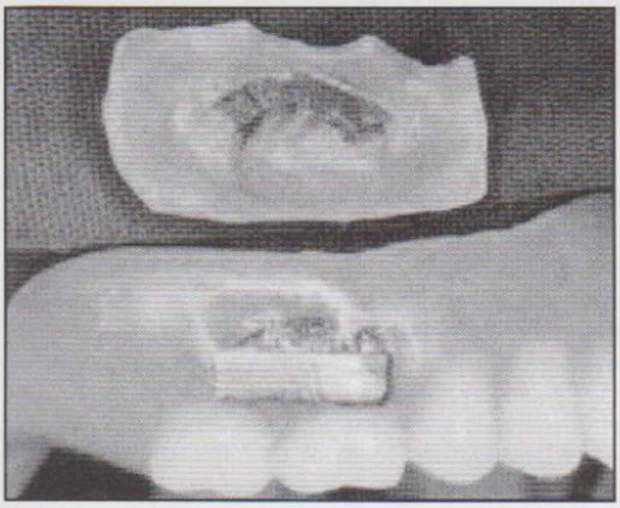

Fig. 5 : Finished Denture seen with Magnets on the Buccal Polished Surface and inside the Cheek Plumper of that side.

Figure 6 shows patient immediately after inserting only the complete dentures sans the buccal support on either side. After inserting the complete denture she now inserts the buccal supports on either side which have been engraved as L and R for convenience. Once inserted into the mouth they go and snap into proper position on account of the magnetic forces.Patient after insertion of prosthesis and the buccal support of either side (figure 7 and figure 8).

Fig. 6 : After Insertion of only the Dentures.

Fig. 7 : Denture with Cheek Plumper.

Fig. 8 : Side View with Denture.

ADVANTAGES OF MAGNET RETAINED CHEEK PLUMPERS

- The magnets have a small size and hence can be placed within the denture and the cheek plumper without being obtrusive to either.
- Produce strong attractive forces between the hollow plumper portion and the steel encased magnet within the buccal tissue surface of the denture.
- Can be introduced in the mouth after the insertion of the denture as two separate portions each of which are marked for convenience
- Can be removed from the mouth during eating and when experiencing excessive muscle fatigue.
- Allows for ease of placement and cleaning.
- Automatic reseating.

DISADVANTAGES OF MAGNET RETAINED CHEEK PLUMPERS

- Poor corrosion resistance.
- Alleged harmful effects of magnetic field on the health of the oral tissues.
- Loss of magnetic property over a period of time and hence requiring frequent replacement.

CONCLUSION:

25 years of battering the vagaries of married life lead to a slumping in of the cheeks and loss of sparkle in the eyes of this lady patient. By giving the patient magnet retained cheek plumpers an attempt was made to restore cheek fullness to the extent that comfort and function would permit. More importantly what it managed to do, was to restore the lost enthusiasm for life and a smile on her face which are perhaps the most essential requirement to boost self esteem.

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Occlusal Assessment

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ABSTRACT

The occlusal anatomy of teeth functions in harmony with structures controlling the movement pattern of mandible like temporomandibular joints and the anterior teeth.

During any given movement the unique anatomic relationships of these structures continue to dictate a precise and repeatable pathway.

This paper describes methods to carry out clinical occlusal assessment based on:

1) *Occlusal contacts and interferences in various mandibular movements.*
2) *Various methods to locate centric relation contact position.*
3) *Vertical and horizontal dimension of the slide from centric relation contact position to intercuspal position.*

Such clinical assessment along with other investigation such as radiographs, diagnostic casts and diagnostic waxups are required to detect signs and symptoms of occlusal problems which in turn help to determine whether to provide a conformative or reorganised approach in a given situation.

INTRODUCTION

"Establishing or providing occlusion that successfully permit efficient masticatory function is basic to dentistry and survival".

In health the occlusal anatomy of the teeth functions in harmony with structures controlling the movement patterns of the mandible. The structures that determine these patterns are temporomandibular joints and the anterior teeth. During any given movement the unique anatomic relationships of these structures continue to dictate a precise and repeatable pathway.

To maintain harmony of the occlusal condition, the posterior teeth must pass close to but not contact their opposing teeth during mandibular movement. It is important to examine each of these structures carefully and appreciate how the anatomic form of each can determine the occlusal morphology necessary to achieve an optimal occlusal relationship.

Key Words : Occlusion, Occlusal interference.

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This article describe methods to carry out clinical occlusal assessment based on the (1) occlusal contacts and interferences in various mandibular movements (2) various methods to locate centric relation contact position (3) criteria in developing occlusion based on the vertical and horizontal dimension of the slide from centric relation contact position to intercuspal position.

AIMS

1. Establish baseline measurement such as vertical dimension, overjet and overbite.
2. Detect signs and symptoms of occlusal problems
3. Decide between conformative or reorganized approach

SIGNIFICANCE OF OCCLUSAL ASSESSMENT:

From a thorough review of literature there is no well controlled studies that implicates the occlusion as an aetiological factor in temporomandibular disorders. However the dentist has to pay attention to the occlusion regarding,

- to reduce mobility if caused by the occlusion,
- patient comfort, i.e. to check any interferences,
- mechanical integrity of restoration, teeth and osseointegrated fixtures,
- to maintain control so that treatment can progress in a predictable manner.

METHODS TO CHECK OCCLUSAL CONTACT:

1) Occlusal tapes: Before starting, medicate the patient with antisialogooges and then thoroughly wipe the teeth. A 15 micron GHM occlusal tape is held with aid of Miller's forceps and the mandible guided to centric relation contact position, or any excursive position requiring checking.
   It should be noted that density of color of mark is not related to force of contact and heavier contact tend to spread the mark peripheral to the actual contacting area, with the later being devoid of ink.
2) Shim stock: The 12 micron foil is held with mosquito forceps between the teeth and checked for resistance to the pulling of foil. However on mobile teeth, it may indicate contacts that are not necessarily initial contacts. If initial contacts are indeed on the mobile teeth, these teeth will be depressed and the secondary contacts on

other teeth will then appear to be as primary contacts.

3) Sandblasted Surfaces: This can be used for any metal surface. The occlusal surface is sandblasted with 15 micron aluminium oxide which produces a matt finish, the restoration is then placed in patient's mouth and movements made. If there are any interferences or high points on the restoration, the matt finish gets polished to a shiny surface in that particular area, which should then be removed.

4) T-scan: It is an electronic device, which enables tooth contacts to be observed on a monitor screen, the contacts can be observed as primary, secondary and tertiary. It also indicates relative forces on each of these contacts.[1] (Fig. 1 & 2a,b)

Disadvantage: The T-scan identifies the approximate location of contact, and hence tape markings are necessary for exact location. T. scan is useful instrument only when used in conjunction with tapes, shim stocks and sandblasted surfaces.

Fig. 1 : T-scan Hand Piece.

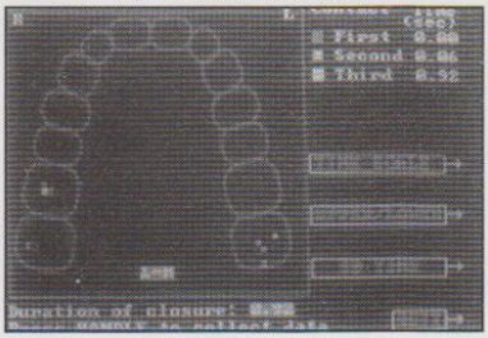

Fig. 2a : Screen showing primary, secondary and tertiary contacts and their location.

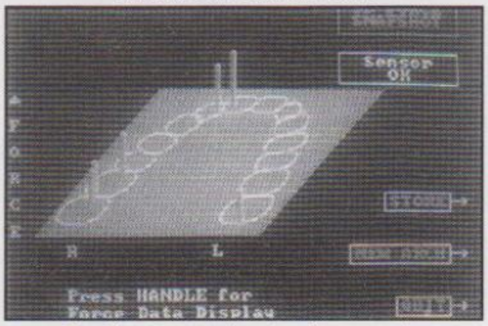

Fig. 2b : Screen showing force mode. The higher the bar the greater the force.

CENTRIC RELATION CONTACT POSITION (CRCP) AND TECHNIQUES TO LOCATE CRCP:

It is the relationship of the mandible to the maxilla in which initial contact has occurred following closure with condyles in their most superior position in the fossae with their anterior surfaces functioning against the posterior facing surface of the ementia.[2] (Fig. 3)

Fig. 3 : Centric Relation Contact Position.

Slight modifications in technique may be necessary to suit individual needs because, of the differences in patients' ability to locate CRCP.

The techniques are divided accordingly as :-

a) Easy patient: Where leaf gauge of thin mylar or paper strips is inserted between the teeth and slowly removed until the CRCP is achieved.

b) Slight difficulty patient: Where acrylic resin anterior jig is used for location of centric relation contact position.

The position is maintained for approximately 5 min so as to break proprioceptive reflexes and enable the patient to forget the habitual position of the mandible. Finally the jig is slowly removed and patient's jaw closed to initial contact in centric relation.

c) More difficulty patient: An occlusal stabilization splint made of acrylic is used which is adjusted periodically until the mandible can be manipulated easily to locate CRCP.

MOVEMENT FROM CENTRIC RELATION CONTACT POSITION TO INTERCUSPAL POSITION

Intercuspal position is an adaptive mandibulo maxillary relationship, deflective contacts in centric relation may lead to a path of closure which avoids the single tooth contacts i.e. ICP may depend upon avoidance of centric relation interferences.

To check for movement observe the incisors to determine vertical and horizontal dimension of the slide. From CRCP to ICP.

It can be subdivided into 2 types :-

1) Large vertical : Horizontal ratio, where vertical component of slide is more than the horizontal one. (Fig. 4)

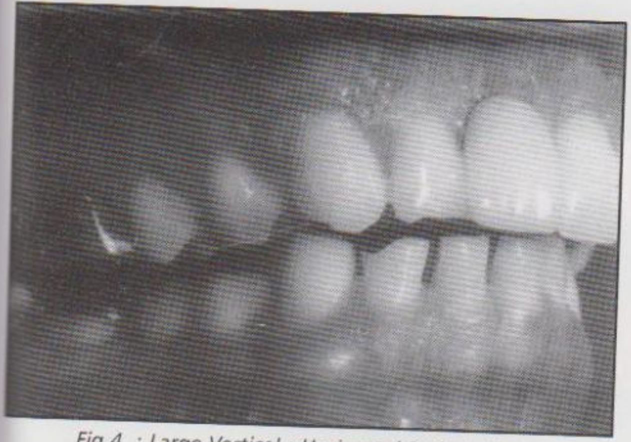

Fig.4. : Large Vertical : Horizontal Ratio in CRCP.

2) Large horizontal : Vertical ratio, where horizontal component is more than the vertical component. (Fig. 5)

Fig. 5 : Large Horizontal : Vertical Ratio in CRCP.

According to Wise[3] when the mandible moves from centric relation contact position to intercuspal position and vice versa, the horizontal/ vertical movement of the condyle is directly related to the vertical/ horizontal ratio measured at the incisor region of the mandible.

Patient with large vertical than horizontal component tend to have little if any horizontal movement of condyles, whereas those with large horizontal component have a correspondingly larger horizontal movement of the condyles.

SIGNIFICANCE:

A slide with large vertical : horizontal ratio is easy to adjust as condyles move vertically but on average will only move horizontally by a small amount, conversely a slide with large horizontal : vertical ratio is difficult to adjust as there is likely to be a large horizontal shift of condyles.

Following adjustment the former tends to result in CRCP coinciding with original ICP and requires little adaptation by patient. The later frequently results in CRCP becoming distal to original ICP and may result in loss of contact between upper and lower anterior teeth giving rise to guidance problems.[4]

In patients with history of clicking and large horizontal : vertical ratio it is prudent to retain deflective contacts, so as to prevent the mandible from distally repositioning and possibly altering condyle / meniscal relationship.

When fabricating a new restoration,

- a conformative approach should be used in cases of large horizontal : vertical ratio since removal of deflective contacts may result in distal movement of the mandible leading to TMJ clicking and loss of anterior guidance,
- a reorganized approach should be used in cases of a large vertical : horizontal ratio so that CRCP and ICP coincide with little or no distal movement of condyle.

LATERAL POSITIONS AND EXCURSIONS:

Mandibular movement is guided by condyle fossa relationship and tooth relationship. Identification of the precise contacts made in lateral excursion is particularly important in patients with bruxism as restorations may alter the direction of mandibular movement, leading to mechanical failure or discomfort.

It is divided into,

a) working side contact,

b) non-working side contact.

a) Working side contact :- is further divided into,

i) Group function: Contact of two or more opposing pairs of teeth on working side.

ii) Canine guidance: Contact only of opposing canine with other teeth separated.

Significance: Identification of precise contacts made in lateral excursion is particularly important in patients with bruxism as restoration may alter the direction of mandibular movement, leading to failures or discomfort to the patient.

Whether the working side contact is group function or canine guided.

- the contact should be smooth,
- use similar materials between opposing contacting surfaces to reduce wear, and as a result changes in guidance,
- ensure there is no excessive mobility of guiding teeth,
- eliminate non-working side interferences, so as to achieve working side contacts. (Fig. 6a,b)

If the mandibular movement does not fulfill the above requirement, then adjustment may be necessary prior to restoration.

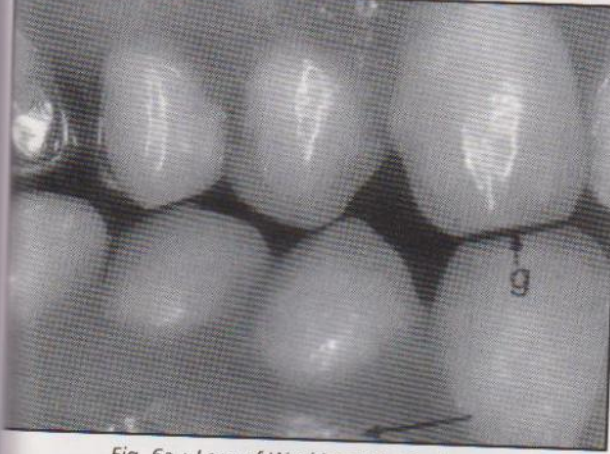

Fig. 6a : Loss of Working Side Contacts.

Fig. 6b : Non working side interference.

Non-working side contact :- These are contacts between apposing teeth on the side of the mandible that moves towards the midline line during lateral excursion.

Significance:

Non-working side interferences on restorations produce horizontal force which can lead to mechanical failure of the restoration or teeth.

Non-working side interferences causing lateral pterygoid sensitivity should be removed prior to restoration.

Non-working side contact can only be removed if there are working side contact to pick up the guidance.

PROTRUSIVE POSITION:

There are 2 relationships.

Straight protrusion

Lateral protrusion

STRAIGHT PROTRUSION:

Checked by instructing the patient to close into the ICP and then slide straight forward until the incisors meet edge to edge.

LATERAL PROTRUSION:

Checked by instructing the patient to close in the ICP then move forward and to one side.

Both protrusive contacts are checked by marking tapes like GHM and shim stock foil.

Significance:

According to the modern theories of occlusion, whether it is a partial denture or a fixed restoration, in protrusion movement, there should be contact between opposing anterior teeth with separation of posterior teeth. So an occlusion requiring restoration particularly of the anterior teeth should be investigated for protrusive contacts as posterior protrusive interferences often require elimination prior to restoration of anterior teeth.

CONCLUSION

Clinical assessment of occlusion may not provide a true picture as discrepancies and interferences may be hidden by neuromuscular adaptation of mandibular movement. But it provides the basis which when combined with other investigations such as radiographs, pantographs, diagnostic casts and waxups will help in the diagnosis and in turn treatment of the patient ensuring better results.

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