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MANUSCRIPT TYPE – Original Article

COMPARISON OF FLEXURAL STRENGTH OF VARIOUS PROVISIOAL FIXED PARTIAL DENTURE RESINS WITH AND WITHOUT AND GLASS FIBRE REINFORCEMENT – AN IN VITRO STUDY.

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Abstract-

Aim- The aim of this study was to evaluate the flexural strength of various provisional crown and fixed partial denture resins with and without glass fiber reinforcement using an invitro testing system.

Materials and Method-In the present study a total of sixty specimens were made. Two groups were made- Group 1 'without glass fibers' and Group 2 'with glass fibers'. Each group included three subgroups- Subgroup A 'PMMA', Subgroup B 'Protemp', Subgroup C 'Cooltemp'. All the subgroups included ten specimens each. The specimens were of 35mm X 2mm X 2mm dimensions. Groups were compared by compared by two factor (fibers and resins) analysis of variance (ANOVA) and the significance of mean difference within (intra) and between (inter) the groups was done by Tukey HSD (honestly significant difference) post hoc test.

Result- The mean flexural strength of Group 2 was comparatively higher than Group 1 at all subgroups. Further, in Group 1, it was highest in Subgroup B1 followed by Subgroup C1 and Subgroup A1, the least (Subgroup A1 < Subgroup C1 < Subgroup B1). Similarly, in Group 2, it was highest in Subgroup B2 followed by Subgroup C2 and Subgroup A2, the least (Subgroup A2 < Subgroup C2 < Subgroup B2). Overall, it was highest in Group 2/Subgroup B2 and least in Group 1/Subgroup A1.

Conclusion- Protemp with glass fiber reinforcement was found to be the best suitable provisional crown and fixed partial denture resin followed by Cooltemp with glass fiber reinforcement. The mean flexural strength of Protemp without E-glass fibres was comparatively higher than PMMA and slightly higher than cooltemp without E-glass fibres.

Keywords: Autopolymerizing polymethyl methacrylate resin, bis-acylic rsin, flexural strength, glass fibers.

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INTRODUCTION:

The use of provisional prosthesis in fixed partial dentures (FPD) in cases with full mouth or partial oral rehabilitation has been an indispensible protocol for restoring function, esthetics, occlusion, and providing pulpal protection until a permanent prosthesis can be given which may take from a week to few months.[1] They should be able to withstand occlusal forces so as to fulfill the above mentioned requirements during the transitional period.[2]

The interim restorations should fulfill biological, mechanical, and aesthetic requirements to be considered successful. Achieving these requirements depends on important properties of resins, including polymerization shrinkage, wear resistance, colour stability, compressive strength, tensile strength and flexural strength.

Materials commonly used to fabricate interim restorations are autopolymerising Poly Methyl Methacrylate (PMMA), different Bis-acryl composite resins. They are chosen for esthetics, micro hardness, fabricating methods, economics and fracture strength. In patients with bruxism or patients whose treatment plan requires long-term use of provisional restorations, provisional restorations with improved physical properties are required.[3,4]

Various materials such as stainless steel wires, glass fibers, polyethylene fibers, nylon fibers, and carbon fibers have been used to reinforce autopolymerizing PMMA resin to improve its strength.[6,7], The concept of using fibers to reinforce an interim restoration appears to have an acceptable rate of success.[8]

E-glass fiber is known in the industry as a general-purpose fiber for its strength and electrical resistance. It is the most commonly used fiber in the fiber reinforced polymer composite industry. E-Glass fiber ("E" stands for electric) is made of alumino- borosilicate glass with less than 1 wt% alkali oxides.

Silanized glass fibers are promising new materials due to their good fusion to the polymer matrix, high aesthetic quality, and increased strength of the resulting composite.[110,12,13] Others have found that the position, quantity, direction of fibers, and the degree of adhesion between the fibers and polymer affect the degree of reinforcement.[14,15]

The purpose of this study was to compare the effects of E-glass fiber reinforcement on the flexural strength of au

auto polymerising Poly Methyl Methacrylate (PMMA), and two different commercially available bis-acryl resins used for fabrication of provisional crown and bridge restorations.

MATERIALS AND METHOD:

MATERIAL	**BRAND NAME**
PMMA-polymethyl methacrylate	DPI
PROTEMP- bis-acrylic composite resin	3M ESPE
COOLTEMP- bis-acryl composite resin	COLTENE
BONDING AGENT	3M
GLASS FIBRES	----

Table No. 1- Material Used in the study

In the present study a total of sixty specimens were made. The specimens were of 35mm X 2mm X 2mm dimensions (in accordance with the American National Standards Institute/American Dental Association specification no. 27).[1,16]

The fiber-reinforced specimens were made from pre-cut 30mm–long fibers which were wetted using the polymer-monomer mix (PMMA,) and bonding agent (bis-acryl), and then these were placed in the bottom side of the mould cavity with resin applied on top of fibers. The mould was placed between two glass slabs and a weight of 2.5 kg will be applied over it.

Resins/ Materials	**Without glass fiber (Group 1) (n=30)**		**With glass fiber (Group 2) (n=30)**	
	Subgroup	**N**	**Subgroup**	**n**
PMMA	Subgroup A1	10	Subgroup A2	10
Protemp	Subgroup B1	10	Subgroup B2	10
Cooltemp	Subgroup C1	10	Subgroup C2	10

Table 2: Distribution of samples and allocation of groups

All materials were mixed and polymerised according to the manufacturers' instructions. The specimens were stored in distilled water at 37 oC for 10 days. After this period, the specimens were positioned on a flexural strength testing apparatus with 10mm support separation. A 3-point bend test was carried out in a universal testing machine (Instron; M12-13667-EN) with a 10kN load cell at a crosshead speed of 1mm/minute. The force was applied on specimens to the resin side until Breaking Point. Data was obtained on the digital screen connected to the universal testing machine. The force at fracture was recorded in MPa and tabulated.

Volume of sample=

Vf = [(Wf / rf)/(Wf/ rf +Wr/ rr)] x 100(%)

Wf = Vf x [Wf/ rf + Wr/Rr] x rf / 100

Where,

Wf is the weight proportion of E-glass,

rf =(2.54g/cm3) is the density of E-glass,

Wr is the weight proportion of resin, and

rr =(1.238g/cm3) is the density of resin.

Data was obtained on the digital screen connected to the Universal Testing Machine. The force at fracture was recorded in Megapascal(MPa) using testing machine software.

Data were summarised as Mean ± SE (standard error of the mean). Groups were compared by compared by two factor (fibers and resins) analysis of variance (ANOVA) and the significance of mean difference within (intra) and between (inter) the groups was done by Tukey HSD (honestly significant difference) post hoc test after ascertaining normality by Shapiro-Wilk's test and homogeneity of variance between groups by Levene's test. A two-tailed (α=2) $p<0.05$ was considered statistically significant. Analysis was performed on SPSS software (Windows version 17.0).

Mean Value of sample $= \frac{\text{Total sum of samples}}{\text{Total number of samples}}$

RESULT AND OBSERVATIONS:

Subgroups	Group 1		Subgroups	Group 2	
	N	Mean ± SE		n	Mean ± SE
Subgroup A1	10	44.08 ± 1.89	Subgroup A1	10	52.95 ± 2.11
Subgroup B1	10	58.82 ± 1.25	Subgroup B1	10	67.19 ± 2.47
Subgroup C1	10	57.45 ± 0.86	Subgroup C1	10	64.71 ± 1.82

Table 3: Flexural strength (N) of two groups and three subgroups

Flexural Strength:

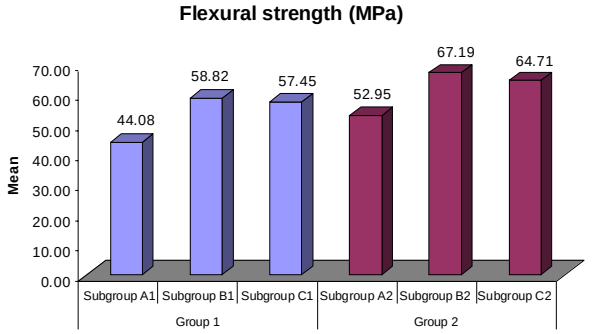
The flexural strength of two groups/fibers (Group 1 and Group 2) and three subgroups/resins (Group 1: Subgroup A1, Subgroup B1, Subgroup C1; Group 2: Subgroup A2, Subgroup B2, Subgroup C2) is summarised in Table 3. The mean flexural strength of Group 2 was comparatively higher than Group 1 at all subgroups. Further, in Group 1, it was highest in Subgroup B1 followed by Subgroup C1 and Subgroup A1, the least (Subgroup A1 < Subgroup C1 < Subgroup B1). Similarly, in Group 2, it was highest in Subgroup B2 followed by Subgroup C2 and Subgroup A2, the least (Subgroup A2 < Subgroup C2 < Subgroup B2). Overall, it was highest in Group 2/Subgroup B2 and least in Group 1/Subgroup A1.

Comparing the effect of groups and subgroups together on flexural strength, ANOVA showed significant effect of both group ($F=30.36$, $p<0.001$) and subgroups ($F=37.59$, $p<0.001$) on flexural strength (Table 4). However, the interaction effect of both (group x subgroup) on flexural strength was found insignificant ($F=0.10$, $p=0.901$).

Further, for each group, comparing the difference in mean flexural strength between subgroups (i.e. intra group), Tukey test showed significantly ($p<0.001$) different and higher flexural strength of both Subgroup B1 and C1 as compared to A1 in Group 1 but not differed ($p>0.05$) between Subgroup B1 and C1 i.e. found to be statistically the same (Table 5).

Similarly, in Group 2, it was also found significantly ($p<0.01$ or $p<0.001$) different and higher in both Subgroup B2 and C2 as compared to A2 in but not differed ($p>0.05$) between Subgroup B2 and C2 i.e. found to be statistically the same (Table 6).

Further, for each subgroup, comparing the difference in mean flexural strength between groups (inter group), Tukey test showed significantly ($p<0.05$) different and higher (16.8%) flexural strength of Subgroup A2 as compared to Subgroup A1 (Table 7). Further, it was also found significantly ($p<0.05$) different and higher (12.5%) in Subgroup B2 as compared to Subgroup B1 (Table 7). However, it did not differed ($p>0.05$) between Subgroup C1 and Subgroup C2 though it was 11.2% higher in Subgroup C2 than Subgroup C1 (Table 7).



Graph 1. Mean flexural strength (N) of two groups and three subgroups.

Table No.4- Effect of groups and subgroups on flexural strength (N) using ANOVA

Source of variation (SV)	Sum of squares (SS)	Degree of freedom (DF)	Mean square (MS)	F Value	p value
Group	1000.09	1	1000.09	30.36	<0.001
Subgroup	2476.78	2	1238.39	37.59	<0.001
Group x Subgroup	6.86	2	3.43	0.10	0.901
Error	1778.79	54	32.94	-	-
Total	5262.51	59	-	-	-

Comparisons- Group 1	Mean difference (%)	p value
Subgroup A1 vs. Subgroup B1	14.74 (25.1)	<0.001
Subgroup A1 vs. Subgroup C1	13.37 (23.3)	<0.001
Subgroup B1 vs. Subgroup C1	1.36 (2.3)	0.995

Table No. 5: Comparisons of difference in mean flexural strength (N) between subgroups of Group 1 by Tukey test

Comparisons- Group 2	Mean difference (%)	p value
Subgroup A2 vs. Subgroup B2	14.24 (21.2)	<0.001
Subgroup A2 vs. Subgroup C2	11.76 (18.2)	0.001
Subgroup B2 vs. Subgroup C2	2.48 (3.7)	0.926

Table No. 6: Comparisons of difference in mean flexural strength (N) between subgroups of Group 2 by Tukey test

Comparisons- Subgroups	Mean difference (%)	p value
Subgroup A1 vs. Subgroup A2	8.87 (16.8)	0.013
Subgroup B1 vs. Subgroup B2	8.37 (12.5)	0.022
Subgroup C1 vs. Subgroup C2	7.25 (11.2)	0.069

Table No. 7: For each subgroup, comparisons of difference in mean flexural strength (N) between groups by Tukey test

DISCUSSION: Flexural strength, also known as modulus of rupture, or bend strength, or transverse rupture strength is a material property, defined as the stress in a material just before it yields in a flexure test. The transverse bending test is most frequently employed, in which a specimen having either a circular or rectangular cross-section is bent until fracture or yielding using a three point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of yield. It is measured in terms of stress[17], here given the symbol σ.

Flexural stresses produced in a three-unit fixed dental prosthesis (FDP) and a two-unit cantilever FDP are due to bending forces. These bending forces can act in one of two ways: (1) by subjecting a structure such as an FDP to three-point loading, whereby the endpoints are fixed and a force is applied between these endpoints, (2) by subjecting a cantilevered structure that issupported at only one end to a load along any part of the unsupported section, Also, when a patient bites into an object, the anterior teeth receive forces that are at an angle to their long axes, thereby creating flexural stresses within the teeth.

In the present study it was found that the mean flexural strength of Group 2 (with glass fibres) was comparatively higher than Group 1 (without glass fibres) in all the subgroups. It was also seen that amongst these three provisional crown and bridge materials subgroup B (Protemp 4) with glass fibre reinforcement had the maximum flexural strength. The mean of unreinforced PMMA group was 44.08 MPa. The mean of unreinforced Protemp group was 58.82 MPa. The mean of unreinforced Cooltemp group was 57.45 MPa. The mean of fiber-reinforced PMMA group was 52.95 MPa. The mean of fiber-reinforced Protemp group was 67.19 MPa. The mean of fiber-reinforced Cooltemp group was 64.71 MPa.

Duymus ZY (2014)16 found the highest average flexural strength value in the Charisma with Construct fiber reinforcement (442.00 MPa). The lowest average flexural strength value was found in the Dentalon Plus without fiber reinforcement (70.50 MPa). There was significant difference between Fiber-splint ML, Construct and control group.

Polymerization shrinkage of acrylic resin and poor wetting of fibers within the dough can lead to voids formation, which can hamper the strength of acrylic. This can be prevented by proper wetting of glass fiber with monomer. However, excess use of monomer would increase the polymerization shrinkage[22]The effect of the luting agent on flexural strength of interim FDP was not investigated in this study.

Gupta Parikshit et al.(2017)1 also found that among the various reinforcements used to the increase fracture strength of autopolymerizing PMMA resin, sample reinforced with unidirectional glass fiber showed maximum increase in mean ultimate force and stress. The mean ultimate stress of unreinforced group was 49.72 MPa, for those reinforced with stainless steel wire (straight ends) was 67.12 MPa, reinforced with stainless steel wire (looped ends) was 62.73 MPa, reinforced with unidirectional glass fibers wa 70.09 MPa, and reinforced with randomly distributed glass fibers was 52.38 MPa.

CONCLUSION:

Within limitations of this invitro study, the following points were concluded:-

- Protemp with glass fiber reinforcement is best suitable provisional crown and fixed partial denture resin followed by cooltemp with glass fiber reinforcement followed by PMMA with glass fiber reinforcement.
- The mean flexural strength of Protemp without E-glass fibres was comparatively higher than PMMA and slightly higher than cooltemp without E-glass fibres.
- The mean flexural strength of Protemp with E-glass fibres was comparatively higher than PMMA and slightly higher than Coolemp with E-glass fibres.
- The mean flexural strength of PMMA with E-glass fibres was comparatively higher than PMMA without E-glass fibres.
- The mean flexural strength of Protemp with E-glass fibres was comparatively higher than Protemp without E-glass fibres.
- The mean flexural strength of Cooltemp with E-glass fibres was comparatively higher than Cooltemp without E-glass fibres.
- The site of placement of fibres is crucial for strength of the restoration. As per literature the various sites of reinforcement include occlusal, middle and cervical third[39,40]. It has been proven that by placing the fibres at middle third, there is considerable improvement in flexural strength.

- The intraoral conditions could not be simulated while testing of samples such as repeated monomer. However, excess use of monomer would increase the lateral forces were taken into consideration.

Clinical trials along with Also, other properties like color stability, micro-hardness, polymerisation shrinkage, marginal adaptability and absorption need to be further investigated to help the clinician choose the most optimum interim crown and bridge material for clinical use.

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MANUSCRIPT TYPE – Original Article

EVALUATION OF PRIMARY STABILITY OF DENTAL IMPLANTS HAVING DIFFERENT SURFACE AREA PLACED IN THE MANDIBULAR POSTERIOR REGION – AN INVIVO STUDY USING RESONANCE FREQUENCY ANALYSIS

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Abstract-

Aim- This study aims to establish a correlation between primary stability and surface area of dental implants placed in the mandibular posterior region, and also to compare the effect of length and diameter on the primary stability of dental implants with similar surface area.

Materials and Method- A total of 100 ADIN TOURAG S implants were selected for the present study having a mandibular posterior edentulous region with having delayed loading and placement protocol. Gross surface area of various implants has been calculated using a formula 2πrh +πr^2, divided into four subgroups on the basis of range of their surface area. Primary stability was measured using resonance frequency analysis i.e. Osstell Mentor device which is noninvasive and clinical reliable method to evaluate implant stability.

Result- A statistically significant relationship was observed in ISQ when comparing low with high and very high surface area and also when comparing medium with very high surface area of dental implants. A statistically significant relationship was observed in ISQ when comparing low with high and very high surface area and also when comparing medium with very high surface area of dental implants.

Conclusion- Higher surface area means higher primary stability but this difference is significant only if difference in surface area is more and not significant when difference in surface area is less. The importance of diameter over length in a particular group of surface area is more important in low surface area groups as compared to medium, high and very high surface area groups.

Keywords: Dental Implants, primary stability, Resonance frequency analysis, Implant stability quotient.

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INTRODUCTION:

Osseo integrated dental implant has been emerging as a major treatment option in replacement of completely and partially edentulous patients[1]. Direct structural and functional connection between bone and the surface of a load carrying dental implant depends on successful osseointegration[2,3] and for maintaining and achieving this implant stability is a major requirement for clinical success[4].

Implant stability is classified into two different stages: Primary and secondary. Primary stability achieved from mechanical engagement with cortical bone site during implant placement whereas, the secondary stability is the eventual outcome from series of regeneration and secondary remodeling of the bone and tissue around the implant[5]. Both are interrelated to each other as primary stability determines the secondary stability, which dictates the time of functional loading[6].

Primary implant stability is defined as the absence of mobility in the bone bed, immediately after placement of the implant which depends on the quantity and density of bone, surgical technique and implant design, length, diameter[7].

Several diagnostic methods, both invasive and noninvasive have been used for measuring implant stability such histomorphometry analysis, tensional test, push out/pull out test and reverse torque, percussion test, radiography, cutting torque test, perio test and resonance frequency analysis (RFA) used in the clinical scenario[8,9].

RFA has gained popularity as it is a non-invasive diagnostic method, the most advance version of Osstell® resonance frequency analysis system nowadays is the Osstell Mentor, that automatically converts kHz to ISQ values10. It is typically a hand-held portable device, that uses the magnetic frequencies between the transducer called as Smartpeg and the resonance frequency analyzer. Implant stability quotient (ISQ) is a unit used to express RFA value on a scale from 1 to 100.

The length, diameter and surface geometry determines the surface area of the implant. Increase in length of the implant do increase the surface area of the implant by being directly proportional but an increase in the diameter of the implant do enhance its surface area even more as the surface area is directly proportional to the square of its radius. Hence, generating a thought that diameter is more important than length of the implant. However, increase in the diameter of the implant do result in decrease in the very critical amount of remaining bone thickness post placement of dental implant especially in the buccal and lingual,/palatal region on the crest. Hence creating a paradox in the clinician's mind as to what is more important? Also, there can be a situation in which two implants out of which one having more length and one having more diameter can have similar surface area or bone implant interface. Hence, a clearcut understanding is needed to deal with this concept.

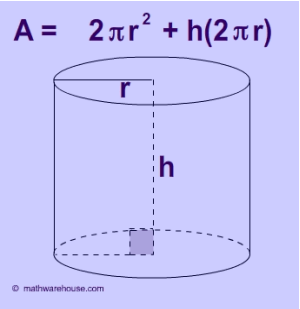
MATERIALS AND METHOD:

It was an experimental study of total 100 ADIN TOURAG S implants placed in mandibular posterior region. Implants of various length and diameter were utilized according to the radiographic and clinical assessment in each patient. The list is as follows-

LENGTH(mm)	DIAMETER(mm)
6.25	3.5
8	3.75
10	4.2
11.5	5
13	

Comparsion was drawn regarding the influence of surface area of dental implant on primary stability, hence gross surface area of various implants have been calculated using a formula as follows:Comparsion was drawn regarding the influence of surface area of dental implant on primary stability, hence gross surface area of various implants have been calculated using a formula as follows:

$$2\pi rh + \pi r^2$$



But, the gross surface area of dental implant were calculated by using formula $\pi r^2 + 2\pi rh$ instead of $2\pi r^2 + 2\pi rh$ because of exclusion of the top surface of dental implant as it will be used for abutment and internal connection and is not embedded into bone. Also, for the sake of simplicity ,the surface area calculation were done on the basis of assuming it as a smooth cylinder and not a threaded one. As we had used a single implant system, the thread geometry, surface treatment, pitch and apical anti rotational morphology remains the same for all the samples, hence the correlation factor may cause a uniform increase in surface area in all samples.After calculating the gross surface area it is further divided into four Groups. The division were based on the following criteria as:

LOW SURFACE AREA 250-290 (mm^2)	**MEDIUM SURFACE AREA 291-330 (mm^2)**	**HIGH SURFACE AREA 331-370 (mm^2)**	**VERY HIGH SURFACE AREA 371-410 (mm^2)**
257.4 (L-10,D-3.5)	291.23 (L-11.5,D-3.5)	350.30 (L-13,D-3.75)	398.27 (L-13,D-4.2)
279.65 (L-10,D-3.75)	324.20 (L-13,D-3.5)	358.71 (L-11.5,D-4.2)	392.5 (L-10, D-5)
266.39 (L-8,D-4.2)	314.98 (L-11.5,D-3.75)		
274.75 (L-6.25,D-5)	319.14 (L-10-D-4.2)		
	329.7 (L-8,D-5)		

Comparison between four group is done to establish correlation between surface area

and primary stability of dental implant as-

A vs B vs Cvs D

Then intragroup analysis is done to compare the effect of implant length and diameter on

primary stability with implant having similar surface area as-

A1 vsA2 , B1 vs B2, C1 vs C2 , D1 vs D2

Resonance frequency measurements was recorded using Osstell Mentor which involves the use of a small magnetic transducer i.e Smart Peg that is attached to the implant ,using 4-6 Newton centimeter of torque , measured as probe was placed with angle of 90 degree to the Smart Peg without touching followed by audible tone. After two such sound there will be a beeping sound and the display will be present with one or two ISQ variable among them highest one was recorded.

RESULT:

The present in vivo study compares the primary stability of dental implants having different surface area placed in the mandibular posterior region using resonance frequency analysis.

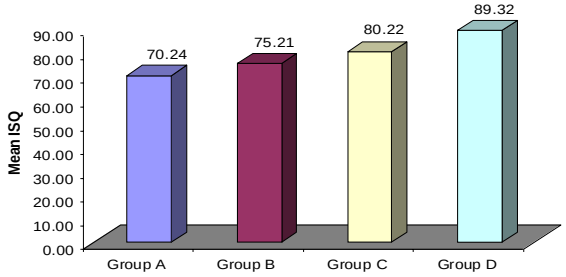
In Intergroup comparison the mean ISQ of Group D was the maximum (Graph 1) followed by Group C, Group B and Group A the minimum (Group A < Group B < Group C < Group D).

Further, comparing the difference in mean ISQ between the groups, Tukey test showed significantly different and higher ISQ of both Group C and Group D [70.24 ± 8.88 vs. 89.32 ± 5.26, mean diff=19.08 (21.4%), q=10.51, P<0.001] as compared to Group A whereas not differed between Group A and Group B [70.24 ± 8.88 vs. 75.21 ± 9.96, mean diff=4.97 (6.6%), q=3.11, P>0.05] i.e. found to be statistically the same.

Comparing the mean ISQ of four groups, ANOVA showed significantly different ISQ among the groups (F=20.72, P<0.001) (Table 1).

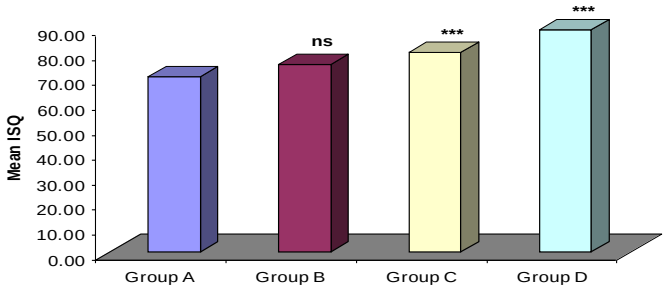
Group	**n**	**Mean ± SD**	**F value**	**P value**
Group A	21	70.24 ± 8.88	20.72	<0.001
Group B	33	75.21 ± 9.96		
Group C	27	80.22 ± 6.38		
Group D	19	89.32 ± 5.26		

Table No. 1 ISQ of four groups



Graph 1 - Mean ISQ of four groups. 1

Furthermore, mean ISQ of Group D [75.21 ± 9.96 vs. 89.32 ± 5.26, mean diff=14.10 (15.8%), q=8.54, P<0.001] was also found significantly different higher as compared to Group B but not differed between Group B and Group C [75.21 ± 9.96 vs. 80.22 ± 6.38, mean diff=5.01 (6.2%), q=3.37, P>0.05] i.e. found to be statistically the same (Graph 2).



Graph 2. Comparisons of difference in mean ISQ between four groupsGraph 2. Comparisons of difference in mean ISQ between four groups

^{ns}P>0.05 or ***P<0.001- as compared to Group A

Moreover, mean ISQ of Group D was also found significantly different higher as compared to C [80.22 ± 6.38 vs. 89.32 ± 5.26, mean diff=9.09 (10.2%), q=5.30, P<0.01].

In intragroup comparison based on length and diameter, each group were further sub-grouped into two groups viz. Group A (Group A1: length at or above 10, diameter at or below 3.75; GroupA2: length below 10, diameter at or above 4.2, Group B (GroupB1: length at or above 11.5, diameter at or below 3.75; GroupB2: length below 11.5, diameter at or above 4.2,, Group C (GroupC1: length at or above 13, diameter at or below 3.75; GroupC2: length below 13, diameter at or above 4.2, and Group D (GroupD1: length at or above 13, diameter at or below 4.2; Group D2: length below 13, diameter above 4.2.

Comparing the difference in mean ISQ between two subgroups, Student's t test showed significantly different and higher (18.1%) ISQ of Group A2 as compared to Group A1.The difference in mean ISQ between two subgroups, Student's t test showed significantly different and higher (11.8%) ISQ of Group B2 as compared to Group B1.The difference in mean ISQ between two subgroups, Student's t test showed similar ISQ between two subgroups though it was 0.9% higher in Group C2 as compared to Group C1, whereas the difference in mean ISQ between two subgroups, Student's t test showed significantly different and higher (5.3%) ISQ of Group D2 as compared to Group D1.

Group A1 (n=12)	Group A2 (n=9)	Mean diff (%)	t value	P Value
64.17 ± 6.31	78.33 ± 3.64	14.17 (18.1)	6.01	<0.001

Table 2: ISQ (Mean ± SD) of two subgroups of Group A

Group B1 (n=21)	Group B2 (n=12)	Mean diff (%)	t value	P value
71.71 ± 8.19	81.33 ± 10.14	9.62 (11.8)	2.98	0.006

Table 3: ISQ (Mean ± SD) of two subgroups of Group B

Group C1 (n=6)	Group C2 (n=21)	Mean diff (%)	t value	P value
79.67 ± 8.91	80.38 ± 5.73	0.71 (0.9)	0.24	0.814

Table 4: ISQ (Mean ± SD) of two subgroups of Group C

Group D1 (n=8)	Group D2 (n=11)	Mean diff (%)	t value	P value
86.50 ± 6.12	91.36 ± 3.56	4.86 (5.3)	2.19	0.043

Table 5: ISQ (Mean ± SD) of two subgroups of Group D

DISCUSSION :

Implant stability depends on both endogenous and exogenous factors[11] . Bone density is the endogenous factors and implant configuration is among the exogenous factors . Among the related implant configuration , diameter and length play major roles in clinical success of implants, since they directly influence the primary stability and removal torque values[12,13.]

The effects of the dental implants length and diameter on long term prognosis assessed by primary stability at areas of poor bone density has been a controversial issue . This highlights the necessity to explore theeffects of various dimensions of implant on primary stability and overall success rate .

Based on the results of the current study the primary stability of Group D implants having Very High surface area have maximum ISQ value as compared with Group

C, B and A. As the surface area increases the chances of bone getting interlocked in the implant interface becomes better and hence increasing the primary stability. These results are in conjunctions with a study by Bilhan et al which stated that cylindrical implants with high surface area exhibited a higher RFA compared to tapered implants. The difference is attributed to lack of conformity of the apical end of the implant with the drilled cavity[14].

Also in this study contrastingly from low to medium and medium to high surface area the ISQ values of primary stability attained are not significant. These results are also in conjunction with the results of Bilhan et al study in which there is no significant difference were observed in primary stability of implants of 3.75mm and 4.5 mm in diameter, this could be attributed by the fact that especially in mandibular posterior region, the cortical engagement occurs only at high and very high surface area, hence increasing the ISQ significantly. This type of cortical engagement does not happen when going from low to medium or medium to high surface area especially in the region of mandibular posteriors where most of the times we have good bone width. This could be a reason for this kind of result.

Long term survival rate depends on diameter and length of dental implant, as they both influence implant stability. Longer implants showed higher stability than shorter implants. Higher stability with increased implant diameter and reduced stability in smaller size diameter implants can be attributed to the fact that in the coronal part there is less friction during insertion of a shorter diameter implant[15].

Based on the result of intra group comparsion, primary stability is mainly affected more by diameter as compared by length of dental implant. This is because of increase of diameter has more importance on surface area as compared to length, results of this are in conjunction with a study by Chiapasco et in which implant diameter played more significant roles in reducing cortical bone stress and enhancing implant stability, while implant length was more effective in reducing cancellous bone stress under both axial and buccolingual loads.

Similar results were found in study done by Ostman et al[16] , wider implants shows higher ISQ value as they engaged with buccal and lingual cortical plates and offer a larger area for osseointegration.

On the contrary in a study by Guan et al[17] states that the stress within cancellous and cortical bone could be reduced by increase in length of implant, Lekholm et all [18] states that long implants are necessary for primary stability as it ensure greater surface area for bone contact.

The use of variable designs and geometry of end osseous dental implant clinically becoming known today. Dental implant with different diameter, length is introduced widely today and its selection depends on the density of edentulous ridge, prosthetic options, type of occlusion and emergence profile[19]. Wide diameter implant leads to more bone implant contact which may compensate for the lack of bone height and density. Increase in implant length increases the success rate of dental implant but only to a certain extent.

CONCLUSION:

The present study assessed co-relation between primary stability and surface area of dental implants placed in the mandibular posterior region, and also to compare effect of length and diameter on the primary stability of dental implant.

Following conclusion were drawn from this study: -

- There is no statistical significant difference in primary stability attained at the time of surgery when going from low to medium and medium to high surface area of dental implants.
- A significant difference in primary stability attained at time of surgery when going from high to very high surface area of dental implants.
- A highly significant difference in ISQ obtained when comparing low with high and very high surface area and also when comparing medium with very high surface area of dental implants.
- In intragroup comparsion of length and diameter shows higher ISQ value with implants having increase diameter as compared with length.
- In this intragroup comparison between length and diameter, the difference in primary stability in low surface area is highly significant, medium surface area is just significant , high surface area is non-significant and very high surface area is just significant.

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MANUSCRIPT TYPE – Original Article

ASSIMILATION OF VARIOUS TECHNIQUES FOR MANAGEMENT OF RESORBED RIDGES- A CASE REPORT.

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Abstract

We all clinicians face the common problems in making complete denture prosthesis for patients exhibiting high degree of bone resorption. Though resorption can be prevented to a very great extent but sooner or later it comes back as a challenge to the clinician. The result leads to a dissatisfied patient with an ill-fitting loose prosthesis. Initial issue is recording the oral tissues and using them for creating retention and stability in the prosthesis. The final and ultimate success depends on many other factors such as the occlusal scheme used, balancing and patient ability to adapt and yet the most important step still remains the same i.e. impression technique employed for proper impression. A few modified impression techniques are hereby suggested for increasing the prognosis of such patients.

Keywords: Dental Implants, primary stability, Resonance frequency analysis, Implant stability quotient.

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INTRODUCTION:

We as a dentist face a lot of difficulty in fabricating complete denture specially for a resorbed mandibular ridges and hyperplastic tissue in maxillary anterior region. This challenges not only us for taking an impression but also for the patients first and most important need of having a proper nutrient, speech and esthetics. [1]

Resorption in mandible is much more fast and severe than maxilla. Stability and retention of mandibular denture is of the most important value for the clinician as well as for the patient.

The impression technique plays the substantial role in achieving this fact. Proper impression plays a crucial role in the success of the treatment specially in cases of resorbed mandibular ridges and hyperplastic tissues where there is insufficient tissue to fulfil the requirement of support, stability and most importantly retention.[2] An accurate impression is necessarily lays the foundation of a good prosthesis as it determines the retention and comfort of the prosthesis for the prosthesis.

The situation can be more challenging as in the cases of reduced bone height, unfavourable residual ridge morphology, and/or muscle attachments and unfavourable tissues. [3]

The article describes an impression technique with many other modifying factors of highly resorbed mandibular ridge and hyperplastic maxillary anterior ridge using an orthodontic wire, elastomeric impression materials, impression compound, zinc oxide eugenol to gain maximum retention and stability.

CASE REPORT

A 83 years old male patient reported to the department of Prosthodontics, crown bridge and implantology, with a chief complaint of loosening of lower denture. The patient was apparently in good health and did not report any significant medical history.

Patient was a denture wearer for the past 20 years but not satisfied with the prosthesis due to poor stability. On intraoral examination, a highly resorbed mandibular ridge with a maxillary anterior flabby tissue was observed [Fig 1].

fig 1(a)

fig 1(b)

The impression techniques

Following are the different impression techniques that can be used for resorbed mandibular ridges:

1.The admixed technique for mandibular primary impression.

2.The functional impression technique for mandibular final impression and a combination of impression materials for maxillary ridge.

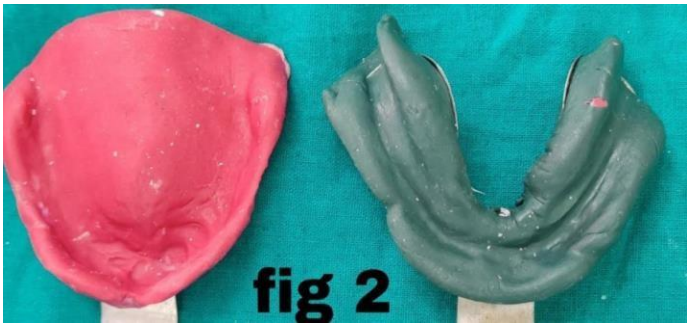
3.The neutral zone technique

1.The Admixed Technique

For a prosthesis to gain a proper seat, stability and retention more the basal seat area covered more is the probability of getting the better result. So, to gain as much coverage of the basal seat as possible, an admixed technique is advocated.

This technique involves making of a primary impression by mixing impression compound and green stick compound in the ratio of 3:7. this technique gives a character of flow due to green stick and plasticity due to impression compound. [5]

Hence the net result is an impression with a better record surface and proper extension. Maxillary primary impression was made using an impression compound [Fig 2].



2.Functional impression

This technique is very helpful in helping us to achieve a proper retention and stability in mandible and even in hyperplastic tissues.

Retention is very rare in these cases and as a clinician we should have a proper retention and stability because denture should even move with a slightest of the tongue and muscles.

A functional impression can be made better by doing the border molding using a stable custom tray or directly by using a suitable elastic impression material directly. Temporary soft liners and tissue conditioners can be used as functional impression materials because of the delayed setting property and a continuous over a longer period of time thereby recording all possible movements of the mandibular musculature [5] [Fig 3(b)].

For maxillary we first made a custom tray with suitable border molding and then posterior final impression was made with Zinc oxide eugenol impression material and anterior was taken with the help of a light body elastic impression material [fig 3 (a)].

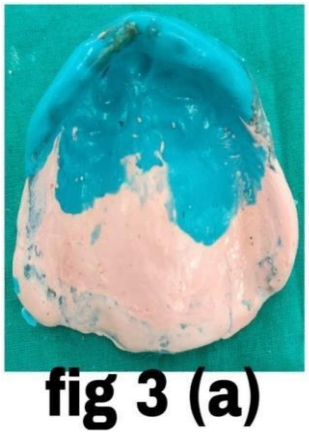


fig 3 (a)

fig 3(b)

A. Proper extension of the custom tray should be made and border molding should be done.

B. After completion of the procedure, instead of using the regular impression material for making definitive impressions, a functional impression material can be used for mandibular impression and modified impression technique or maxilla.

C. The material is mixed and placed on the custom tray.

D. Material then takes the proper shape and border molding is done.

E. When the initial set occurs, the patient is asked to read loudly newspaper and sat words like “aaa”… “ooo”.. “eee”.

F. The impression material stays within the oral cavity for a period of minimum 30-45 mins. All oral activities of the patient are encouraged for that.[6]

G. When the material has achieved a final set, tray is removed and the impression is poured using dental stone as soon as possible.

H. The obtained cast can be used as a master cast for fabrication of prosthesis useful in poor ridge cases.

3. Neutral zone technique

Recording of neutral zone can increase the stability and retention to a great extent. Recording the neutral zone is itself quite simple by we all almost try to overlook its importance.[7]

A-After taking jaw relations, the maxillary and mandibular cast is mounted using a face bow transfer.[Fig. 4 a,b]

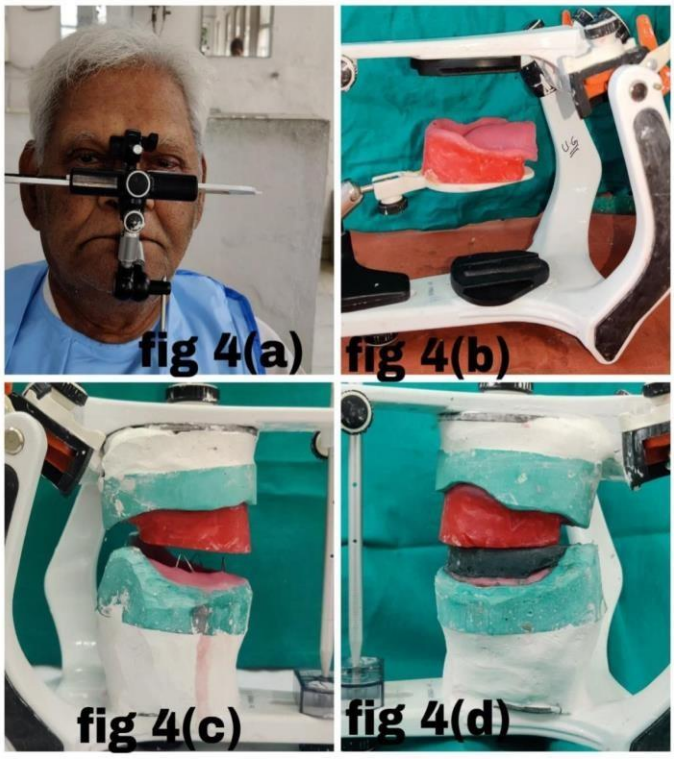


fig 4(a)

fig 4(b)

fig 4(c)

fig 4(d)

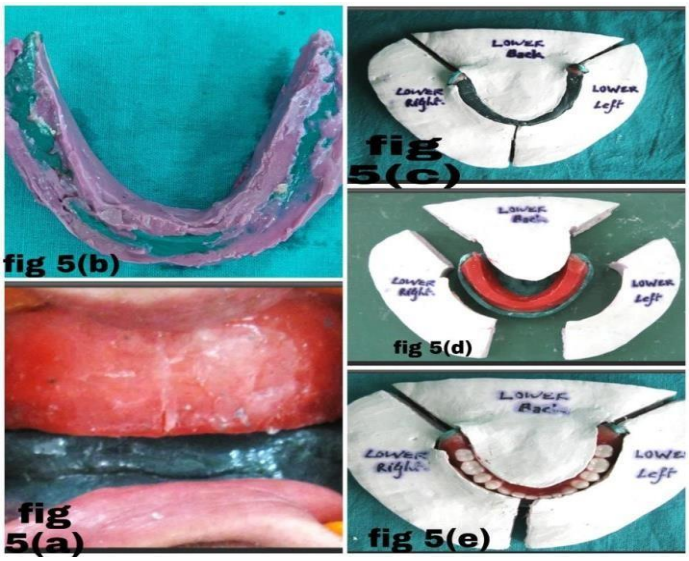
B. Thereafter the mandibular wax rim is cut off and wire loops in the shape of letter "v" are made on the lower record base up to the height of the mandibular wax rim [Fig 4(c,d)].

C. The maxillary record base is placed in the oral cavity.

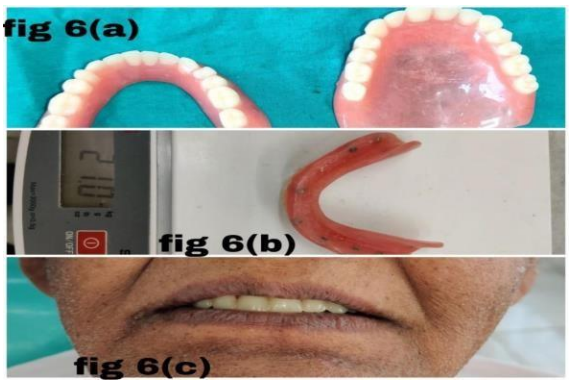
D. Functional impression material is loaded within the loops on the lower record base and it is placed within the oral cavity for placement.

E. Patient is said to say words like "aaaa..", "ooo..", and "eee…" or to say words like TIC-TAC-TOE with a mouth closed and without opening. These zones recorded if recorded natural state leads to a better prosthesis[8] [fig 5 (a,b)].

F. Plaster indices are made around the recorded neutral zones and then, the loops are removed from the record base. Indices are placed, and occlusal rims are made within the plaster indices, which serves as a guide for future teeth arrangement [fig 5 (c,d,e)].



During acrylization mandibular denture some metal beads were incorporated so as to make of denture base a little heavy.[9] This helps us to get a better stability.



DISCUSSION

Dr. M.M. Devan rightly said "the perpetual preservation of what remains is more important than the meticuluos replacement of what is missing. The inability of the residual ridge and its overlying tissues to withstand masticatory forces is the principle problems in the highly resorbed mandible[10]. The muscle attachments located

near the ridge crest increases the dislocating effect. For these reasons the action of the muscle and Extension of denture without dislocation, must be accurately recorded in the impression. The addition silicone that is used in border moulding can be handled easily and manipulated.

Resorption of mandibular ridges is a common problem in a clinicians day to day life. So as to get a better result for clinician as well as patient some modifications can be done to achieve this.

SOURCE OF DATA-NIL CONFLICT OF INTEREST- None Declared

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MANUSCRIPT TYPE – Original Article

A REVIEW OF WINKLER'S METHOD OF MANAGEMENT OF RESORBED MANDIBULAR RIDGE

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Abstract-

The management of highly resorbed ridge has always been a challenge to the prosthodontist for years. Obtaining consistent mandibular denture stability has long been a test for dental profession. Particularly, Atwood's Order V and Order VI pattern of bone resorption is accompanied with difficulties in providing successful dentures. Stability of lower denture in such cases is usually the distinguishing factor between success and failure.1 In this we have used a combination of different impression techniques to improve mandibular denture stability in a severely resorbed mandibular ridge, keeping in mind the prevention of further ridge resorption.

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INTRODUCTION:

All clinicians face the common problems in making complete denture for patients exhibiting highly resorbed ridge. Though resorption can be prevented to an extent but the fact that alveolar bone tends to resorb under complete lower denture is known to both, the clinician as well as the user of complete denture.[2] It is also accepted that the rate of resorption of mandibular residual ridge varies from person to person.[3] Atwood categorized ridge form into six orders ranging from preextraction state (Order I) to the atrophic depressed mandibular ridge (Order VI).[4] Highly resorbed residual mandibular ridge is commonly observed in elderly patients, along with thin, atrophic mucosa along with lower threshold of pain, with diminished muscle tonicity and reduced resiliency of tissues accompanied by poor adaptive capacity. Providing a stable mandibular denture for such patients has been a more difficult problem encountered by dentist.[5] The journey towards successful denture fabrication for such patients begins with an accurate impression making that will help to ensure that the complete denture is stable and retentive that provides physiological comfort to the patient.[6]

Case Report: A 64-year-old male patient presented with the chief complaint of difficulty in mastication, loosening of both upper and lower dentures, and poor esthetics for the past 3-4 years. He also complained of denture moving during speaking and swallowing. On intraoral examination, mandibular ridge was severely resorbed (Figure 1). There was no hyper mobile tissue on palpation. The patient was informed of all the treatment modalities and he opted for fabrication of complete denture due to financial constraints. He did not report any systemic disease. Clinical and radiological examination revealed severe resorption in mandibular ridge and moderate resorption in maxillary ridge.Case Report: A 64-year-old male patient presented with the chief complaint of difficulty in mastication, loosening of both upper and lower dentures, and poor esthetics for the past 3-4 years. He also complained of denture moving during speaking and swallowing. On intraoral examination, mandibular ridge was severely resorbed (Figure 1). There was no hyper mobile tissue on palpation. The patient was informed of all the treatment modalities and he opted for fabrication of complete denture due to financial constraints. He did not report any systemic disease. Clinical and radiological examination revealed severe resorption in mandibular ridge and moderate resorption in maxillary ridge relations.

Atwood classified residual ridge resorption into:

Order 1: Pre-extraction

Order 2: Post-extraction

Order 3: High, well-rounded

Order 4: Knife-edged

Order 5: Low, well rounded

Order 6: Depressed

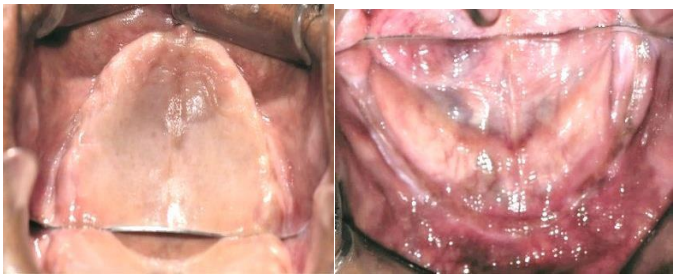


Figure.1- Maxillary and mandibular residual ridge

Maxillary primary impression was made using impression compound, while the mandibular primary impression was made using McCord and Tyson's admixed technique [2] for flat mandibular ridges. Impression compound (*DPI* Pinnacle, The Bombay Burmah Trading) and green stick tracing compound in the ratio of 3: 7 parts by weight were placed in a bowl of water at 60∘Cand kneaded to a homogenous mass that provides a working time of about 90 seconds. Then this homogeneous mass was loaded in an aluminum stock tray and the impression was made.

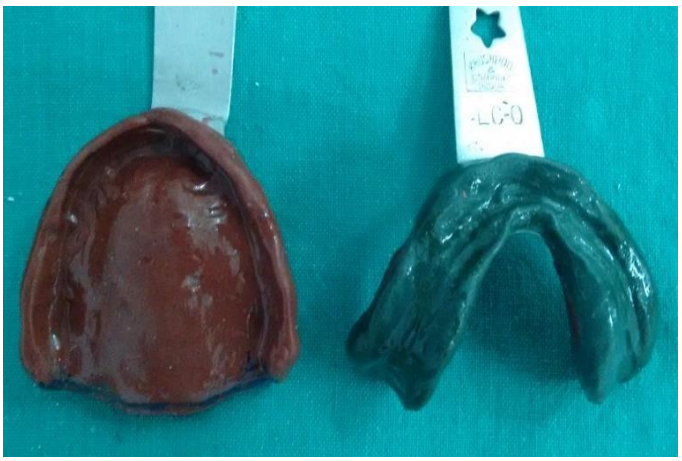


Figure2. Maxillary & mandibular primary impression

Primary cast was poured followed by spacer adaptation of wax spacer and a base plate using DPI self-cure acrylic resin. Occlusal rims were fabricated for recording jaw realtions.

Since the final impression is to be done in closed mouth technique firstly jaw relation was done. Once all the parameters of the jaw relation have been established then border molding was done in the maxillary arch, spacer was removed and final impression was made using addition silicone light body material in closed mouth technique. (fig 4)

Figure 3. Jaw relation for closed mouth impression

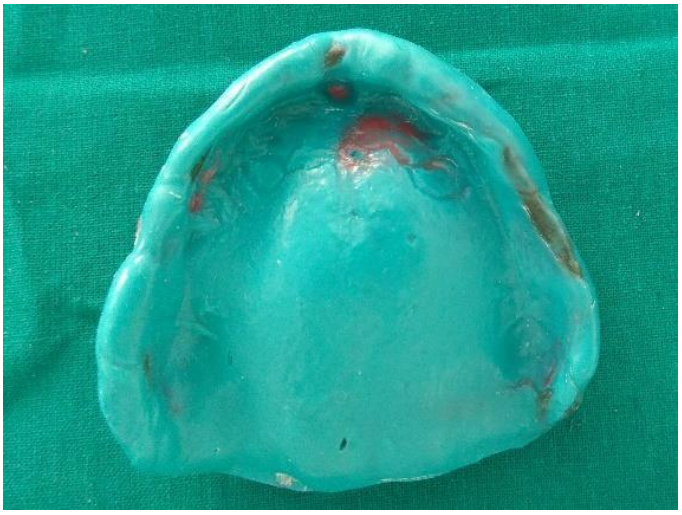
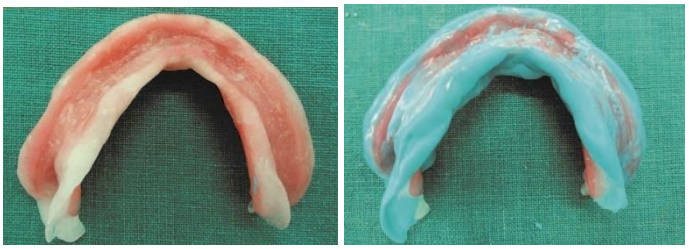


Figure4. Maxillary final impression in closed mouth Technique

Once maxillary impression was made the mandibular impression process was started. In this technique, denture bases with occlusal rim were fabricated on the primary cast. Jaw relations were done to record appropriate horizontal and vertical dimensions. Wax spacer was removed and tissue conditioning material was applied on the tissue surface of mandibular denture base and patient was asked to close the mouth in the prerecorded vertical dimension and do various functional movements such as puffing, blowing, whistling, and smiling.

Figure4: Mandibular final impression (figure in left after three coats of viscogel soft liner, figure in right after application of light body addition silicone.)



Three coats of tissue conditioner material were applied at an interval of 8–10 minutes and functional movements were made by the patients. Final impression was made with low viscosity addition silicone material with closed mouth technique. Master casts were obtained after pouring the final impressions with type III gypsum product (Stone Plaster, Neelkanth Minechem, Rajasthan, India).

Base plate was fabricated on the master cast. Occlusal rims were fabricated and final jaw relations were done. Occlusal rims were sealed in the patient's mouth and mounted on the articulator. Teeth arrangement was done and followed by wax try-in. The denture was processed and finished using conventional method. Final dentures were inserted in patient's mouth and were checked for retention, stability, support, and occlusion.

Figure5. Final jaw relation

Figure6. Try in

Figure6. Final Denture

Figure 7. Denture Insertion

Force measurement gauge devised by Burns et al was used in this case study to compare the denture retention with the older one. The patient was made to sit in the dental chair in an upright position with the head resting firmly against the headrest. The mandibular denture was placed correctly and the patient was asked to rest his tongue passively in the floor of the mouth with its tip adjacent to the anterior denture teeth. A wire loop (0.9mmin diameter)was placed on the geometrical center of the polished lingual surface to which the pull end of the force meter (graduated up to 196 N) was attached .A vertical upward force was applied to dislodge the denture while the patient was sitting in an upright position with the occlusal plane parallel to the floor and the digital force measurement gauge (digital force gauge device model 475040-NIST, Extech Instruments Corporation) held in the palm of the operator . This force was measured in Newton and recorded as the denture's retention. The retention of mandibular dentures was also evaluated subjectively, and the patient was requested to comment on the retention of each mandibular denture.

RESULT:

It was observed that the mean force required to dislodge the dentures was 21N for functional technique, 7N for cocktail technique, and 12N for putty and light body rubber base wash.

DISCUSSION:

The success of every complete denture relies on the achievement of the three basic properties of retention, stability, and support. Achieving these three properties in mandibular denture is more challenging because of anatomic limitations that demands added attention. The retention of the dentures is influenced by the factors like adhesion, cohesion, fluid, viscosity, atmospheric pressure, external factors arising out of occlusion and oral-facial musculature.7,8 The accuracy of complete denture impression techniques has long been debated. Variety of denture border outlines, resulting from the use of the same impression technique for all patients, has been shown and documented.9 The degree of muscular activity and the extension of denture borders without displacement are important aspects of any impression technique. For patients with an accentuated bone resorption, it is a difficult task to obtain good retention and stability of the complete denture due to the presence of muscular insertions near the ridge crest or border, which might cause muscle induced displacement of the denture. In these cases, functional technique is highly recommended. The results of the study are in support with the study conducted by Drago10 which concluded that mandibular denture bases constructed from closed mouth technique were more retentive than the open mouth techniques. The closed mouth functional technique by Winkler has certain advantages; since it is time saving, interference due to tray handling is eliminated; there are also less chances of under- or overextensions of denture border as movements are performed by the patient and pressure applied by the patient during impression making is the same as the pressure applied while occluding. However, there are few disadvantages of this technique such as the fact that the dentist has no control over patient movement which may result in under- or overextended borders. Movement of tongue is restricted anteriorly which may alter the anatomy of lingual border. The variety of impression materials and working characteristics of these materials made it possible to develop impression procedures best suited for specific conditions in each area in a given mouth. Whatever method is used for making impression, it should be based on the basic principles11 of maximum tissue area coverage and intimate contact so as to achieve the objectives of retention, support, stability, esthetics, and preservation of residual ridge (supporting structures).

CONCLUSION:

Prosthodontic rehabilitation of a patient with high degrees of bone resorption in a conventional manner is a difficult task. Modification in treatment procedure should be considered to deliver a stable prosthesis along with fulfillment of the patient's functional and esthetic demands. This case report illustrates the impression technique which is beneficial to achieve effective retention, stability, and support for Atwood's Order V and VI [11] ridge deformities.

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MANUSCRIPT TYPE – Original Article

COMPARATIVE EVALUATION OF THE FLEXURAL STRENGTH AND ANTIMICROBIAL PROPERTIES OF HEAT CURE DENTURE BASE RESINS BY ADDITION OF TiO2 AND METHACRYLIC ACID: AN IN-VITRO STUDY.

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Abstract-

Aim- To evaluate and compare the flexural strength and antimicrobial properties of heat cure denture base resins by addition of TiO2 nanoparticles and methacrylic acid at different concentration.

Materials and Method- In the present study, 180 samples were prepared. 30 samples for each group i.e. conventional non altered denture base acrylic resins (group I), altered heat cure acrylic resin with 0.5% and 1% TiO2NPs (group IIA and IIB), PMMA altered with 20% and 25% MAA (group IIIA and IIIB) and 1% TiO2NPs+25 % MAA incorporated in PMMA (group IV) were prepared. These specimens were stored at 37˚C in distilled water for 1 day. Specimens were incubated in BHI broth containing S. aureus and C. albicans in different test tubes at 37˚C for 18 hrs before the evaluation of microorganism adhesion and flexural strength. CFUs of C. albicans and S. aureus were evaluated when incubated at 37˚C on blood agar. Flexural test was measured by using universal testing machine at speed of 5mm/min. Data were subjected to static analysis (ANOVA, Tukey's HSD test).

Result- Reduction in CFU counts of S. aureus and C. aureus were found more significant for group IV as compared to group I and there was non-significant reduction in flexural strength in group II. Other groups showed significant reduction in flexural strength when compared to control group.Reduction in CFU counts of S. aureus and C. aureus were found more significant for group IV as compared to group I and there was non-significant reduction in flexural strength in group II. Other groups showed significant reduction in flexural strength when compared to control group.

Conclusion- Group IV had better antimicrobial property and acceptable flexural strength. Hence, this information can be used clinically as per patient requirement.

Keywords: Antimicrobial property, flexural strength, TiO2NPs, MAA, PMMA.

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INTRODUCTION:

The increase in average life span of human beings, as a result of various treatment and cure modalities, enhances the need of rehabilitative procedures for elderly; including edentulism. In-spite of preventive and restorative measures, the change in dietary habits from raw food to cooked soft and fast food is leading to tooth decay and gum diseases or even edentulism. Prosthodontists have an obligatory commitment towards society for rehabilitating the edentulous / semi-dentulous population with denture prosthesis to enable them live a healthy life.

Even with the presence of implants around, the conventional complete dentures are still most viable option for rehabilitation of such patients in countries like India.

Poly (methyl methacrylate) had been material of choice because of innumerable reasons [1]. But comparatively it has poor mechanical properties like impact, bending, and fatigue strength, thermal conductivity and is also prone to adhere with bio film, plaque and microbial flora [2, 3] on its intaglio surface which remains in contact with oral mucosa.

Along with various disinfectant solution for immersion, additives like nanoparticles of Titanium dioxide[7], SiO2, ZnO2, Ag, and Methylacrylic acid[5]are also suggested to enhance antibacterial property of resins, but with associated effects on physical and mechanical properties like flexural and impact strength[9], micro-hardness[7], elastic-modulus and glass-transition temperature[8] of PMMA.

MATERIALS AND METHOD:

Sampling Method:

In this study a total of 180 specimens were made of resin and resin containing TiO_2NPs or/and MAA. to evaluate and compare the flexural strength and antimicrobial properties against *S. aureus* and *C.albicans* of heat cure denture base resin (Trevalon) by addition of Titaniun dioxide NPs Anatase phase (SRL) 0.5% and 1% by wt and Methacrylic acid stabilized with Hydroquinone monomethylether (SRL) 20% and 25% by volume. The dmension of specimens were of 65×10×3.3 mm according of ADA specification No.12.

	Group-I	Group-II Contains TiO_2NPs		Group-III Contains MAA		Group-IV Contains TiO_2NPs+ MAA
	Control group (N=30)	Subgroup-IIA(N=30) 0.5%TiO_2NPs	Subgroup-IIB(N=30) 1%TiO_2 NPs	Subgroup IIIA(N=30) 20%MAA	Subgroup IIIB(N=30) 25%MAA	(N=30) 1%TiO_2NPs +25%MAA
Flexural strength	10	10	10	10	10	10
S. aureus	10	10	10	10	10	10
C. albicans	10	10	10	10	10	10

Table-1: Distribution of samples and allocation of groups

To prepare these, four stainless steel metal dies of same dimension were fabricated (Figure-1). Petroleum jelly (Vaseline) was applied to the all four dies and dies were invested in lower half of dental flask (VarsityFlask) filled with Type II dental plaster (Dentco, Neelkanth Minechem,jodhpur) (figure-2). After it sets, a thin layer of separating media (Pyrax) was applied. Then, the plaster was poured in the counterpart of the flask which was placed over the base part. A metal to metal intimate contact was ensured. Then, the flask was tightened in the clamp, after the plaster was set the flask was then opened, the dies were retrieved and a negative mold was obtained.

For all group's specimen polymer powder was measured in a digital weighing machine (Shimadzu AUX220). Monomer was measured using a syringe and measuring jar.

For group I, measured amount of powder and liquid for 30 samples were mixed in silicon cup. For modified group II and III, part of measured powder of resin for specimens were substituted with same weight of TiO2 as required to bring it 100% powder and Parts of measured liquid of resin for specimens were substituted with same volume of Methacrylic acid as required to bring 100% liquid. For example, in subgroup IIA, 0.5% w/w (0.5 g) TiO2 were added to 99.5% (99 g) PMMA polymer to bring polymer powder to 100% (100 g) and in subgroup IIIA, 20%v/v (20ml) MAA were added to 80% (80ml) PMMA liquid to bring PMMA liquid to 100% (100ml) and then mixed with liquid and powder as per manufacturer's recommendation respectively. Same was done for subgroup IIB and IIIB.

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For group IV, 1% w/w TiO2NPs added powder and 25% v/v MAA added liquid were mixed in a silicon cup as per manufacturer's recommendation.

When dough stage was reached, mixture was kneaded properly and packed into the mold space of the dental flask. The flask was left under the hydraulic bench press for bench curing for 30 minutes, then flask was kept in heat cured acrylic curing unit as recommended by the manufacturer. Slow bench cooling was done till room temperature, and the specimens were retrieved carefully.

Testing the Specimens:

Flexural Strength Testing:

Ten specimens from each groups and subgroup were subjected to flexural strength testing under 3-point loading[8]. Prior to flexural strength test, finished and polished samples were stored in distilled water for one day at 37˚C to reduce residual monomer[8,13]. The specimens were inserted in universal testing machine which consist a loading wedge and a pair of adjustable supporting wedges. The distance between the centers of the wedges was 50 mm. This dimension represents the space between the maxillary molars in a complete denture. The specimens were placed on the supporting wedges in such a way that loading wedge, set to travel at a crosshead speed of 5mm/min. The initially applied force was zero followed by gradual increase. The force was applied perpendicular to the center of specimen strips until the deviation of the load deflection curve and fracture of specimen occurred. The load was measured at the point of fracture of the specimen in Newton.

The ultimate flexural strength was calculated using the following formula in Megapascal:

$$\text{flexural strength} = 3\times F\times I \div 2\times b\times h2$$

F = Maximum applied load in Newton,

I = Distance between the support wedges,

b = Width of the specimen prior to storage in water,

h = Height of the specimen prior to storage in water

Here values of l, h and b were 50, 3.3 and 10 mm respectively.

Antimicrobial Testing:

Culture media used; Sucrose containing blood agar media at 37˚C.

Sample preparation for S. aureus and C. albicans adhesion;

The specimens were immersed in distilled water and incubated in incubator for 24 hours at 37˚C (figure-6.A&B); in order to prevent the occurrence of distortion and release of monomer after polymerization when in culture, by promoting the maximum water sorption [8,13] . After 24 hours all the samples were clean and sterilized with 2% chlorhexidine [8,14]. The sterile broth was used to wash them in order to remove chlorhexidine residue and were then placed in different sterilized container.

Microbiological test;

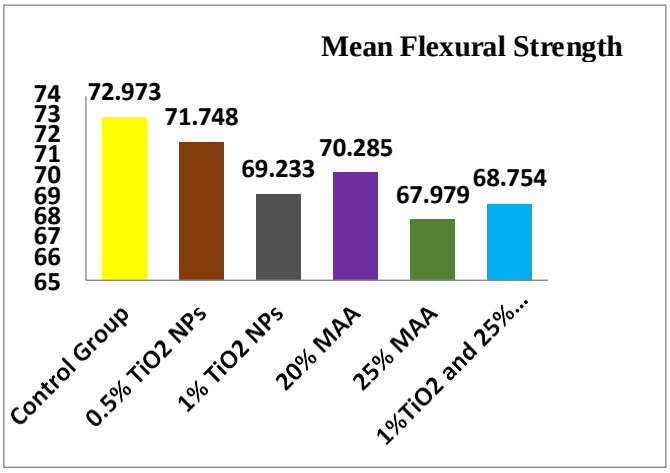
The BHI broth volume was maintained with a suspension and turbidity equivalent to a McFarland standard of 0.5. Five ml of BHI broth for each sample was distributed into the individual test tubes and inoculated with C. albicans and S. aureus. Sterilized specimens were transferred into these test tubes with help of sterile forcep. The test tubes were incubated in incubator for 18 hrs at 37˚C (figure-9&10). After incubation specimens were removed and cleaned with sterile BHI broth to remove non-adherent cells of S. aureus and C. albicans. With the help of the sterilized Nichrome wire loop (2mm diameter) primary inoculum was spread over the blood agar plate with quadrant streaking method.

Blood agar plates with primarily inoculum with S. aureus and C. albicans were incubated at 37˚C for 48 hrs and for one week respectively. After incubation, the colony forming units (CFU) were noted for all the samples.

On blood agar plate S. aureus appeared as grapes like clusters which were golden yellow in colour whereas growth of C. albicans on blood agar plate appeared as small, white colonies.

RESULTS AND OBSERVATIONS

For Flexural Strength:



Graph-1Graphic representation of mean flexural strength

Comparing the effect of groups and subgroups together on flexural strength, ANOVA showed highly significant effect of all four groups and subgroups (F=9.953, p<0.001) on flexural strength.

Pairwise comparison using Post hoc Tukey's test showed that significant difference(P≤0.05) was found in the flexural strength of all the groups except subgroup-IIA (P=0.704)when compared with control group.

Significant differences were found in the flexural strength of subgroup-IIA when compared with subgroup-IIB(P=0.50), subgroup-IIIB(P=0.001) and group-IV(P=0.011). Comparison of flexural strength in subgroup-IIIB vs subgroup-IIA(P=0.001),subgroup-IIB vs subgroup-IIA(P=0.50) and group-IV vs subgroup-IIA(P=0.011) were also significant.(Table-2).

For Staphylococcus aureus:

Comparing the effect of groups and subgroups together on CFU counts (×105 /ml) of S.aureus, ANOVA showed highly significant effect of all four groups and subgroups (F=122.502, P=00.0001) on CFU count of S. aureus.

Pairwise comparison using Post hoc Tukey's test showed that significant difference(P≤0.05) was found in the S.aureus colony count of all the groups except subgroup IIA when compared with subgroup IIB(P=0.743)(Table-2)

For Candida albicans

Comparing the effect of groups and subgroups together on CFU count (×105 /ml) of C.albicans, ANOVA showed highly significant effect of all four groups and subgroups (F=793.985, P=00.000) on CFU counts of C.albicans.

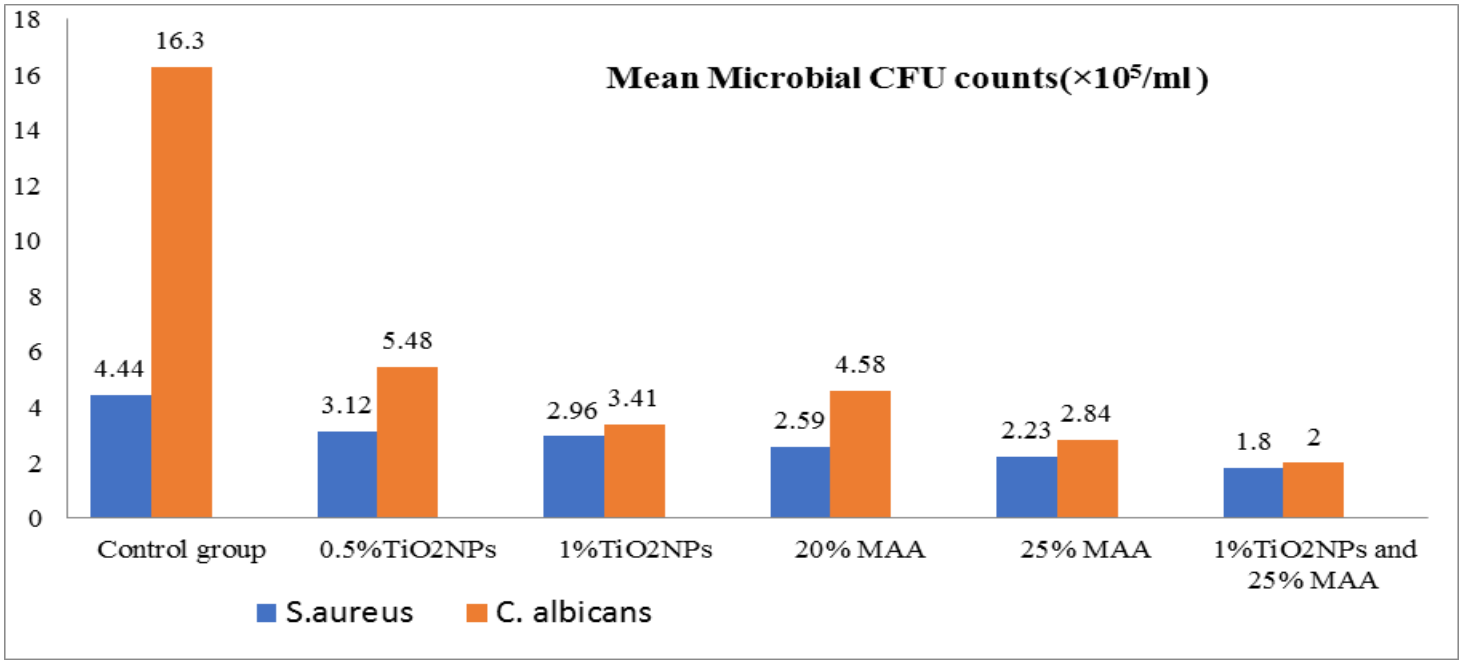
Pairwise comparison using Post hoc Tukey's test showed that significant difference (P≤0.05) was found in the C.albicans colony count of all the groups except subgroup IIIB when compared with subgroup IIB(P=0.283).(Table-2)

Table-2: Inter group comparison of mean difference of Flexural Strength and CFU count (×105 /ml) of S. aureus and C. albicans assessed by

		Mean difference of CFU count ($\times 10^5$ /ml) of *Staphylococcus aureus*			Mean difference of CFU count ($\times 10^5$ /ml) of *Candida albicans*			Mean difference of Flexural strength		
(I) Group	**(J) Group**	**Mean Difference (I-J)**	**Std. Error**	**P-value**	**Mean Difference (I-J)**	**Std. Error**	**P-value**	**Mean Difference (I-J)**	**Std. Error**	**P-value**
Group-I	**Subgroup-IIA**	1.32000***	0.11665	0.000	10.82000***	.26628	0.000	1.22500NS	.85157	.704
	Subgroup-IIB	1.48000***	0.11665	0.000	12.89000***	.26628	0.000	3.74000***	.85157	.001
	Subgroup-IIIA	1.85000***	0.11665	0.000	11.72000***	.26628	0.000	2.68800*	.85157	.030
	Subgroup-IIIB	2.21000***	0.11665	0.000	13.46000***	.26628	0.000	4.99400***	.85157	0.000
	Group-IV	2.64000***	0.11665	0.000	14.30000***	.26628	0.000	4.21900***	.85157	0.000
Subgroup-IIA	**Group-I**	-1.32000***	0.11665	0.000	-10.82000***	.26628	0.000	-1.22500NS	.85157	.704
	Subgroup-IIB	0.16000NS	0.11665	0.743	2.07000***	.26628	0.000	2.51500*	.85157	.050
	Subgroup-IIIA	0.53000***	0.11665	0.000	.90000*	.26628	.016	1.46300NS	.85157	.526
	Subgroup-IIIB	0.89000***	0.11665	0.000	2.64000***	.26628	0.000	3.76900***	.85157	.001
	Group-IV	1.32000***	0.11665	0.000	3.48000***	.26628	0.000	2.99400**	.85157	.011
Subgroup-IIB	**Group-I**	-1.48000***	0.11665	0.000	-12.89000***	.26628	0.000	-3.74000***	.85157	.001
	Subgroup-IIA	-.16000NS	0.11665	0.743	-2.07000***	.26628	0.000	-2.51500*	.85157	.050
	Subgroup-IIIA	0.37000*	0.11665	0.029	-1.17000***	.26628	.001	-1.05200NS	.85157	.818
	Subgroup-IIIB	0.73000***	0.11665	0.000	.57000NS	.26628	.283	1.25400NS	.85157	.683
	Group-IV	1.16000***	0.11665	0.000	1.41000***	.26628	0.000	.47900NS	.85157	.993
Subgroup-IIIA	**Group-I**	-1.85000***	0.11665	0.000	-11.72000***	.26628	0.000	-2.6880*	.85157	.030
	Subgroup-IIA	-0.53000***	0.11665	0.000	-.90000*	.26628	.016	-1.46300NS	.85157	.526
	Subgroup-IIB	-0.37000*	0.11665	0.029	1.17000***	.26628	.001	1.05200NS	.85157	.818
	Subgroup-IIIB	0.36000*	0.11665	0.036	1.74000***	.26628	0.000	2.30600NS	.85157	.090
	Group-IV	0.79000***	0.11665	0.000	2.58000***	.26628	0.000	1.53100NS	.85157	.476
Subgroup-IIIB	**Group-I**	-2.21000***	0.11665	0.000	-13.46000***	.26628	0.000	-4.99400***	.85157	0.000
	Subgroup-IIA	-0.89000***	0.11665	0.000	-2.64000***	.26628	0.000	-3.76900***	.85157	.001
	Subgroup-IIB	-0.73000***	0.11665	0.000	-.57000NS	.26628	.283	-1.25400NS	.85157	.683
	Subgroup-IIIA	-0.36000*	0.11665	.036	-1.74000***	.26628	0.000	-2.30600NS	.85157	.090
	Group-IV	0.43000**	0.11665	.007	.84000*	.26628	.030	-.77500NS	.85157	.942
Group-IV	**Group-I**	-2.64000***	0.11665	0.000	-14.30000***	.26628	0.000	-4.21900***	.85157	0.000
	Subgroup-IIA	-1.32000***	0.11665	0.000	-3.48000***	.26628	0.000	-2.99400**	.85157	.011
	Subgroup-IIB	-1.16000***	0.11665	0.000	-1.41000***	.26628	0.000	-.47900NS	.85157	.993
	Subgroup-IIIA	-0.79000***	0.11665	0.000	-2.58000***	.26628	0.000	-1.53100NS	.85157	.476
	Subgroup-IIIB	-0.43000**	0.11665	0.007	-.84000*	.26628	.030	.77500NS	.85157	.942

using TUKEY HSD

Graph-2: graphic representation of mean CFU count (×10^5 /ml) of *S. aureus* & *C.albicans*



DISCUSSION-

Heat cure PMMA resins have been the material of choice for the denture fabrication because of numerous reason like it is biocompatible, dimensionally stable, easily available material etc[17]. Despite of these advantages acrylic resin has potential for microbial adhesion. Therefore, efforts have been made to add some specific antimicrobial agents like nanoparticles and co-monomer into the PMMA[12]. In many nanoparticles, TiO2NPs have gained popularity because of its higher stability, antimicrobial properties, less cost, photocatalytic activity, and safety toward both humans and the environment[10] .Co-monomer (MAA) has gained importance because of its antimicrobial properties and biocompatibility[8]. It also prevents the cross contamination from laboratory to the patient and dentist.

The addition of NPs and MAA in PMMA may affect the mechanical properties of the denture base resin like flexural strength, impact strength and tensile strength etc.

Nazirkar G. et al conducted a study in which they added the TiO2NPs at different concentration (0.5% and 1%) in denture base resin and assessed the flexural strength of denture base resin. According to this study, the flexural strength of the final prosthesis had been adversely affected with incorporation of TiO2NPs [10].

A study conducted by Ahmed MA et al showed decrease flexural strength with increase in concentration of TiO2NPs; as they had incorporated the TiO2NPs in heat cure PMMA at 1% and 5% by wt.[11]

The present study also showed the significant reduction in Flexural strength of TiO2NPs incorporated PMMA.

The TiO2NPs additive can act as an impurity and interfere with the polymerization reaction which could affect the internal structure of polymerized PMMA and decreases the flexural strength of polymerized denture base resin. The TiO2NPs added in PMMA act as a plasticizer which increases the amount of residual unreacted monomer, may cause decrease in the strengths of the denture base resin[10].

Gupta L.et al modified the PMMA by adding MAA to the monomer at different concentration (0, 15, 20, and 25 wt %) to evaluate the effect on flexural strength and on adhesion of S.aureus. Result showed a non-significant reduction in flexural strength with increase in concentration reduction in flexural strength with increase in concentration of MAA in PMMA[8].

MAA tends to be a hydrophilic material. When MAA incorporated in PMMA, water sorption by PMMA increased due to presence of hydrophilic radicals. Water is a very complex solvent which creates strong interaction with the polymer of denture base resin because of its ability to form hydrogen bonds with denture base resin. So it can be assumed that water sorption could be the reason for decrease in flexural strength of denture base resin when altered with MAA[17].

A study was conducted by Ahmad R. et al on the antibacterial properties of TiO2NPs added at 0% and 1 % by wt in PMMA. It was concluded that, as the concentration of TiO2NPs increased, the antibacterial property of the TiO2NPs also increased. This study was conducted against the E.coli bacteria[18].

Acosta-Torres LS et al incorporated the metal oxide nanoparticles (TiO2NPs and Fe2O3NPs) to heat cure PMMA to evaluate the physical, mechanical and microbial activity on denture base resin. There was significant reduction in adhesion of C.albicans, flexural strength and porosity of denture base[2].

Gupta L. et al modified the PMMA by adding MAA to the monomer at different concentration (0, 15, 20, and 25 wt %) and evaluated the effect on adhesion of S.aureus and on flexural strength. Addition of MAA to denture base resin significantly reduced the microbial adhesion without significantly affecting the flexural strength[8].

Another study was done by Gupta L et al to evaluate antifungal activity of MAA incorporated in PMMA at different concentration (0, 15, 20, and 25 wt %). The result showed significant reduction in adhesion of Candida albicans with increase in concentration of MAA in PMMA[19].

The adhesion of microbes to polymerized denture base resin has been correlated with attractive hydrophobic and repulsive electrostatic forces. For hydrophobic surfaces such as heat cure denture base resin, monomer units on the surface of acrylic plate, relate with the hydrophobic provinces on proteins presented in the cell membrane of the microbes by strong hydrophobic bonds. Such interactions would cause adhesion of microbes more readily to hydrophobic surfaces such as PMMA plate. Since the adherence process takes place even in the presence of repulsive forces (due to electrostatic interaction), the contribution of electrostatic interaction is secondary to the hydrophobic interaction[13,20,21,22].

C. albicans and S. aureus have net negative surface leading to the electrostatic repulsion through the negative–negative charge interactions with the PMMA. Highly negatively charged denture base acrylic resin (PMMA) can prevent/reduce the adhesion of C. albicans and S. aureus. Conventional PMMA has very less net negative charge. Thus, it can be proposed that the addition of MAA to PMMA increases net negative charge of PMMA, which probably leads to a significant increase in the electrostatic repulsive forces and may prevents or reduces the adhesion of the microbes to PMMA[8,13,19].

Addition of TiO2NPs reduces the adhesion of microbes on PMMA by reducing the microbial biofilm formation in mouth and on denture base resin and also due to the anti-adherence property of TiO2NPs[15].

No study was conducted to evaluate the flexural strength and antimicrobial activities of PMMA by incorporation 1%TiO2NPs and 25%MAA together. In this present study PMMA was altered with 1% TiO2NPs+25% MAA in group-IV. Result showed that mean flexural strength of group-IV was less than all groups and subgroups except subgroup IIIB, which showed lowest mean flexural strength.

The TiO2NPs act as a plasticizer in PMMA. TiO2NPs increases the amount of unreacted residual monomer which decreases the strengths of PMMA. In contrast, MAA causes controlled polymerization of residual monomers thus leaving a lesser amount of residual monomer in the acrylized resin, resulting in better strength of the material[10,23,24]. Thus it can be assumed that when these two materials are combined together, they counteract each other's actions.

The limitation of the present study was that the intraoral conditions could not be simulated while testing of specimens like saliva and repeated masticatory loads on the prosthesis.

CONCLUSION:

Within the limitation of this study following conclusions were made that addition of TiO2NPs and MAA both showed significant increase in antimicrobial properties and decrease in the flexure strength of the material. The combination of 1% TiO2NPs and 25% MAA shows the best antibacterial and antifungal properties amongst all concentrations. This information can be clinically applied by using the best suited concentration of TiO2NPs and/or MAA as per the patient requirement.

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MANUSCRIPT TYPE – Original Article

A SEMI-CUSTOMIZED OCULAR PROSTHESIS FOR A PATIENT WITH OCULAR DEFECT: A CASE REPORT

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Abstract-

In human being severe physical and psychological distress occurs due to disfigurement caused by loss of eye. Ocular prosthesis is the only available mode of rehabilitation for the missing eye. Different materials and techniques are used for the fabrication of the missing eye. Resin is proved to be better among the available materials. Stock eye or customized ocular prosthesis has their own advantages and disadvantages. In our clinical report, we have fabricated a semi-customized ocular prosthesis with stock iris and customized sclera.

Keywords: Enucleation ocular prosthesis, rehabilitation, semi-customized

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INTRODUCTION:

Loss or absence of a part of the face especially eye can cause severe physical and emotional problems.1 Loss of eye could be because of malignancies, congenital defect, irreparable trauma, painful blind eye or sympathetic ophthalmia.2 Depending on the severity of the involvement, the surgical management may include one of three approaches: evisceration, enucleation or exenteration.3

Evisceration is the surgical procedure involving the excision of the intraocular contents of the globe, leaving the sclera, and sometimes the cornea. Enucleation is the surgical removal of the entire globe and a portion of the optic nerve from the orbit. Exenteration is the en bloc removal of the entire contents of the orbit including the extraocular muscles.3

A prosthesis (came from Ancient Greek word prosthesis which means "addition, application, attachment") or prosthetic implant is an artificial device that replaces a missing body part, which may be lost through trauma, disease, or a condition present at birth (congenital disorder). Any prostheses is intended to restore the normal functions of the missing body part.

Psychological distress associated with the loss of eye can be significantly improved by an ocular prosthesis, simulating the natural eye. First evidence for the replacement of missing eye was obtained from the Egypt dynasty, who used precious stones, earthenware, copper, and gold. Materials such as vulcanite and celluloid were used during 19th century. In the early part of 20th century, Muller-Uri family fabricated glass eye using sand with a low iron oxide content. In 1944, by the combined efforts of the individuals of the armed forces of the United States, methyl-methacrylate resin was successfully used for the fabrication of the ocular prosthesis.4,5Since then usage of resin gained popularity because of its light weight, translucency, better fracture resistance, ease of fabrication, easy adjustability, and its capability for intrinsic and extrinsic coloring.6

There are several techniques in the literature for fitting and fabrication of the artificial eye. Fitting a stock eye, modifying a stock eye on the positive replica of the ocular defect and the fabrication of the custom eye prosthesis comes under it. In custom made ocular prosthesis, both sclera and iris are custom made. First two techniques are less time-consuming but often have the disadvantages like compromised esthetics and unreliable fit. Custom ocular prosthesis provides improved esthetics, and fit but usually more time-consuming and complicated.4-8 This clinical report demonstrates a technique for fabricating ocular prosthesis with stock iris and custom made sclera to provide functionally and esthetically satisfactory result.

CASE REPORT:

A 62-year-old female patient reported to the Department of Prosthodontics, Sardar Patel Post graduate Institute of Dental Sciences, Lucknow, UP, India with a chief complaint of facial disfigurement because of a missing left eye since her 3 month of age (Figure 1). The history revealed congunctivitis to the left eye at the age of 3 months followed by the enucleation of the same at the age of 62 years due to infection.

Examination of the eye socket revealed a healthy conjunctiva with no signs of infection or inflammation covering the posterior wall of the anophthalmic socket and showing synchronous movements. According to the treatment based classification system given by Himanshi et al., the patient was categorized under Class 3 phthisis bulbi, i.e moderate enophthalmos with disfigured sclera9.

Figure 1- Pre-operative view showing ocular

In this case a semi-customized ocular prosthesis was planned with stock iris and custom made sclera, and the treatment procedure was explained to the patient before the commencement of the treatment.

OCULAR IMPRESSION:

In this case the conformer given by the ophthalmologist at the time of surgery was used as custom tray for taking the final impression (figure 2). A technique described by Taicher et al. was performed.

Figure 2- Conformer

Figure 3- Conformer Attached to hollow Cylinder

Light body addition silicon impression material (Aquasil, Dentsply, Detrey GmbH, Germany) was used for taking impression. After making retentive holes in conformer a plastic hollow cylinder was attached to the conformer in center (figure 3). the conformer was placed in ophthalmic socket (figure 4). Then light body impression material was pushed through plastic hollow cylinder. After inserting sufficient impression material the patient was asked to perform various eye movements with her head upright (figure 5). After setting of impression material, the impression was removed from the ophthalmic socket.

Figure 4- Placement of Conformer in socket

Figure 5- Conformer filled with impression material

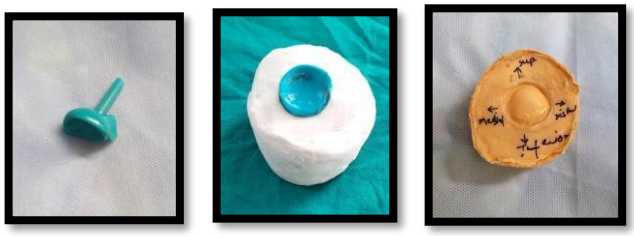

Figure 6- impression, base formation, and final cast

WAX CONFORMER OR THE SCLERAL TRY-IN:

Modeling wax was used for wax up of sclera on the mould (figure 7). It was retrieved from the mold and inserted in the ocular cavity and checked for stability and esthetics. Necessary sculpting of the anterior surface of the conformer was done to mimic the features of the contra-lateral natural eye and fullness of eyelid (figure 8). This altered wax up was used to fabricate the final acrylic resin ocular prosthesis.

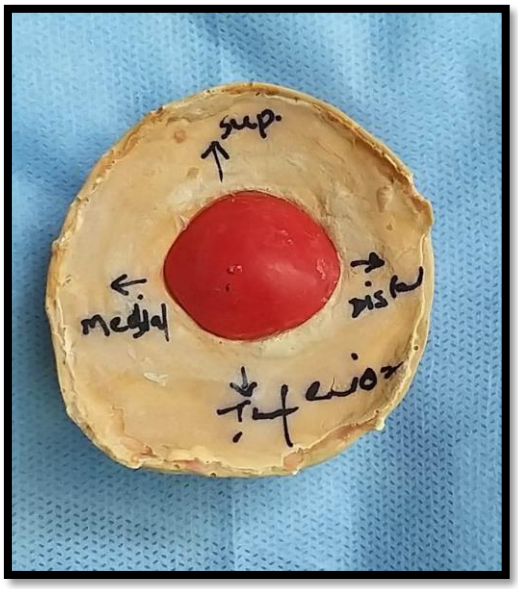

Figure 7- Wax up for scalera

Figure 8- wax up trial

SELECTING AND POSITIONING IRIS:

The size, shade, and configuration of the iris were selected by taking the contralateral natural eye as a guide. Most closely matching iris was selected from the stock eyes. This stock iris was positioned on the scleral wax pattern, and the border was sealed using a hot instrument. The position of the iris was finalized in accordance with the contralateral eye using graph grid method.10 Shade selection for the sclera was done using the natural eye as a guide (figure 9).

Figure 9- Shade selection and positioning of iris

Figure 10- Final waxup trial with iris

FABRICATION OF RESIN SCLERA

Scleral wax pattern with the stock iris positioned over it was removed from the socket. It was washed under tap water. To stabilize the stock iris within the mold, an auto polymerizing acrylic resin (DPI-Self cure, Dental products of India Ltd.) extension of a diameter of around 4mm and length of around 6 mm was attached over its center. Flasking and dewaxing were done in a conventional manner. Selected shade of the heat cure acrylic resin (DPI-Heat cure, Dental Products of India

Ltd.) was manipulated and packed into the prepared mould. Acrylization was done by following a long curing cycle.

Acrylic resin sclera with the iris attached over it was obtained after deflasking. Acrylic resin extension from the iris was trimmed off using an acrylic trimmer, followed by finishing and polishing was done. Uncharacterized prosthesis was inserted into the socket. Stability of the prosthesis, contour of the sclera, and the position of the iris was reconfirmed.Acrylic resin sclera with the iris attached over it was obtained after deflasking. Acrylic resin extension from the iris was trimmed off using an acrylic trimmer, followed by finishing and polishing was done. Uncharacterized prosthesis was inserted into the socket. Stability of the prosthesis, contour of the sclera, and the position of the iris was reconfirmed.

Figure 11- Acrylized prosthesis

Acrylic resin sclera was trimmed uniformly to a depth of around 1 mm. Over the reduced surface of the sclera painting was done using the soft color tones of brown, pink, to match the sclera of the contralateral natural eye. Red nylon fibers were placed along the outer periphery to simulate the blood vessels. Once the characterization was satisfactory, all the colors and nylon fibers were stabilized by applying a thin layer of cyanoacrylate adhesive over it. Trimmed sclera part was replaced by clear heat polymerizing acrylic resin, followed by curing, deflasking, finishing, and polishing of the prosthesis (figure 11). Final ocular prosthesis was inserted into the socket and evaluated for fit, esthetics, and the coordinated movements with the contralateral eye (figure 12). Post insertion instructions were given to the patient, regarding the usage, limitation, and the maintenance of the prosthesis.[11]

Figure 12- Final Prosthesis placement

DISCUSSION:

Customized ocular prosthesis has the advantages over stock eyes like, better contouring, color matching, and co-ordinated movements with the contralateral eye.4,8 Customizing the iris demands extra skill and time from the operator.12,13 Customizing iris can be avoided if stock iris matching with the contralateral natural eye is available. Semi-customize prosthesis with the stock iris and customized sclera has advantages of both stock and custom prosthesis. This technique is not advised when the color, contour, and configuration of the stock iris is not satisfactorily matching with the contralateral natural eye of the patient.

CONCLUSION:

Success of the ocular prosthesis largely depends on the precise laboratory procedure and artistic skills of the operator. Through this technique, the demand for the artistic skill and consumption of time are reduced by the use of precisely selected stock iris, yet esthetic and functional requirements are met by the customized sclera.

CLINICAL SIGNIFICANCE:

Semi-customized ocular prosthesis is of use for masking the compromised artistic skill of the operator. This technique reduces the laboratory and clinical time and provides a satisfactory result in indicated patients.

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MANUSCRIPT TYPE – Original Article

DENTURE THAT ACT AS A BANDAGE: IMMEDIATE DENTURE-A CASE REPORT

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Abstract-

An immediate complete denture is a replacement of the lost natural teeth and associated tissues which is inserted into the patients mouth immediately following the extraction of remaining teeth. The transition from dentulism to edentulism should be psychologically atraumatic as far as possible. The case presented here are transitional or non transitional immediate complete denture was planned after extraction of remaining natural teeth.

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INTRODUCTION:

The immediate denture is a dental prosthesis that is constructed to replace the lost dentition, associated structures of the maxillae and mandible and inserted immediately following removal of the remaining teeth.There are two types of immediate dentures in the literature: conventional immediate dentures and interim immediate dentures .[1] In the traditional type, the conventional immediate denture is fabricated to immediately place after the extraction of natural teeth and can be used as the definitive or long-term prosthesis. The interim type is used for a short time after tooth extraction. After the achievement of healing period, the immediate denture may be relined or replaced with the newly fabricated final denture .[2] The interim immediate denture show numerous advantages like preservation of facial appearance and vertical height, muscular tone, phonetic and reduction of post-extraction pain. [3]

One of the most important issues to be considered in immediate denture fabrication may be the difficulty to assess the occlusal vertical dimension (OVD) and centric relation after extraction of the posterior teeth.

CASE REPORT:

A 65 year old patient referred to the department of prosthodontics for replacement of missing teeth in lower right and left back region of the jaw and want a complete upper denture .On intra oral examination patient presented with retained lower anteriors and lower left 1st premolar and which are periodontally unfavourable and a completly edentulous maxilla with no abnormality detected. As the teeth present are not periodontally sound so extraction of the teeth and fabrication of the conventional immediate denture was advised.Extraction of remaining teeth was planned followed by delivery of an immediate denture.

PROCEDURE:

• The case was proceeded by recording case history of the patient. figure1,2

• Preliminary impressions are made with irreversible hydrocolloid.Preliminary cast were poured with dental stone .

• Separating medium were applied on the cast and maxillary and mandibular special tray were made.Maxillary and mandibular border moulding was done using low fusing impression compound and subsequently followed by final impression with zinc oxide eugenol paste.

• Mandible dual impression was taken with irreversible hydrocolloid and cast were poured.

• Jaw relation were recorded and the record bases were sealed with bite registration paste followed by articulation on the mean value articulator.figure3

• Shade selection was done and teeth were arranged.This was followed by try-in .figure4

• On the articulator ,alternate teeth was cut away on the cast and the labial portion of each root were excavated to a depth of 1-2 mm on the labial side and flush with the gingival margin of the lingual or palatal side.The selected teeth were placed in their specific positions and modified. Figure5

• The mandibular anterior teeth were extracted in toto after attaining informed consent of patient and sutures were placed Figure6.The interim denture was inserted after adjustments. Figure7-Figure8

• Interim immediate denture act as a stent on the extraction socket which help in healing.Patient was advised to wear the denture overnight and was called after 24 hours of the insertion.Patient complained of ulceration in mylohyoid region and maxillary palatal region and required trimming were done.Patient was advised to continue wearing denture and called for suture removal after a week.Patient was recalled after 6 months to check for stability and retention of both the dentures and relining was done.

DISCUSSION:

When removal of all teeth becomes necessary an immediate denture is an important treatment modality .There are many advantages of immediate dentures as it acts as a matrix which control haemorrhage ,prevents contamination and provide protective covering over the wounds.

An immediate denture provide restoration of phonetics and masticatory functions and facilitates transition of the edentulous state. [4] All in all it help to boost the patient's confidence even after extraction of all teeth.

CONCLUSION:

In the era of implant and immediate implant treatment,

immediate complete denture treatment should still be considered as an important treatment modality . A detailed extra oral and intra oral evaluation and correct treatment planning will lead to a successful replacement of missing structures with immediate dentures which is functionally acceptable and pleasing to the patient.

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Figure 1: Mandibular Retained Teeth

Figure 2: Intra Oral view of Maxillary Edentulous Arch

Figure 3 :Jaw relationship

Figure 4-5: Teeth Setting and excavation of root

Figure 6: Extraction of Mandibular inserted

Figure 7: Maxillary Denture inserted anterior teeth

Figure 8:Final Insertion of immediate denture

MANUSCRIPT TYPE – Original Article

AN ASSOCIATION OF SLEEPING DISORDERS, NUTRITION, ADDICTIONS, PHYSICAL ACTIVITY AND ORAL HEALTH WITH METABOLIC SYNDROMES: A REVIEW

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Abstract- With the advancement of lifestyle and living standards, an increase in type 2 diabetes mellitus and cardiovascular diseases have been observed, which give rise to Metabolic syndrome. This occur due to several derangements or risk factors like blood pressure, obesity, nonalcoholic fatty liver disease, insulin resistance or glucose intolerance, dyslipidemia (raised triglyceride and lowered high density lipoprotein cholesterol levels) and hypertension. Metabolic syndrome is basically presence of any of the three or more above risk factors. Several studies have been found on association between oral health and metabolic syndrome. But to our best knowledge there are hardly any studies which have focused on association of oral health, sleeping disorders, nutrition, addictions and physical activity with metabolic syndromes. In this review we endeavor to incorporate the current scenario.

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INTRODUCTION:

With the advancement of lifestyle and living standards, an increase in type 2 diabetes mellitus (T2DM) and cardiovascular diseases (CVD) have been observed. [1] This occur due to several derangements or risk factors like blood pressure, obesity, nonalcoholic fatty liver disease (NAFLD), insulin resistance or glucose intolerance, dyslipidemia (raised triglyceride and lowered high density lipoprotein [HDL] cholesterol levels) and hypertension. Thus, Metabolic syndrome (MetS) is basically presence of any of the above mentioned three or more risk factors. [2]

Several studies have found an association between oral health and MetS. [3,4,5] But to our best knowledge there are hardly any studies which have focused on association of oral health, sleeping disorders, addictions and physical activity with metabolic syndromes. Keeping these issues in consideration we endeavor to focus on the current scenario in this review.

ASSOCIATION OF SLEEPING DISORDERS AND METABOLIC SYNDROMES

Sleep is usually considered as an indicator to evaluate an individual's health condition. According to sleep guidelines an adult individual should sleep 7 to 9 hours per night and should follow healthy sleeping pattern before bedtime. [6, 7] While a person is asleep several physiological changes occur in the body which are considered to be crucial in order to stay healthy. Thus, a good sleep enhances good health in an individual. [8] Although sleep process is controlled by several regulatory systems, but if it gets disrupted it give rise to sleeping disorders. [9]

Sleeping disorders generally include insomnia, obstructive sleep apnea (OSA), fatigue, sleep paralysis, parasomnia, hypersomnia, restless leg syndrome, difficulty in maintaining sleep, or early morning awakening. [9] Several perpetuating (for eg. bedtime), precipitating (for eg. psychosocial stressors) or predisposing factors other than lifestyle modifications are responsible for these disorders. [9]

The sleep cycle is controlled by circadian rhythm which is reported different in males and females. It is reported that females have shorter 24-h cycle as compared to males. [10] Studies have established gender differences on the basis of various parameters including physiological disparities. Some focus on the fact that this difference was due to hormonal fluctuations. [11, 12] Studies also suggests that this difference was also due to physiological changes that eventuate at the time of pregnancy, menopause and pubertal development. [13, 14] A meta-analysis also reported a gender based association of less and greater sleep with MetS. [15]

Studies have also found that excessive or less sleep effects immunology, endocrinology and metabolism of an individual, thereby giving rise to some health related issues like obesity, diabetes, hypertension or cardiovascular problems, which are components of MetS and is generally overlooked. [12, 16]

Several studies have reported an association of MetS with short or long sleep durations among children, adolescents, and even with adults. [17,18]

In a recent study, it was observed that there exhibits an association between sleep duration and blood pressure (BP) both systolic and diastolic. BP is considered as an integral marker of hypertension and several cardiovascular diseases, which are important components of MetS. Authors concluded that short sleep duration was associated with elevated BP, while elevation in sleep duration was associated with reduction in BP. [19] In a study by Kim et al it was concluded that sleep durations both short and long were considered as risk factor for MetS, particularly hyperglycemia, obesity (waist circumference), elevated triglycerides and hypertension.[12] Moreover, in a recent study it was also reported that individuals particularly woman with less sleep were at a risk for hypertension, cardiometabolic diseases and prediabetes.[10]

Among the sleeping disorders insomnia is more prevalent and is considered to be the major risk factor of an increased hypertension, in a recent meta-analysis authors concluded that insomnia is considered as a major risk factor as it elevates hypertension by 21%. [20]

Interestingly, in a study it was observed that individual with obstructive sleep apnea (OSA), a kind of sleeping disorders, possess an increased risk of cardiometabolic disease (a component of MetS) and vice versa they also reported that individuals having MetS were more vulnerable towards sleep apnea. [17] In a meta- analysis it was reported that there exhibits a significant association between increased blood pressure (a component of MetS) and OSA. [21]

Although several studies have reported an association

between OSA and MetS, still to date their relationship is questionable. [22, 23] As few studies have not found any relationship between some of the components of MetS and OSA. [24, 25] Moreover, a recent study have reported that in patients with T2DM there exhibits no significant association between OSA and MetS. [23]

ASSOCIATION OF NUTRITION AND METABOLIC SYNDROMES

Nutrition specifies essential nutrients present in the food required by an individual. Nutrients generally comprises of carbohydrates, fats, fiber, protein, water, minerals and vitamins. [26] Lack of required amount of nutrients cause adverse effect on health. Moreover, good quality of nutrition is associated with stronger immunity, better infant, child and maternal health, whereas malnutrition or undernourishment causes serious health issues including MetS. Thus, nutrition is considered as an integral part in the development and health of an individual. [27]

In developing countries like India, malnutrition is a threat for human health. Malnutrition includes both undernutrition and overweight (obesity). The cause of malnutrition could be modified lifestyle, socio-economic status, poor knowledge about benefits of healthy and nutritional diet, substance abuse, or any kind of disease. [28, 29]

Undernutrition includes several mineral and vitamin deficiencies, which is the major cause of mortality among children, this also weakens their healthy development. Whereas, overweight is associated with several chronic diseases. Thus, nutrition has its impact during early stages of life which extends till adulthood. [30, 31]

Nutrition problem arises in adolescents since childhood which continues during lifetime. Vitamin and mineral deficiencies have several adverse effect in the overall development. Out of which iron, vitamin A, iodine and zinc deficiencies are of major concern among children, due to which there is occurrence of anaemia, blindness and mortality caused by measles and diarrhea. Moreover, anaemia is a major nutritional problem among adolescent girls. Consuming proper diet and taking essential nutrients can minimize the problem in girls. This could further reduce maternal and child mortality rate and malnutrition cycle (from one generation to another). [30, 32, 33]

According to WHO the developing nations are facing several challenges out of which malnutrition is among them. But instead of starvation, overweight or obesity is the problem of concern. [31] With the change in lifestyle particularly consuming processed or fast food, instead of fresh homemade food, urbanization, digitalization and living a sedentary life gave rise to obesity.[27] Disturbance in the energy level result in weight gain and disrupt metabolism which leads to obesity. [34] In obesity triglycerides are found to be stored in adipose tissue. An increase triglycerides leads to dyslipidemia, reduction in the HDL-C (high density lipoprotein-Cholestrol), increase in LDL-C (low density lipoprotein cholesterol), which ultimately effects heart and causes T2DM. [27]

Obesity can change metabolic and hormonal status, particularly hormone leptin. Consumption of saturated fatty acids, processed carbohydrates, fats, and less intake of minerals and vitamins leads to leptin and insulin resistance, thereby giving rise to MetS. Obesity is also found to increase the inflammatory factors which causes MetS [35, 36] compulsive disorders like compulsive shopping or gambling or game addiction, hoarding disorder, sexual disorders. [42]

But still it is a debatable topic among researchers and clinicians, as they consider non chemical addictions similar in characteristics and consequences to substance related addictions. [43] Among substance related tobacco (smoking or non-smoking), alcohol, drugs are considered as major issue, since it is matter of concern for both society and individual. [37]

It has been observed that individual with substance abuse disorder had MetS, which was a major cause of mortality. [44] Moreover, it was also observed that this was due to cell damage, reduction in the production of energy, high body mass index and nutritional deficiencies. [44]

Several studies have reported an association between MetS and alcohol consumption. Few disparities were also observed, as some reported J-shaped, U-shaped, inverse linear, positive linear or no association. This disparity was perhaps due to type of beverage, duration or gender biased. [45, 46]

A meta-analysis reported that there exhibits an association between high risk of MetS and heavy alcohol consumption and an association was also observed between low risk of MetS and light alcohol consumption. [47] In another study an association of heavy drinking with MetS was also observed among obese or overweight individuals. [45] Studies have also found an association of certain drugs like marijuana, cocaine heroin with health

related issues particularly T2DM, cardiovascular diseases. [48] Even tobacco (smoking or non-smoking) was also found to be associated with several respiratory diseases, cancers and overall health. [49]

Association of physical activity and metabolic syndromes

The physical activity guidelines issued by U.S. Department of Health and Human Services emphasized on the fact that physical activity is closely linked to human health. [50] WHO (World health organization) has defined physical activity as the movement of the body which is produced by skeletal muscles with expenditure of energy. [51] Moreover, they also recommended that adults should indulge themselves for about 150 minutes per week in moderate intensity physical activity or 70 minutes of high intensity physical activity. They even recommended physical activity in a day for different age groups, for instance infants (less than 1 year) should have at least 30 minutes and children 1-4 years of age group should have 180 minutes of physical activity. Whereas, children and adolescents of age group 5 to 17 years should indulge themselves for at least 60 minutes per day in moderate to vigorous intensity of physical activity. [50, 51] Physical activity comprises of movements such as walking, cycling, exercises which includes weight lifting, aerobics, any kind of sport or active recreation. [51]

Studies have concluded that any kind of physical activity decreases the risk of cardiovascular diseases, T2DM, hypertension, depression, and several types of cancers. Whereas, individual who are physically inactive are prone and are at higher risk to the above mentioned disorders. [50, 51] Physical inactivity is considered to be a major cause of obesity among individuals. Several studies have documented this fact and concluded that as the weight and obesity increases prevalence of MetS increases, particularly T2DM and cardiovascular diseases in all individuals, including children. Several developing countries are facing this challenge which is effecting overall well-being of an individual. [52]

In a meta-analysis, it was identified that as the leisure time physical activity was greater the risk of MetS was less. The authors also concluded that although there exhibits few discrepancy (which could be due to study design, sample size, type of samples etc), still around 17 studies have found an association between risk of MetS and physical activity. [51] Several studies have also found similar findings suggesting an association of physical activity with that of other diseases like T2DM, hypertension, cardiovascular diseases, several cancers, stroke and mortality. [53, 54, 55]

Studies have suggested that individuals who are following the WHO guidelines and performing moderate or high intensity physical activity of 150 minutes per week had 36 to 37% low risk of MetS. [56] Sedentary behavior refers to the activity which requires an expenditure of less than metabolic equivalent, is also associated with MetS. Studies have found an association of MetS and its components with sedentary behavior. Moreover, it was also observed that sedentary lifestyle is linked with T2DM. [57, 58] Sedentary behavior was also found to be associated with mortality, cancer, T2DM, cardiovascular diseases and obesity by The United States Physical Activity Guidelines Advisory Committee (PAGAC). [59] In another study it was concluded that risk of MetS was increased with sedentary behavior, whereas light physical activity and moderate to high intensity physical activity decreases the risk of MetS. [60] When association of physical activity, risk of MetS and overall diet quality were evaluated, it was found that physical activity and diet quality were associated with a reduced risk for abdominal obesity among women and hypertriglyceridemia among men. [61]

When physical activity, sedentary behavior and sleep pattern were evaluated among children and adolescents of the age group 5 to 17 years, it was observed that those who had high sleep, high physical activity and low sedentary behavior had less cardio-metabolic problems and adiposity. [62]

In a recent meta-analysis it was observed that TV watching and sedentary behavior were associated with MetS, thus it was suggested by the authors that adults should follow a healthy lifestyle by avoiding sedentary behavior and should also avoid prolonged sitting. [58] When association of sedentary behavior and physical activity were evaluated it was found that sitting time including occupational sitting time and screen time including TV watching had a contradictory relation with physical activity. [63]

In a recent study it was also concluded that as the sedentary time was increased there was an increase in T2DM. They also found a significant association between MetS and physical activity, and suggested to increase the physical activity in order to minimize the prevalence of MetS. [64] When relation between physical activity and sedentary behavior was evaluated in older adults (from 71 to 91 years of age), it was found that adiposity and MetS

were negatively associated with physical activity and sedentary behavior. [65]

In a recent study it was also concluded that there exhibits an association between sedentary behavior and T2DM, thus authors suggested to have a glycemic control within an individual. [66]

ASSOCIATION OF ORAL HEALTH AND METABOLIC SYNDROMES

In the last few decades several scientific and epidemiological studies have established an association between oral diseases and systemic disorders or metabolic syndromes. [67, 68] But most of them have reported different degree of association, this could be due to variation in the interpretation of MetS, methods of subject selection, their enrollment, methods used for assessment of oral diseases particularly periodontitis. [68]

Tooth loss and periodontitis are considered as major health problems in reference to oral health. Studies have reported periodontitis and dental caries to be the basic cause of tooth loss, which ultimately effects the overall health status of an individual. [69, 70] Tooth loss generally take place due to excessive inflammation which leads to hypo salivation. [70] Souza et al., reported that individual with MetS possess less teeth and had shortage of functional dentition. They also emphasized that problems with dentition effects an individual's eating pattern. Individual select soft diet or soft food which is generally rich in saturated fat and cholesterol and less in micronutrients. This ultimately give rise to obesity, abnormal lipid metabolism, glucose intolerance or hypertension leading to MetS. [70, 71] Moreover, several studies have indicated edentulism as a major risk factor for hypertension. [71, 72, 73] In a recent study it was observed that individuals with increased tooth loss had higher SBP (systolic blood pressure), but when confounding variables were adjusted no significant association was observed in multivariate regression analysis. [71]

On contrary to the above studies' findings, an opposite association was observed among men between hypertension, blood pressure and number of teeth. [74] They also observed later an inverse association between left ventricular mass and tooth loss. Their study also reflected that females were more susceptible for hypertrophic changes in heart. [74] Authors also reported that poor oral health causes inflammatory stimuli which is more profound among female participants. They also pointed out on gender differences highlighting on the fact that since woman are frequent smokers than men hence hypertension is less observed in them. [75]

Some authors believed that inflammatory activity and systemic oxidative stress are the root causes of MetS and periodontitis. [69, 70] Some studies also emphasize on the fact that the association between MetS and periodontitis is solely biological. Pathogens causing periodontitis release some kind of toxic products which might trigger inflammatory cytokines. [70, 76, 77] Some studies also suggest that DNA from periodontal pathogens might wander from oral cavity to other sites of the human body, which were salvaged by endarterectomy or were found in human atherosclerotic plaques. [76]

In spite of various studies available on the association of MetS and periodontitis, still there are few studies emphasizing the influence of oral infection on MetS.

On a contrary, in a recent cohort study it was reported that no association was observed between missing or decayed teeth, periodontitis and MetS. In fact they observed age and body mass index as the independent risk factors which might be related with the progression of MetS. [78] An inverse association was also observed between systolic blood pressure, hypertension and number of teeth among men. [75]

CONCLUSION:

In developing countries like India, due to changes in lifestyle, population, digitalization, changes in diet and sedentary habits have led to several disorders specially MetS, which are found to be associated with physical activity, sleeping habits, nutrition, substance abuse and oral diseases mainly, which are also somewhere interlinked with each other. Thus, a healthy lifestyle which includes nutritional diet, physical activity, sleeping pattern, avoidance of substance abuse and oral health, should be followed by and individual.

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REVIEW ON RADIATION STENTS

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Abstract-

Abstract: The success rate of head and neck cancer treatment has tremendously increased after the advent of radiotherapy. Radiotherapy is of immense help in treating head and neck cancer along with surgery and chemotherapy. In spite of the recent advancements, radiation therapy has its own disadvantage in the form of post-operative complications. Complications arise when the unaffected tissues surrounding the affected area is exposed to radiation and exceeds its tissue tolerance level. The complications not only add to patients suffering but also affect the prognosis of the treatment. Preventing the complications is not a tough task as treating them. Therefore, it is wise to prevent the complications before it occurs. Radiation stents are devices that serve this purpose. A radiation stent is an intraoral prosthesis designed to position/shield tissues during radiotherapy of the head and neck regions. This article will give a clear view of all the various types of radiations stents that can be fabricated.

Keywords: Radiotherapy, Head and neck cancer, post-operative complications, Tissue tolerance level, Radiation stent.

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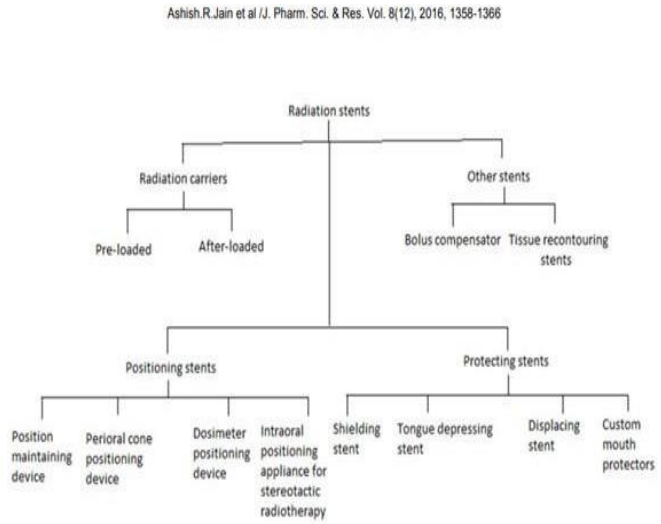
INTRODUCTION:

Prevalence of head & neck cancers is increasing day by day, leading to higher morbidity and mortality rate. These patients not only suffer social acceptance and hampered day to day life but also psychological disharmony . Head and Neck cancers may need surgical resection , Radiotherapy or Chemotherapy . Amongst which radiation therapy is considered as standard and widely used procedure for such patients with their successful results but radiotherapy is frequently associated with wide range of oral implications such as Radiation caries , loss of taste , xerostomia , Erythema , mucositis , trismus and osteoradionecrosis, that significantly reduces the quality of life of patient. Hypersensitivity of the teeth, taste loss, oral bacterial shift and periodontal breakdown are other problems of concern while treating patients undergoing radiotherapy. So as to prevent so many side effects of radiation some preventive measures can be taken which reduces the negative effect of radiation and can help in improving the quality of life of patients . One of the preventive modality is radiation stents . These are the intraoral devices designed to shield adjacent tissues from radiation during orthovoltage treatment of malignant lesions of head and neck region . These devices can be included during the treatment phase to really focus the beam of radiotherapy so as to prevent adjacent tissue from unnecessary damage

CLINICAL IMPLICATION:

Radiation therapy has been used with increasing frequency in the recent years for the management of neoplasm of head and neck region. Majority of patients need to undergo radiation dose during their course of treatment that becomes a challenge for the dentist to treat such patients as they present with radiation caries , reduced mouth opening , reduced salivation . Since the use of these stents is individualized, close collaboration between the radiotherapist and the prosthodontist is essential. These measures make the patient's treatment course smoother.



DESCRIPTION:

Ashish R Jain et al broadly classified the radiation stents into radiation carriers, positioning stents, protecting stents. Radiation carriers are ancillary prostheses used to administer radiation to confined areas by means of capsules, beads or needles of radiation emitting materials such as radium or cesium. They carry radiation sources in close proximity to the site of treatment (intracavitary) or directly into the tumor mass (interstitial). They are of two types; preloaded carriers and after loaded carriers. In pre-loaded carriers the radioactive sources are placed and sealed within the carrier. This might subject the radiotherapist and the patient to unnecessary exposure to the radiation during placement. In this technique the radioactive source is implanted into the tissues of the tumor. There are two applications of this technique: permanent and removable implantation.

After placing the needles radioactive sources are introduced into the tissues through the needles. The needles are then removed and the sources are left permanently implanted in the tumor. The purpose of position maintaining stent is to hold the movable structures in position desired by the radiotherapist. It is used in cases where multiple treatment sessions are required and the structures need to be positioned in a fixed and reproducible manner. Its disadvantage is Large one piece stents are difficult to insert if a patient begins developing radiation mucositis and Trismus. This type of stent serves to direct the beam of radiation only to the required posterolateral borders of the tongue and the buccal mucosa. Custom mouth protectors are used When radiation hits metal in a person's mouth, the radiation scatters and may be associated with an increased risk for

developing mouth sores.

Thus, it is often recommended that patients wear custom radiation mouth guards when undergoing radiation if the metal in their mouth will be in the field of the radiation. The mouth guards do not eliminate the risk of developing mouth sores, but may help reduce the risk by preventing the soft tissue from directly touching the intraoral metal. Tissue recontouring stents are useful when the beam is adjusted for midlines for treating skin lesions associated with lips. Due to curvature of the lip, low doses of radiation are delivered at the corner of the mouth, whereas higher doses are delivered at the midline. These stents flatten the lips and the corner of the mouth thereby placing the entire lip in the same plane and providing equal and exact radiation dose. Tissue bolus compensators help in treating superficial lesions of face with irregular borders. Due to irregularities in the lesion, some areas within the field may go untreated while others may develop isolated hotspots . Bolus is a tissue equivalent material which is placed directly onto the irregularities that helps in converting irregular tissue contours into flat surfaces which are perpendicular to the central access of the ionizing beam, to thereby more accurately aid in the homogenous distribution of the radiation Various intraoral prosthesis can be fabricated easily and with expertise for each individual patient to help meet difficult problems of delivering high dose radiation therapy to the oral cavity and the paranasal sinus areas. Modification of the described prostheses based on individual patient need is necessary to maximize these benefits. At times, the head and neck surgeon and radiotherapist are not fully aware of the many primary and supportive services that the maxillofacial prosthodontists can perform through the use of the prostheses. It is recommended that such a specialist be on the team for consultation before planning any head and neck cancer surgery or before starting radiotherapy. These measures make the patient's treatment course smoother and simplify the surgeon's treatment plan. Large prospective trial that includes prevention and treatment of radiation-induced trauma to oral tissues are required for improving management and increasing prognosis.

Apart from prosthodontic uses, numerous oral complications related with radiotherapy can also be controlled with the treatment prosthesis given by a prosthodontist. On occasion, the head and neck specialist, radiotherapist are not aware of numerous essential and strong administration that the maxillofacial prosthodontist can perform using these types of prosthesis. It is recommended that such a specialist be on the team for consultation before planning any head and neck cancer surgery or before starting.

As the famous proverb goes 'Prevention is better than cure' it is wise to prevent the complications before it occurs. The complications add on to the patients' pain and increase their suffering. Though these complications can be effectively prevented with the help of these stents, they are not being greatly used. Their use has not become a common practice. Prior to every case of head and neck radiotherapy, the surgeon and the radiotherapist should consult a maxillofacial prosthodontist regarding the type of radiation stent that is required and its fabrication. This simple and effective preventive measure will make the treatment easier and comfortable for the patient.

It is thus recommended that a multidisciplinary approach be considered while treating a patient with head and neck cancer wherein a Surgeon, a Radiotherapist and a Prosthodontist must be on the team for a consultation before planning the treatment. These measures will help provide better treatment and improve the quality of life of the patient.

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MANUSCRIPT TYPE – Original Article

PROSTHETIC REHABILITATION OF PHTHISIS BULBI : A CASE REPORT

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Abstract-

The loss of eye due to any cause, be it trauma, infections, congenital absence, leads to a major loss of ability. This loss may be complete, known as anopthalmia or partial (Phthisis bulbi). Such patients mostly present with the chief complaint of partial or complete loss of vision. Also a major concern is unaesthetic appearance for the patient. The rehabilitation of ocular defects has been done since time immemorial. Dating back to the Babylonian and Egyptian era, ocular prosthetics has evolved upto the use of glass and methacrylate resin use. Various techniques have been used for fabrication of the same. No consensus has been made till date, regarding the best technique to be followed.

The present article, describes a case report for rehabilitation of phthisis bulbi, partial loss of eye due to trauma. The difficulty level in rehabilitation of such cases depends on the time of presentation of the case. The earlier the presentation, the lesser the loss of supporting ocular tissues. The present case has been rehabilitated with a modified custom scleral shell. Stock prosthesis, although saves laboratory time, but is not very well adapted to the tissue bed. This brings about many complications, hypertrophy of residual tissues, lesser function of musculature, to name a few. Custom made prosthesis, overcomes these shortcomings, leading to better scleral, palpebral adaptation, extraocular movement. The basic skill needed for fabrication of custom prosthesis is iris painting. This laboratory step can be modified by use of color matched prefabricated iris from stock prosthesis.

Thus use of modified custom ocular prosthesis is one of the many better ways to prosthetically rehabilitate an ocular defect. Delivery of such prosthetic aide not only augments the anatomical function of the underlying tissues, but also leads to increase in the social acceptability of the patient and instills a sense of self confidence. Hence, improves the quality of life.

Keywords: enucleation, trauma, rehabilitation, prosthesis.

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INTRODUCTION:

"Eyes are captivatingly beautiful"; undoubtedly, we've all heard this phrase numerous times. But imagine the pitiful condition of the person who has lost one. It's not just the vision that is lost for him but the psychological trauma that he has to face adds to the agony. The loss of eye can be either due to the congenital deformities (Anophthalmia, Microphthalmia) or acquired deformities (Phthisis bulbi, Atrophic bulbi, Staphyloma, Post-evisceration, post-enucleation, post-chemical injuries, Contracted socket following radiation, Post-orbital exenteration). Depending on the severity of the situation, the surgical management may include one of three approaches: evisceration, enucleation, or exenteration.1,2

The ocular defect can be rehabilitated by either a Prosthetic contact lens, Scleral shell or Full thickness prosthesis. Prosthetic contact lenses are fitted over the scarred corneas with partial/total discolouration of cornea. A wide variety of soft and semi-soft contact lenses are available for cosmetic application. The bases of differentiating a scleral shell from a full thickness ocular prosthesis vary in the literature.

According to one school of thought, scleral shell is any prosthesis with a thickness measuring less than 1.5 mm. A full thickness ocular prosthesis measures more than 1.5 mm in thickness. However according to the world dictionary of ophthalmic prosthesis by Kelly et al.3,4,5 a scleral shell defined as any ocular prosthetic device fitted over a residual globe like phthisis bulbi, atrophic bulbi or microphthalmos. A full thickness ocular prosthesis is fitted in an orbit with no residual globe.

"Phthisis bulbi" is a histopathological diagnosis of end stage ocular disease showing atrophy, shrinkage, and disorganization of the eye and intraocular contents.6 "Phthisical eye" is often a clinical diagnosis used to refer to a nonfunctional (inaccurate projection of rays or absent perception of light), sunken, hypotonous, and disfigured eye.

An ocular prosthesis fitted over phthisis bulbi or a stained visually impaired eye of close to normal size is a positive way to improve the cosmetic appearance and mental prosperity of the patient.7 Except if careful intercession is fundamental, fitting a prosthesis over the leftover eye is an effective option in contrast to enucleation or evisceration. All in all, for these people there is negligible disturbance of the periocular tissues, hence, lessening fitting issues related to enucleation and evisceration. A prosthesis appropriately fitted over phthisis bulbi or a stained visually impaired eye will keep up the uprightness of the orbital life structures, upgrade cosmesis, and successfully rehabilitate the patient.

CLINICAL REPORT

A 25-year-old male patient presented to the OPD of the prosthodontics department, faculty of dental sciences, King George's Medical University, Lucknow. Chief complaint of the patient was loss of vision and unaesthetic appearance due to shrunken left eye (Fig 1, 2). The patient presented with a history of trauma (blade) 4 months backimportant than length of the implant. However, increase in the diameter of the implant do result in decrease in the very critical amount of remaining bone thickness post placement of dental implant especially in the buccal and lingual,/palatal region on the crest. Hence creating a paradox in the clinician's mind as to what is more important? Also, there can be a situation in which two implants out of which one having more length and one having more diameter can have similar surface area or bone implant interface. Hence, a clearcut understanding is needed to deal with this concept.

Fig 1. Pre-operative view showing uniocular Phthisis bulbi of the left eye

The eye socket and extra ocular tissues were examined. No associated pain, discomfort or residual edema was found on palpation. Thorough ophthalmic evaluation was done and the defect was diagnosed as Phthisis bulbi of the left eye. After examination, an appropriate treatment plan was adjudged for the patient.

Fig 2. A) Normal eye

B) Eye with defect

CLINICAL PROCEDURE

The management involved fabrication of a Custom made PMMA scleral shell. The procedure was explained to the patient in detail and consent was obtained for the same, as well as photographic documentation of the case.

The procedure was initiated by selecting and modifying a pre-fabricated PMMA stock tray. The tray was placed in the socket and checked for fit. Petroleum jelly was first applied to the eyebrows for the easy removal of the impression after setting. A syringe without the needle portion was then attached to the central escape hole on the custom tray to serve as a handle for the impression tray, through which the impression material can be easily injected into the defect area. Light body Condensation silicone was then manipulated (Oranwash L, Zhermack zeta plus, Zhermack dental Co., Italy) and loaded into the syringe and then, injected in the socket. The patient was then asked to perform all eyeball movements, directed by finger gaze, to allow the silicone material to flow into all areas of the enucleated socket.

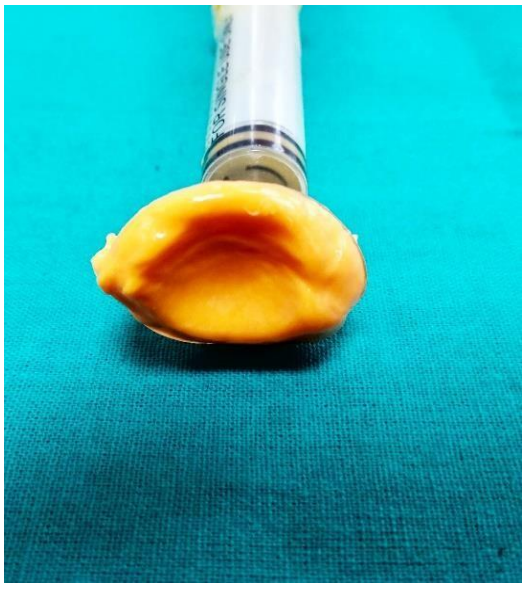

Fig 3 – Impression of the defect

The Impression was retrieved and examined for accuracy (Fig 3) and the cast was poured in two parts with the second part being poured after applying separating medium and making orientation grooves on the partially set first half (Fig 4).

Fig 4. Final cast

Thereafter, white carving wax was mixed with sticky wax in the ratio 3:1, and this molten wax is poured on to the cast. The custom made wax pattern is retrieved from the cast and tried in the patient's socket. The wax pattern was then modified for adequacy of ocular movements, proper palpebral movements, scleral contour and convexity (Fig. 5).

Fig 5. Wax pattern try-in for iris positioning

Next step was the marking of iris position on the wax pattern. It was done by visual method using facial landmarks, the patient was asked to fix his gaze on a distant spot. Iris position was marked on the wax pattern by comparing with the contralateral normal eye. Color matched Iris was obtained by trimming off the scleral portion of a stock scleral shell. The trimmed and finished iris was embedded in the wax pattern and margins merged seamlessly. The wax pattern was inserted again and checked for proper contours, adequate eye movements, proper iris position, scleral contour and convexity. Necessary corrections were then made. This led to completion of wax pattern try in (Fig. 6).

Fig 6. Final wax try-in

Wax pattern try in was followed by reproduction of scleral shade of the normal eye. For this, shade tabs were prepared by mixing and matching different shades and proportions of tooth coloured acrylic (SC 10, Pyrax, Roorkee, India) till the colour of sclera of the other eye was replicated. Then the adjusted and modified stock eye-wax pattern combination was invested, flasked and de-waxed. Characterization of the prosthesis was achieved by placing red silk fibres to mimic veins and acrylic colour was further dabbed on to the flask. The silk fibres and colour were secured in place by monopoly syrup (Fig. 7).

Fig 7. Characterization on dewaxed flask

This was followed by routine curing, finishing and polishing. The final finished and polished ocular prosthesis is then placed in the socket after proper disinfection (Fig. 8). The prosthesis is lubricated with an ophthalmic lubricant (Ecotears, Intas Pharmaceuticals Ltd, Ahmedabad, India) to maintain a tear film over the prosthesis and to improve eye movements. During the delivery, minute adjustments were made for patient comfort. Final disinfection of prosthesis was done with 0.5% chlorhexidine and 70% isopropyl alcohol solution for 5 minutes, later the prosthesis was rinsed in sterile saline solution and inserted. The patient was informed regarding instructions for proper hygiene of the prosthesis and the socket. Also, the use of ancillary products like ocular lubricants and cleansing solution was discussed with the patient. The patient was motivated for regular follow up visits. All the above mentioned instructions helped in improved adaptation of the prosthesis in the patient.

Fig 8. Final prosthesis in place

DISCUSSION AND CONCLUSION

The loss of eye structures has a deep impact on the psychosocial condition of a person. In order to mitigate the same, fabrication of ocular prosthesis has been done since times immemorial. But difficulties with facial prostheses arise due to movable tissue beds, quality of prosthesis retention, and associated irritation of the tissue beds.8 A correctly placed prosthesis should restore the normal opening of the eye, support the eyelid, restore the degree of movement and be adequately retained and aesthetically pleasing. The first ocular prostheses were made by Roman and Egyptian priests as early as the fifth century BC, made of painted clay attached to cloth and worn outside the socket. It took about twenty centuries for the first in-socket prosthesis to be developed. The prosthesis used during the time of the World War II were made of glass. Pre- fabricated prosthesis can either be made in glass or poly methyl methacrylate resin. Glass is not the material of choice as it is subject to damage and surface deterioration from contact with orbital fluids, leading to a usable life expectancy of only 18 24 months.9 Any custom made prosthesis, involves procedures of complex iris painting and color characterization of the acrylic scleral tab. This needs procurement of exact skills of color painting, which is difficult to achieve. The technique presented in this case report modifies the custom made prosthesis by using color matched iris from a stock prosthesis. Use of the pre- fabricated iris decreases

the skill sensitivity quotient needed for iris painting, while also saving laboratory time. The custom made scleral shell adapts well to the tissue bed, provides maximum comfort and restores full physiologic function to the accessory organs of the eye. The prosthetic management of the uniocular phthisis bulbi is less challenging with early presentation. With loss of essential tissue structures around the eye, restoration of proper form and function becomes increasingly difficult. The custom made scleral shell fabricated for the uniocular phthsis bulbi patient presented here successfully restored the patient's esthetics and improved his social acceptance thereby, improving his quality of life.

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