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Comparative Evaluation of Fracture Resistance of Endodontically Treated Mandibular First Molar Restored with Fibre Reinforced Composite, Nanohybrid Composite and Bulkfill Composite – An In-vitro Study

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Abstract

Aim: The present in vitro study was conducted with an aim to compare the fracture resistance of endodontically treated mandibular first molar restored with Fibre reinforced composite, Nanohybrid composite and Bulkfill composite.

Materials and Methods: 100 Two rooted mandibular first molar was divided into 5 groups. Group 1 (N=20) was left intact. Endodontic treatment was done in remaining 4 groups. Group 2 (N=20) was positive control group (prepared and unfilled). In Group 3 (N=20) post endodontic restoration was done with bulkfill composite, In Group 4 (N=20) with nanohybrid composite, In Group 5 (N=20) with fibre reinforced composite. The specimens in all five groups were subjected to fracture resistance using Universal Testing machine.

Results: There was a statistically highly significant difference seen for the values between the groups with highest values in group 1 followed by group 5, 3, 4 and least with group 2.

Conclusion: Endodontically treated teeth restored with fibre reinforced composite shows highest fracture resistance.

INTRODUCTION

Teeth are more likely to fracture after endodontic therapy than before therapy[1]. The restoration of endodontically-treated teeth has always been a challenge[2]. The reason most often cited for this finding has been the dehydration and loss of dentin after the endodontic procedures and the removal of important anatomic structures such as cusps, ridges, and the arched roof of the pulp chamber, all of which provide much of the necessary support for the natural tooth[3].

Restoration of root canal treated teeth with a permanent, definitive, post endodontic material is a final step for successful root canal treatment[3]. An optimal final restoration for endodontically treated teeth maintains aesthetics, function, prevent the fracture of remaining tooth structure, and also prevents micro leakage[4].It is important to determine that the recent materials are successful to ensure the fracture resistance in endodontically treated teeth[5].

Nanocomposite were introduced with lower shrinkage by replacing triethylene glycol dimethacrylate (TEGDMA) with polyeythlene glycol dimethacrylate (PEGDMA) relative to the conventional and microhybrid composites. They consist of agglomerated nano-sized particles and nanoclusters with a filler loading of 82% by weight and surface modified zirconia/silica exhibiting excellent esthetics, high compressive, diameteral tensile and flexural strength[6].

Bulk fill composites were introduced as posterior restoratives that allows larger increments upto 4 mm to be polymerized[6].

Recently E-glass fibre with barium glass filler, fiber reinforced composite material everX posterior has been introduced. Manufacturers claims that this short-fiber composite reinforces the restoration by preventing crack formation which is the main cause for failure of the post endodontic restoration[7].

So, the purpose of the present study was to compare the fracture resistance of endodontically treated mandibular first molar restored with Fibre reinforced composite (GC EVERX POSTERIOR), Nanocomposite (BRILLIANT™ NG, COLTENE, WHALDENT) and Bulkfill composite (TETRIC N CERAM, IVOCLAR VIVADENT).

AIM & OBJECTIVES

The main objective of this study was to compare the fracture resistance of different types of composite restorative material as post endodontic restoration and evaluate the fracture resistance of the different types of composite restorative material by using Universal testing machine.

MATERIALS AND METHODOLOGY

The endodontic file system for root canal instrumentations & the post obturation restorative material used are as follows:

- 100 Mandibular first molars,
- Ultrasonic scaler (Satellac, Acteon)
- Tweezer, straight probe, scalpel (API Germany)
- Airotor hand piece (NSK, Japan)
- #10, #15, #20 K-files (Dentsply)
- Hyflex CM (Coltene Endo)
- Endo-access Bur, Endo-Z Bur (Dentsply Maillefer, Switzerland)
- DG 16 explorer (API, Germany)
- Endobloc (Dentsply)
- Endomotor (X-smartTM Dentsply Maillefer, Switzerland)
- 3% Sodium hypochlorite (Neelkanth orthodent p ltd.)
- 0.9% Normal Saline (Denis chem lab ltd.)
- EDTA gel (RC help prime dental)
- AH plus Sealer (Dentsply)
- Absorbent paper points (Meta Biomed Co. Ltd., Korea)
- Gutta-Percha Cones (Dentsply Maillefer)
- Composite filling instrument (Coltene , whaldent)
- Fibre reinforced composite (GC everx posterior)
- Nanohybrid composite (Brilliant tm ng, Coltene Whaldent)
- Bulkfill composite (Tetric N Ceram, Ivoclar Vivadent)
- LED curing light (Bestodent)
- Addition silicone impression material (Light body)
- Stainless steel mould (metal), Cold cure acrylic resin (Coltene)
- Modeling wax (Y-dents)
- Universal Testing Machine (Instron)

Selection of Teeth

100 Mandibular first molars teeth extracted for periodontal purpose with approximately same size crown measured mesiodistally and faciolingually (12.5 – 14.5 mm) were used for this study.

Inclusion Criteria

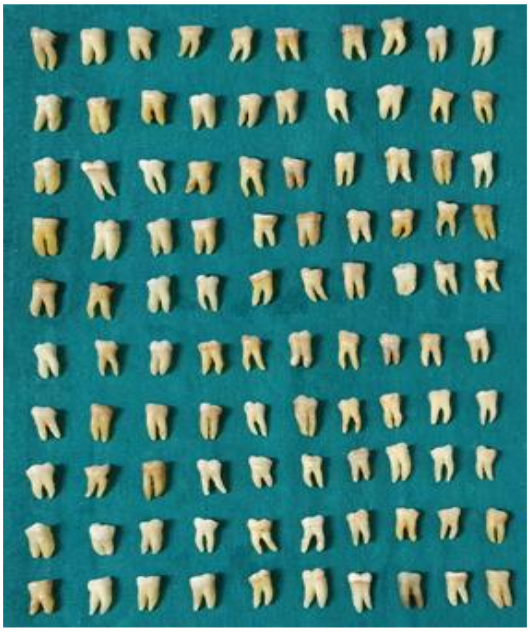
- Teeth without caries.
- Teeth without non carious cervical lesions.
- Teeth with mature apices.
- Teeth having three canals (Two mesial and one distal).
- Teeth having no signs of internal or external resorption.
- Teeth without calcifications.

Exclusion Criteria

Teeth with fracture.
Teeth with root caries.
Teeth with visible cracks.
Teeth with resorptive changes.
Teeth with immature apices.
Teeth with previous restorations or root canal treatment.

Methodology

This was a comparative experimental study, which involved 100 extracted teeth (Permanent mandibular first molars) consisting of positive and negative control groups, each with 20 samples.



Photograph of the Specimen

The selected teeth were cleaned and debride with a scalpel and ultrasonic scaler to remove remaining tissue. They were then stored in 10% neutral buffered formalin for at least two weeks and then in distilled water until they were used for testing.

INSTRUMENTATION

Standard access cavities was prepared in all four groups except in negative control group using Endo access diamond bur no.2 and Endo-z bur using high speed Airotor hand piece under air water coolant spray. A straight line access was prepared to facilitate instrumentation.

Canal patency was established with DG-16 and ISO size 10 K- hand file. Presence of canal was checked, the working length was determined by substracting 0.5 mm from the length of an inserted #10 K-file (Dentsply) with its tip visualized at the apical foramen. All four groups except negative control group were then prepared till an ISO size #20 K-hand file in distal canal and #15 K hand file in both mesial canals. Remaining preparation was done using torque and speed controlled endodontic motor (X-Smart, Dentsply maillefer) along with rotary hyflex CM file system (25/0.04 in both mesial canals and

30/0.06 in distal canal) at 500 rpm speed and 2.4 Ncm torque using a 1:16 reduction handpiece.

EDTA gel RC help (10% carbamide peroxide and 15% EDTA gel) was used during instrumentation with each file size in all the groups studied and the canals were frequently irrigated with 3% sodium hypochlorite and normal saline for complete debridement between every instrument use and final irrigation was done with 17% EDTA solution after instrumentation was completed in each group. Teeth were stored in distilled water after the instrumentation procedures to prevent dehydration.

Obturation

Root canals in all four groups were dried with absorbent paper points and obturated with a master Guttapercha cone of 25/0.04 in mesial canals and 30/0.06 in distal canal using single cone obturation technique with AH plus sealer. Samples were stored in 100% humidity for one day at 37 degree celcius to allow the sealer to set. Then group allocation was done depending on the post endodontic restorative material used containing 20 samples in each group.

Post Endodontic Restoration

After completion of obturation of all four groups, samples were divided into 5 groups-

Group1: Negative control (unprepared and unfilled),

Group2: Positive control group (prepared and unfilled),

Group3: Post endodontic restoration was done with bulkfill (Tetric N ceram) composite,

Group4: Post endodontic restoration was done with nanohybrid composite (Brilliant Ng),

Group5: Post endodontic restoration was done with fibre reinforced composite (GC EverX posterior) and coronal 2mm portion was restored with universal Brilliant Ng Composite.

In samples of group 4 and 5 the dentin surface of access cavities was washed and air dried for 10 sec, then a layer of adhesive One coat 7.0 (Coltene, whaldent) was applied using micro-brush and gently scrubbed For 10 sec and then light cured for 20 sec using curing light and in group 2 , no Adhesive was applied. In group 3 etching of access cavities was done with 37% phosphoric acid for 20 seconds, then washed and air dried for 10 seconds, then a layer of adhesive tetric n bond (ivoclar vivadent) was applied using applicator tip and light cured for 20 sec. The access cavity of each group was then restored with different post endodontic restorative material.

Mounting of Teeth

All the teeth were then mounted vertically, positioned in Centre, in a standardized cylindrical custom made Stainless Steel mould (25mm x 25mm) with coronal portion of the tooth exposed above cemento-enamel junction (CEJ). the replication of periodontal ligament will be done by covered the root surfaces 2mm below the CEJ with wax to obtain a 0.2 to 0.3 mm-thick layer before embedding the roots into acrylic resin. After initial polymerization each tooth will be removed carefully from the respective resin blocks. the wax will gently detached from the surface of the roots and light body addition silicone impression material will be injected into the acrylic resin blocks in the place that will earlier occupied by the root of the tooth and wax. The teeth will then be inserted again in the resin blocks. A homogenous silicone coat that replicated periodontal ligament will thus create taking the wax thickness.

The prepared samples were then kept wet in cotton-gauge pad at room temperature to prevent dehydration before testing.

Measurement of Fracture Load

All the samples were mounted in a Universal Testing Machine. The Stainless Steel rings (acrylic block) were placed on the lower plate of the machine. Mounted ring was vertically aligned in the testing machine one at a time. The tip was cantered and Samples were subjected to axial compression load applied parallel to the long axis of the tooth and a slowly increasing vertical force was exerted (1mm/min) until the samples fracture under load. The fracture moment was determined when a sudden drop in force occurred that was observed on testing machine display. The maximum force required to fracture each specimen was recorded in newtons. The data was tabulated and statistically analyzed to compare the resistance of five groups.

Sample Placed under Universal Testing Machine

RESULTS

The force required to fracture the specimens were recorded as the fracture strength. The load at fracture was recorded in Newton.

Statistical Procedures

Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States).

- Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM).
- Descriptive statistics like Mean & SD for numerical data has been depicted.
  Normality of numerical data was checked using Shapiro-Wilk test & was found that the data followed a normal curve; hence parametric tests have been used for comparisons.
- Inter group comparison (2 groups) was done using t test.

For all the statistical tests, $p<0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.

Table 1: Descriptive Statistics showing the mean standard deviation of all the five groups.

Group	N	Mean force (newtons)	Std. Deviation
1	20	1938.104500	94.1514798
2	20	1119.367500	106.3338031
3	20	1382.669000	95.3570845
4	20	1366.251000	91.4260319
5	20	1795.425500	72.8133185

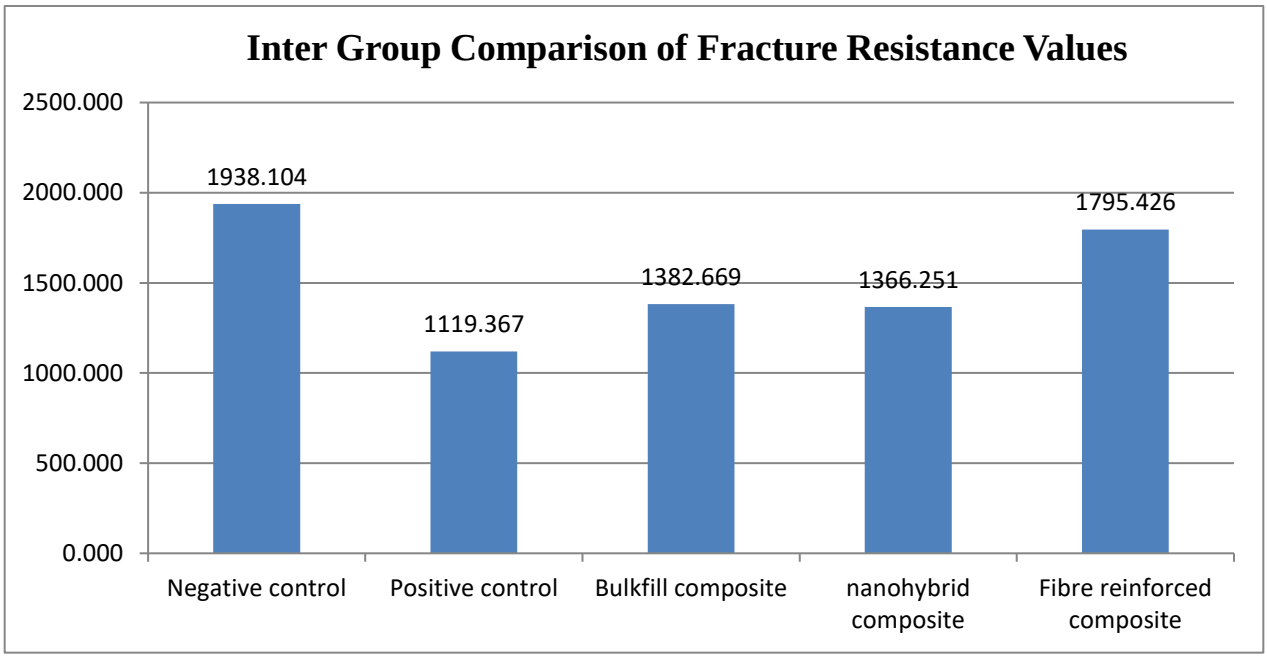
Table 2: Inter group comparison of fracture resistance values between each pair of groups

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	p value	95% Confidence Interval	
						Lower Bound	Upper Bound
Negative Control	1	2	818.7370000	29.3001198	.000**	872.257335	1035.216665
	1	3	555.4355000	29.3001198	.000**	473.955835	636.915165
	1	4	571.8535000	29.3001198	.000**	490.373835	653.333165
	1	5	142.6790000	29.3001198	.000**	61.199335	224.158665
	2	3	-2.6330150	29.3001198	.000**	-479.781165	-316.821835
	2	4	-2.4688350	29.3001198	.000**	-463.363165	-300.403835
	2	5	-6.7605800	29.3001198	.000**	-892.537665	-729.578335
	3	4	16.4180000	29.3001198	.980#	-65.061665	97.897665
	3	5	-4.1275650	29.3001198	.000**	-494.236165	-331.276835
	4	5	-4.2917450	29.3001198	.000**	-510.654165	-347.694835

There was a statistically highly significant difference seen for the values between the following pairs of groups ($p<0.01$)

Group 1 vs 2, 1 vs 3, 1 vs 4, 1 vs 5, 2 vs 3, 2 vs 4, 2 vs 5, 3 vs 5 and 4 vs 5.

Except for group 3 vs 4 where there was a statistically non significant difference seen for the values ($p>0.05$).



DISCUSSION

The main purpose of endodontic treatment is to clean the root canal system, eliminate the toxins and infected content in the canal[8]. An endodontic procedure included access cavity preparation by removal of sound tooth structure followed by root canal preparation that further remove the root canal dentin which severely affects the strength and integrity of the tooth[9].

There are few factors which can influence the result of the fracture resistance studies. These include the tooth mounting method, type of load application device and crosshead speed. During fracture strength testing, point of contact between the loading bar and occlusal surface of teeth may differ and this might cause a large standard deviation of the results[10].

The present study examined the fracture resistance of endodontically treated molars as literature shows that posterior teeth are more prone to fracture.

Mandibular first molars are considered for the study but there can be variation which cannot be controlled hence we have standardized the procedure by making uniform access cavity keeping the dimension of the cavity equal in all the groups (by measuring the teeth mesiodistally and buccolingually as much as possible).

Natural teeth were used in this study to simulate clinical conditions. The teeth were embedded in acrylic resin to mimic the position of the root in the bone & light body addition silicone impression material was used to simulate periodontal ligament & to provide cushioning effect as in clinical scenario.

Selected teeth were cleaned to remove remaining tissue and make debris free with the help of scalpel and ultrasonic scaler and were then stored in 10% neutral buffered formalin for at least two weeks and then in distilled water until further use. This was done in accordance with the previous study done by **Patsandra PS Lam et al[11]** and ISO recommendation ISO/TS11405 for storage medium of extracted teeth. Also distilled water was used as storage medium to keep the teeth, as this medium causes smallest changes in dentin over time as investigated by **Strawn et al[12].**

Major drawback of the posterior composite restorations commonly encountered in the dental practice is the fracture within the body or at the margins of the restorations[13]. Flexural strength and modulus of elasticity are the parameters used to evaluate the elasticity and degradation of the materials under stress[14].

In this study, five groups were taken in which different composite resin restorative materials were placed in three groups and two group was taken as control (positive and negative). Negative Control Group i.e. unaltered tooth showed the maximum fracture resistance and Positive control group (prepared and unfilled) showed the least fracture resistance among all the groups. Among the restored groups, maximum fracture resistance was seen in group 5 i.e. fibre reinforced composite. Whereas there is insignificant difference was observed between group 3 i.e. bulkfill composite and group 4 i.e. nanohybrid composite. Difference seen is due to the physical and mechanical properties of the materials.

Intact teeth presented the highest mean fracture load due to the presence of the palatal and buccal cusps with intact mesial and distal marginal ridges which form a continuous circle of dental structure, reinforcing the tooth[15].

The result showed that there was maximum fracture resistance Among the restored groups in group 5 in which restoration was done using fibre reinforced composite, This is because of the higher modulus of elasticity and lower flexural modulus of the glass fibers are believed to have a modifying effect on the interfacial stresses developed along the etched enamel/resin boundary[6]. The short fibres of fibre reinforced composite will make it a perfect sub-structure to reinforce any composite restoration in large size cavities. Fibres will also prevent and stop crack propagation through the filling, which is considered to be the main cause of composite failures[16].

Bulkfill composite contains ivocerin which is more reactive than conventional initiators and allows larger increments upto 4 mm to be polymerized. These polymerization boosters fill the gaps between the traditional initiators and the glass fillers which relieves shrinkage strain[17]. A special patented filler which is partially functionalised by silanes, acts as a unique shrinkage stress reliever in bulkfill composite. Due to its lower elastic modulus, glass filler is flexible like a microscopic spring and thus reduces the shrinkage stresses developed[18].

Nanohybrid composite contain pre-polymerised particle filling, in addition to high nanometric particle content, produce optimum consistency for

manipulation and modelling along with a noticeable decrease in shrinkage and easily achievable high gloss surfaces. due to its revolutionary matrix with Optimized Light Refractive Index (OLRI), increases the ability to mimic natural tooth colour[19].

CONCLUSION

Under the limitations of the present study, it can be concluded that, the fracture resistance of endodontically treated teeth restored with fibre reinforced composite were significantly superior to the teeth restored with bulkfill and nanohybrid composite.

Conclusion drawn from this study is that attempts to reduce fracture susceptibility of the endodontically treated teeth are limited clinically, because many factors interact in influencing fracture susceptibility. So, to reduce fracture susceptibility, one should keep the tooth preparation as conservative as possible.

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A Comparative Evaluation of SYBOGRAF ® Plus with PRF as compared to PRF Alone in the treatment of Intra bony Defect - A Clinico-Radiographic Study

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Abstract

Background: Periodontitis is a multifactorial diseases resulting in inflammation within supporting tissue of the teeth, progressive attachment and bone loss. The objective of periodontal therapy is to control inflammation and to reduce pocket depths and associated bone defects.

Aim: The aim of the present study was to assess the efficacy and compare the SYBOGRAF® Plus with PRF and PRF alone graft in the treatment of intra-bony defects in chronic periodontitis.

Materials and Methods: A total 20 intra-bony defects were selected from patients with chronic periodontitis and divided into three groups Group I Open flap debridement with SYBOGRAF® PLUS with PRF and Group II Open flap debridement with PRF alone. Before taking the clinical parameters, all the patients underwent oral prophylaxis and then recordings were taken at baseline, 3 months and 6 months for Plaque Index, Gingival Index, Pocket Probing depth, Relative Attachment Level and Bone Fill radiographically.

Results: The results of the present study showed significant difference in both the groups in inter-group and intra-group analysis except in GI from baseline to 6 months.

Conclusion: The overall efficacy in the treatment of chronic periodontitis in terms of clinical parameters (Plaque Index, Gingival Index, Pocket Probing Depth and Relative Attachment Level) and Radiographic parameter (Bone Fill) were shown by Group I (SYBOGRAF ® Plus with PRF) more significant as compared to Group II (PRF alone)

Keywords: Periodontitis; Periodontal therapy; SYBOGRAF® Plus, PRF; Intra-bony defects

INTRODUCTION

Chronic periodontitis is a polymicrobial, complex multifactorial inflammatory disease characterized by presence of gingival inflammation; periodontal pocket formation that affects the supporting structures of the teeth including periodontium.[1] The objective of periodontal therapy is to eliminate the inflammatory process, helps in stoppage of the progression of periodontal disease and contributes in the regeneration of the lost functional attachment. Bone grafts, soft-tissue grafts, guided tissue regeneration, and a combination of all helps in periodontal regeneration.[2] A wide array of bone graft substitute such as autogenous, allogenic and alloplastic materials are available today and have shown to produce greater clinical bone defect fill than flap debridement alone.[3]

The most extensively researched material used in periodontal defects is hydroxyapatite (HA) which is a biocompatible material, non-toxic, osteo-conductive, and osteo-phillic material which have close structural and chemical resemblance to bone mineral.[4] SYBOGRAF®Plus is a synthetic nanocryatalline hydroxyapatite and β tricalcium-phosphate and it is bio-resorbable with a high porosity and is osteoconductive.[5] PRF is prepared by immediate centrifugation of whole blood collected without anticoagulant or gelifying agents and polymerizes slowly leading to flexible and elastic matrix capable of supporting cytokine enmeshment and cellular migration. Platelet-rich-derived fibrin clot formation stimulates collagen synthesis in the periodontium that accelerates wound closure and mucosal healing and effectively promotes wound healing at sites of injury in periodontal tissue.[6]

Hence, the present clinical study was aimed to evaluate the clinical and radiographic outcome of the effect of SYBOGRAF®Plus bone graft along with PRF and PRF alone in the treatment of intra-bony periodontal defects.

MATERIALS AND METHODS

Twenty intrabony defect sites were selected from patients with chronic periodontitis from the out-patient department (OPD) of Department of Periodontology and Implantology, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab. The subjects were selected randomly with no discrimination of sex, caste, religion and socioeconomic status. A complete dental & medical history was obtained and thorough clinical & radiological examination was done. Blood investigations such as complete blood count, bleeding time (BT), clotting time (CT) and tests for viral markers (Hepatitis B & C, HIV) were done. The research protocol was initially submitted to the institutional Ethical committee. After ethical approval, all subjects were verbally informed and written informed consent was taken for participation in the study.

The intrabony defect sites in the selected patients was randomly and equally divided into three groups –

Group I: Open Flap Debridement (OFD) with hydroxyapatite with β- tricalcium phosphate (SYBOGRAF®Plus) with PRF.

Group II: Open Flap Debridement (OFD) with PRF alone.

Inclusion Criteria: Age group - 25-65 years, radiographic evidence of vertical bone loss, Probing depth (PD) equal to or greater than 5 mm.

Exclusion criteria: Teeth with grade II and grade III mobility, Patient with any medications that may affect platelet count or function.

MATERIALS

SYBOGRAF®Plus: Osteoconductive bone graft which mainly composed of 90% nanocrystalline hydroxyapatite 10% β-tricalcium phosphate crystal. The particle size of bone graft ranges 250-550 microns. It is manufactured by Eucare Pharmaceuticals Pvt. Ltd. India

Platelet Rich Fibrins (PRF): The PRF was prepared according to the Choukroun et al. at 3000 revolution per minute for 10 minutes.

OCCLUSAL STENT PREPARTION

Occlusal stents were used for standardization for probing depth.

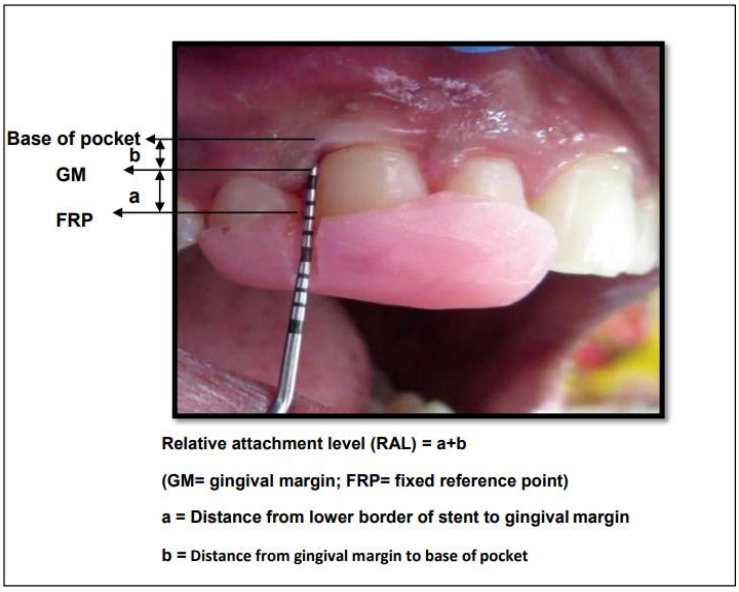

Figure 1 - Measurement of Relative Attachment Level (RAL) Using an Occlusal Stent

The clinical parameters taken as follows:

1. **Plaque Index (PI)**[7]
2. **Gingival Index (GI)**[8]
3. **Probing Pocket Depth (PPD)**
4. **Relative Attachment Level (RAL)**

Radiographic Examination

I) Bone Defect

STATISTICAL ANALYSIS

The recorded data was compiled & subject to statistical analysis using the **SPSS statistical software 19.0 Version**. The intragroup comparison for the different time intervals was doing using **paired t test** to find the difference between the individual time intervals. The intergroup comparison was done using the **One Way ANOVA**. The level of the significance for the present study was fixed at <0.05.

RESULTS

The present study was undertaken to clinically compare the efficacy of bone grafts with PRF and PRF alone in the treatment of periodontal intraosseous defects. Twenty intra-bony defects were selected and divided randomly into three groups. In Group I patient treated with OFD with SYBOGRAF®Plus with PRF and in Group II patients were treated OFD with PRF alone. Clinical and radiographic measurements were recorded at baseline, at 3 months and 6 month post operatively.

Intra-Group Comparison of Clinical and Radiographic Parameters

In Group I and In Group II the mean change in PI, GI, probing depth, RAL and bone fill from baseline to 3 months & 6 months and from 3 months to 6 months found to be significant (p=0.001).

Inter-Group Comparison of Clinical and Radiographic Parameters

1. Plaque Index (PI)

The mean difference of plaque index score l between the Group I and Group II from baseline to 3 months and 6 months was found to be statistically non-significant and in between 3 months and 6 months (p=0.009) was statistically significant. (Table 1).

Dependent Variable	(J) GP	Mean Difference (I-J)	Std. Error	P Value	Significance
Baseline -3 Months	Gp I vs Gp II	5.93520	3.93130	0.148	Non-Significant
Baseline -6 Months	Gp I vs Gp II	9.042	2.42482	0.061	Non- Significant
3 Months -6 Month	Gp I vs Gp II	14.49418*	4.94135	0.009	Significant

Table 1: Intergroup Comparison of Plaque Index

2. Gingival Index (GI):

The mean difference of Gingival index score between the Group I and Group II from baseline to 3 months and 6 months and from 3 months to 6 months were found to be statistically non-significant. (Table 2)

Dependent Variable	(J) GP	Mean Difference (I-J)	Std. Error	P Value	Significance
Baseline -3 Months	Gp I vs Gp II	3.05459	2.88985	0.145	Non-Significant
Baseline -6 Months	Gp I vs Gp II	0.73281	3.71454	0.766	Non-Significant
3 Months -6 Months	Gp I vs Gp II	1.00907	5.80103	0.864	Non-Significant

Table 2: Intergroup Comparison of Gingival Index

3. Probing Pocket Depth (PPD)

The mean difference of probing depth between Group I and Group II from baseline to 3 months, between baseline to 6 months and in between 3 months to 6 months was found to be statistically significant (p=0.000), (p=0.001) and (p=0.023). (Table 3)

Dependent Variable	(J) GP	Mean Difference (I-J)	Std. Error	P Value	Significance
Baseline -3 Months	Gp II vs Gp III	27.61905*	4.69797	.000	Significant
Baseline -6 Months	Gp II vs Gp III	34.575*	4.52194	0.001	Significant
3 Months -6 Months	Gp II vs Gp III	19.765	6.41141	0.023	Significant

Table 3: Intergroup Comparison of Pocket Probing Depth

4. Relative Attachment Level (RAL)

The mean difference of RAL between Group I and Group II from baseline to 3 months and 6 months and from 3 months to 6 months which were found to be (p=0.001) statistically significant. (Table 4and figure 2)

Dependent Variable	(J) GP	Mean Difference (I-J)	Std. Error	P Value	Significance
Baseline -3 Months	Gp I vs Gp II	14.60867*	3.51488	0.001	Significant
Baseline -6 Months	Gp I vs Gp II	25.80713*	2.96845	0.001	Significant
3 Months -6 Months	Gp I vs Gp II	21.29984*	4.22345	0.001	Significant

Table 4: Intergroup Comparison of RAL Scores

5. Radiographic Defect Fill

The mean bone fill between Group II and Group III from baseline to 3 months, between baseline to 6 months and in between 3 months to 6 was significant (p=0.047),(p=0.003)and (p=0.010). (Table 5 and figure 3)

Dependent Variable	(J) GP	Mean Difference (I-J)	Std. Error	P Value	Significance
Baseline -3 Months	Gp I vs Gp II	14.94048*	7.01778	0.047	Significant
Baseline -6 Months	Gp I vs Gp II	14.00595*	6.77415	0.047	Significant
3 Months -6 Months	Gp II vs Gp III	30.59099*	11.67769	0.010	Significant

Table 5: Intergroup Comparison of Bone Defect Fill Scores

DISCUSSION

Periodontal regeneration can be defined as the complete restoration of the lost tissues to their original architecture and function by recapitulating the crucial wound healing events associated with their development.[10,11] Regenerative procedures is a multi-factorial process and requires certain sequence of biological events including cell adhesion, migration, multiplication and differentiation which may restore lost supporting structures of the dentition such as cementum, periodontal ligament and bone to a previously diseased root surface.[12,13]

There are various grafting materials which contribute to new bone formation through osteogenic, osteo-conductive or osteo-inductive mechanisms[14] and supports soft tissue walls of the defect which results in gain in clinical attachment level thereby facilitating regeneration of periodontal structures lost during the disease process.[15] The materials most commonly used have been autografts and allografts.[16] When bone grafting materials are implanted in the defect site then it provides structural framework for clot development, maturation and remodeling which contributes in bone formation in osseous defects.[17]In Group I, SYBOGRAF® Plus allograft has been placed in intrabony defects. Hydroxyapatite became the ceramic of choice because it produces predictable short term and long term results.[18] Advantages of nanocrystalline hydroxyapatite and synthetic tricalcium phosphate biomaterial are biocompatibility and osteo-conductibility and close contact which was used as bone tissue substitute that helps in rapid healing of critical size defects by increasing stimulation of osteoblastic activity.[19]

In group II comprised of PRF alone. Platelets isolated from peripheral blood are autologous and rich source of growth factors-PDGF, TGF- α and β, PDEGF, PDAF, FGF and IGF-1. The concentrated platelets are added to graft materials to get predictable outcome.[20]

The intra-group result of plaque index scores from baseline to 3 months, baseline to 6 months and 3 to 6 months revealed statistically significant reduction in plaque index in both groups. These results were in contrast to those obtained by **Lekovic V et al (2012)[21],** where there was no significant difference in these scores at baseline and at 6 months. The reduction of plaque and gingival scores could be attributed to the patient compliance and proper oral hygiene maintenance. The study conducted by **Bansal & Bharti (2013)[16]** found results which were not in accordance with the present study.

The intra-group result of gingival index scores from baseline to 3 months, baseline to 6 months and 3 to 6 months revealed statistically significant reduction in gingival index in all the three groups. The study conducted by **Raghav et al. (2016)[22]** showed similar results with the present study. The gingival index in inter-group showed decrease in gingival index which was not significant.

In the present study, for both the groups, the mean difference of pocket depth reduction at 3 months and 6 months from baseline was highly significant ($p<0.001$). The study conducted by **Lekvoic et al. (2002)[21]** found statistical significant pocket depth reduction at different intervals. This reduction can be attributed to the decrease in inflammation, shrinkage of the pocket wall, change in tissue bone and placement of graft material into defect. Similar results were obtained by **Ostby N et al (2010)[23]** in their study wherein a significant pocket depth reduction was observed at 3 months, 6 months and 9 months.

The Relative Attachment Level (RAL) gain was highly significant for both the groups from baseline to 3 months and 6 months ($p<0.001$). The study conducted by **Bansal & Bharti (2013)[16]** showed significant results in RAL gain which are in accordance with study. The RAL gain can be attributed to the selection of defect, smoking, plaque control and proper surgical protocols. The studies conducted by **Demir et al. (2007)[23] and Yilmaz et al. (2010)[24]** found out non-significant result in RAL gain which are not similar to the present study.

In the present study, the mean amount of defect fill was statistically significant at 3 months from baseline among the both groups ($P<0.001$). At 6 month interval it was non-significant for group I as well as group II ($p>0.001$). These results were similar to those obtained by **Lekovic V et al (2012)[21]** where there was significantly defect fill occurs at 3 months and at 6 months ($p<0.001$).

The studies conducted by **Sharma et al. (2011)[24], Thorat et al. (2011)[25]** found similar result in accordance with the present study in terms of defect fill. The significant defect fill could be attributed to highly concentrated source of autologous platelets containing variety of biological mediators and improving handling properties of graft leading to graft stability

Overall, Group I showed higher percentage changes from baseline to 3 months and 6 months and between 3 months & 6 months in the present study.

CONCLUSION

The data from the present study suggests that treatment of intrabony defects with SYBOGRAF® Plus WITH PRF results in significant improvements of PI, PD, CAL, RAL and BD fill compared with baseline as compared to PRF alone.

Clinically, there are several factors like patient selection, defect morphology, biological and physicochemical characteristics of grafted biomaterials as well as surgical variables and post-operative maintenance may alter the extent of clinical attachment gain and bone regrowth following a grafting procedure. It is necessary to emphasize that the data generated by the present study was derived from 6 months' time period only. Hence, long tern term studies with greater sample size are required to evaluate the efficacy of the above materials in the treatment of periodontitis.

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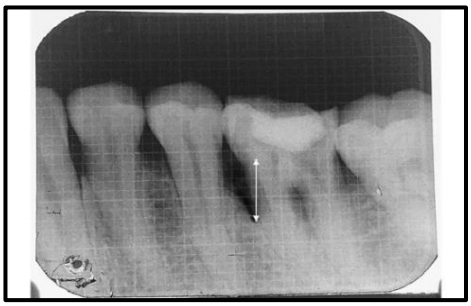
Figure 2: Group I - Clinical and Radiographic Parameters

Probing Depth And Relative Attachment Level At Baseline



Radiograph Showing Bone Defect At Baseline

Probing Depth and Relative Attachment Level at 6 Months

Radiograph Showing Bone Fill at 6 Months

Figure 3: Group II - Clinical and Radiographic Parameters

Probing Depth and Relative Attachment Level at Baseline

Radiograph Showing Bone Defect at Baseline

Probing Depth and Relative Attachment Level at 6 Months

Radiograph Showing Bone Fill at 6 Months

Comparison of two types of Toothbrushes along with Vertical Brushing Technique and Modified Bass Technique for Efficacy of Plaque Control in Orthodontic Patients - A Randomized Control Trail

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Abstract

Introduction - Plaque control is major consensus during orthodontic treatment to prevent periodontal inflammation. OBJECTIVE – The aim of this study to assess oral hygiene status and periodontal health amongst the orthodontic patients.

Methodology - A total of 60 patients were selected with ages between 14 to 24 years old with fixed orthodontic appliances. After the phase 1 therapy the parameters evaluated were OHIS & gingival index & patients were randomly assigned to one of the 4 groups. GROUP 1 – conventional brush with vertical brushing technique. GROUP 2 – conventional brush with modified bass brushing technique. GROUP 3 - orthodontic brush with vertical brushing technique. GROUP 4 - orthodontic brush with modified bass brushing technique.

Results - The result shows a significance decrease in OHIS & gingival index in group 4 as compared to other group in 1 month. CONCLUSION – Thus, it can be suggested that using orthodontic toothbrushes along with Modified Bass Technique is more effective in reducing the plaque accumulation & maintaining the gingival status in patients with fixed orthodontic appliances.

INTRODUCTION

Maintaining good oral hygiene is major consensus for patients undergoing orthodontic treatment.[1] Fixed orthodontic appliance on any patient presents a favorable situation for rapid plaque accumulation requiring enhanced programs of personal oral hygiene and regular professional prophylaxis. Although mechanical cleansing of tooth surfaces becomes a central requirement and can be accomplished in various forms, consisting tooth brushing complimented with the use of dental floss.

In the patients with fixed orthodontic appliances this process becomes a little strenuous and these patients need extra attention to modify the conventional technique seeking the best for them. [2]

According to ADA specification for conventional toothbrush: Length of brushing surface: 1-1.25 inches & Width of brushing surface: 5/16 – 3/8 inches. Rows of bristles: 2-4, Tufts per row: 5-12 & Bristle per tuft: 80-86. [3,4] (Fig 1b).

Generally, orthodontic toothbrushes have a V-shaped groove along the long axis of the toothbrush head. The shorter nylon bristles in the V-shaped groove are progressively firmer and more efficient in removing food debris from the mid bracket region, along with that the comparatively longer and softer filaments are positioned in the bracket-wing region (Fig 1a).

Tests of the effectiveness of the Orthodontic toothbrush compared with the conventional toothbrush in reducing plaque and gingivitis on teeth with fixed appliances have had conflicting results.[1]

Not only the brush but the brushing technique is also of great significance. The tooth brushing techniques most used in orthodontic patients are: Ramfjord's method, modified Stillman and Bass method.[5] Control studies evaluating the effectiveness of usual brushing techniques do not show clear advantage for any of the methods. It is probable that the scrubbing technique is the most simple and common brushing method. Studies have indicated that minimal periodontal disease, bone loss, and caries will occur in adolescents during the course of fixed appliance therapy, if adequate plaque control is not maintained.[6]

Therefore, Patients must be provided information and should be given enough education about periodontal health, disease relating to the same and thereby developing habits of plaque control. Patient must understand their role in the maintenance of periodontal health or else long term success of the treatment is unlikely to happen. [7]

OBJECTIVE

The aim of this study is to assess the effectiveness of different brushing technique with two different toothbrushes on oral hygiene status and periodontal health amongst the patients with fixed orthodontic appliances.

MATERIAL AND METHODS

A total of 60 patients were selected from the out patient department from the department of Orthodontics And Maxillofacial Orthopedics, Jaipur Dental College, MVGU, ages between 14 to 24 years with fixed orthodontic appliances.

Inclusion Criteria:

- Fixed orthodontic appliances in upper and lower arch.
- Full complement of permanent teeth.
- Absence of systemic disease.

Exclusion Criteria:

- No use of antibiotics in past 3 months.
- Poor oral hygiene
- No deleterious habit.
- patients who are mentally or physically challenged.
- patients with cleft palate where oral hygiene regimen could be compromised.

Two different toothbrushes were compared with two different brushing technique by dividing all the 60 patients into groups. The brushes used were conventional brush and orthodontic brush and the techniques used were Modified Bass Technique and Vertical Brushing Technique. In Modified bass technique, the head of the brush is kept parallel to the occlusal plane, with the brush head covering almost 3-4 teeth starting from the distal most teeth of the arch. The bristles are placed at the gingival margin at an angle of 45 degrees to the long axis of the tooth. Gentle vibratory pressure is given using short back and forth movement dislodging the tips of the bristles. Bristles are swept rolling towards the occlusal surface.[8] In Vertical/Leonard brushing Technique, the bristles are placed at 90 degree angle to the facial surface on the clenched anterior & posterior teeth. The maxillary and mandibular arch are brushed separately. Brush vigorously without great pressure with up and down stroke on tooth surface. Pressure, enough to force the filaments into interdental areas is applied, so much so soft tissues should not be injured. [9]

Similar oral hygiene instructions were given to each patient. At baseline the parameters evaluated were: OHI-S (Oral Hygiene Index Simplified) [10] and Gingival index (GI) [11] and patients were randomly assigned to one of the 4 groups:

- **Group 1** - In group 1 patients were given conventional brush and were asked to brush using Vertical brushing technique. (Fig 3)
- **Group 2** - In group 2 patients were given conventional brush and were asked to brush using with modified bass technique.
- **Group 3** - In group 3 patients were given orthodontic brush and explained to brush using with vertical brushing technique.
- **Group 4** - In group 4 patients were given orthodontic brush and explained to brush using with modified bass technique. (Fig 2) OHIS and GI were re – evaluated after one month. (Fig 4 & 5).

Fig 1a: Orthodontic Toothbrush
1b: Conventional Toothbrush

Fig 2: Modified Bass Technique Using Orthodontic Toothbrush

Fig 3: Vertical Brushing Technique Using Conventional Toothbrush

Fig 4: Oral Hygiene Index - Simplified (OHI-S)

Fig 5: Gingival Index (GI)

STATISTICAL ANALYSIS:

All the data were subjected to statistical analysis using SPSS (Statistical Packages for Social Sciences) 20.0. One-way analysis of variance (ANOVA) was used for intergroup comparison of oral hygiene and gingival status. Paired *t*-test was used for comparison of oral hygiene and gingival status from baseline to 1 month within each group.

RESULTS

TABLE 1: Distribution of 60 patients according to proposed treatments

GROUP 1 (n =15)	GROUP 2 (n = 15)	GROUP 3 (n = 15)	GROUP 4 (n = 15)
Conventional brush with vertical brushing technique	Conventional brush with vertical brushing technique	Orthodontic brush with vertical brushing technique	Orthodontic brush with modified bass technique

In the sample of 60 patients diagnosed, the mean OHI (S) score among the groups of patients were given different health care measures, was compared at baseline and 1 month in 4 study groups. Table 2 and fig 6.

Table 2: OHI (S) score at baseline (B) and 1 month.

OHI (S)	n	Baseline	1 Month
		Mean (SD)	*Mean (SD)*
Group 1	15	1.75 (0.6)	1.48 (0.5)
Group 2	15	1.68 (0.62)	1.14 (0.53)
Group 3	15	1.52 (0.58)	1.18 (0.47)
Group 4	15	1.84 (0.59)	1.02 (0.42)
Total	60	1.70 (0.60)	1.21 (0.48)
ANOVA F-value		0.77	2.47
p-value		0.52	0.07

*(OHI(S) - Oral hygiene Index Simplified, *significant when p<0.05, F-is test value of Analysis of Variance*)

The intergroup analysis among study groups of OHI (S) showed that there was statistically no significance with p>0.05, when one group compared to the other three groups for baseline as well as after1 month.

The OHI (S) score measured from baseline to 1 month, when compared to the other three groups. The results were statistically very highly significant (P < 0.05).

Table 3. Comparison of OHI (S) scores from baseline to 1 month.

	Paired differences	Significant 2-tailed
	Mean	
OHI(S)-Baseline to OHI(S) - 1 Month	0.49	<0.0001*

*OHI(S) - Oral hygiene Index Simplified, *significant when p<0.05 F-is test value of Analysis of Variance*

The mean GI score among the groups of patients were given different health care measures was compared at baseline and 1 month in 4 study groups. Table4 and fig7.

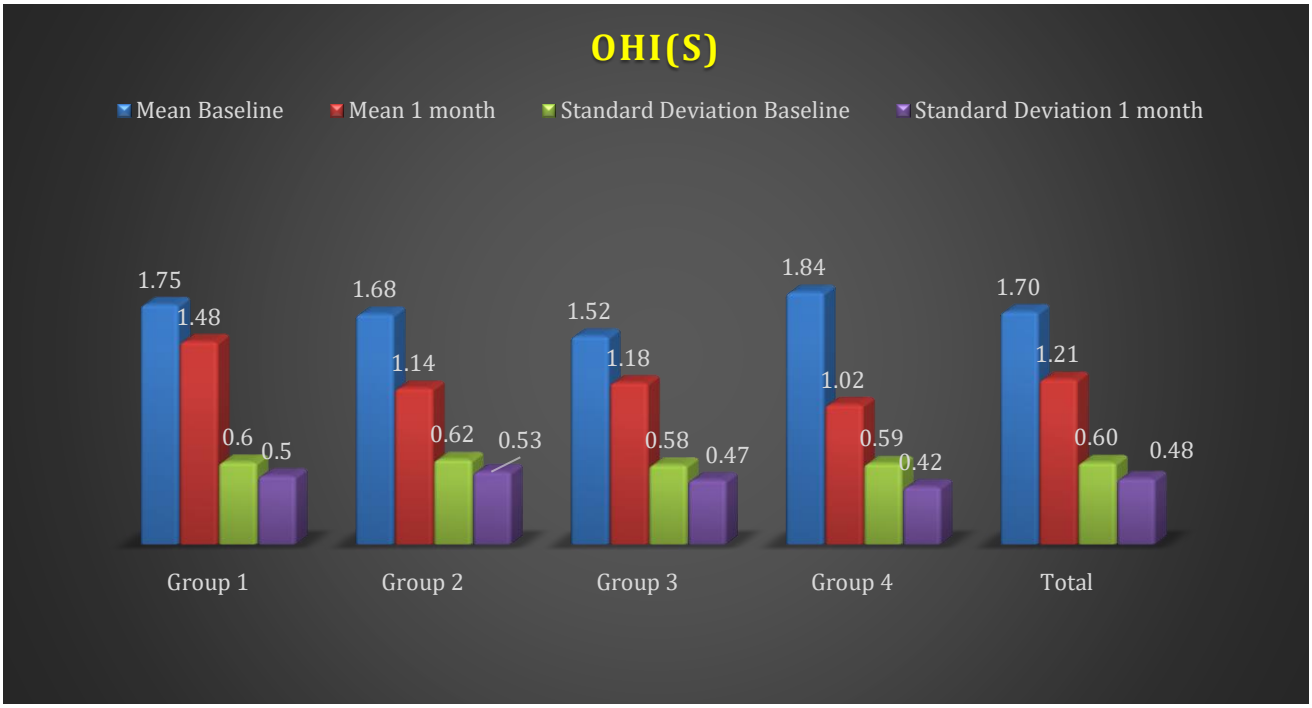

Fig 6: Column Chart Showing OHI (S) Score at Baseline (B) And 1 Month

Table4. GI score at baseline (B) and 1 month.

GI	n	Baseline	1 Month
		Mean (SD)	*Mean (SD)*
Group 1	15	2.64 (0.59)	2.42 (0.57)
Group 2	15	2.75 (0.62)	2.21 (0.52)
Group 3	15	2.62 (0.58)	2.24 (0.56)
Group 4	15	2.86 (0.68)	2.06 (0.53)
Total	60	2.72 (0.62)	2.23 (0.55)
ANOVA F-value		0.48	1.10
p-value		0.7	0.36

*GI- Gingival Index, *significant when p<0.05, F-is test value of Analysis of Variance*

The intergroup analysis among study groups of GI showed that there was statistically no significance with p>0.05, when one group compared to the other three groups for baseline as well as after 1 month. The GI score measured from baseline to 1 month, when compared to the other three groups. The results were statistically very highly significant (P < 0.05).

TABLE5. Comparison of GI scores from baseline to 1 month.

*GI-Gingival Index *significant when p<0.05*

	Paired differences	Significant 2-tailed
	Mean	
GI Baseline to GI- 1 Month	0.4	<0.0001*

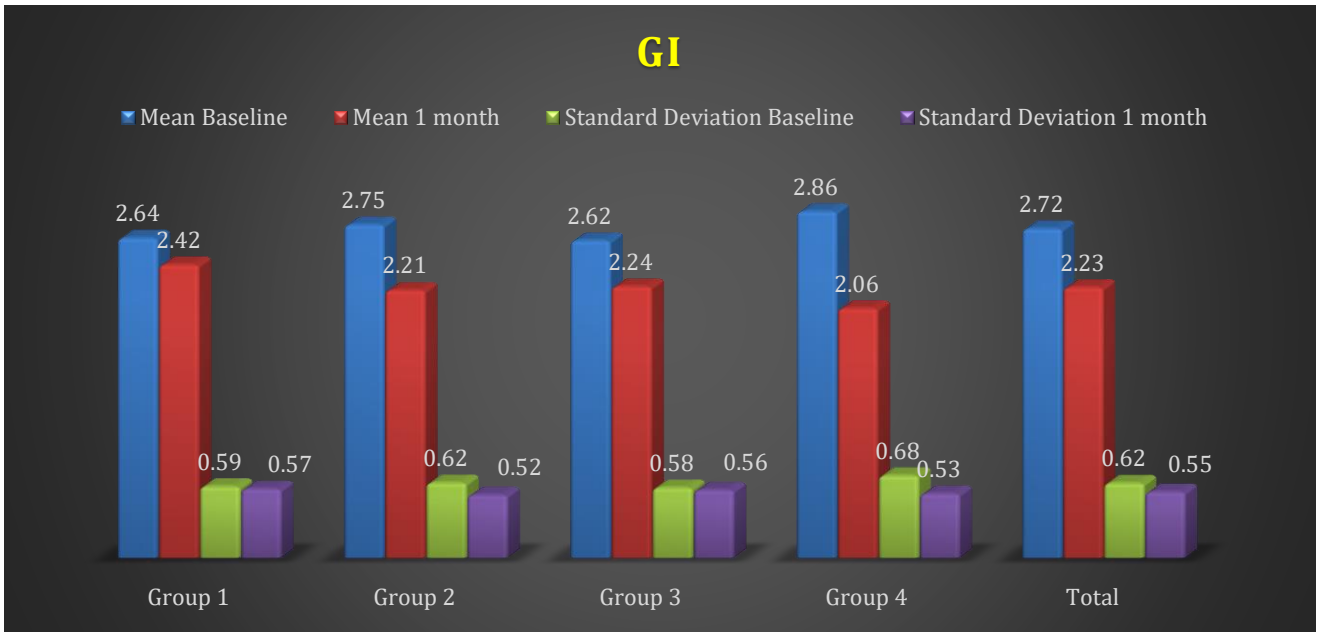

Fig 7: Gingival Index Score at Baseline (B) And 1 Month

DISCUSSION

As discussed, the aim of this study was to assess the effectiveness of different brushing technique with two different toothbrushes on oral hygiene status and periodontal health amongst the patients with fixed orthodontic appliances. The results have revealed that a comprehensive oral hygiene care program helps the patients to control plaque and calculus, decrease gingival inflammation and maintain their oral health status. The effect did not tend to divert with respect to gender or age group.

Davies et al. indicated that although orthodontically treated patients have lower plaque and gingival index scores than did an untreated control group after a 3-year follow-up, the difference was ascribed more to greater awareness of oral hygiene than to the orthodontic therapy itself. [12]

The main goal of orthodontic treatment is to improve dental occlusion and teeth in alignment, which ultimately results in a good functioning of dentition. Although orthodontic treatment with fixed appliances offer disadvantages to the patient, fixed orthodontic appliances can trap food easily, which contributes to plaque formation. If plaque is not carefully removed from teeth and brackets, patients are at a risk of developing gingivitis, dental caries, and oral malodor. There is a direct

relationship between oral health (plaque) and caries incidence in orthodontic patients. [1]

This study was carried out to assess oral hygiene behavior among patients wearing fixed orthodontic appliances. Tooth brushing is the first line of defense in removing debris and plaque accumulated around orthodontic appliances. It is important that patients undergoing orthodontic therapy thoroughly clean their teeth with a toothbrush for a minimum of 2 minutes after every meal (at least 3 times a day). Adolescents exhibit a higher level of supragingival plaque and a higher incidence of gingivitis than adults. Thus, the sample age of 12–18 years was selected in this study.

Patricia et al 2013 suggested that Bass technique can be effective in reducing periodontal clinical parameters of Plaque index and Gingival index in patients with fixed orthodontic appliances. [5]

Zachrission BU in 1971 conducted a study in which horizontal scrubbing technique of brushing was taught after plaque disclosure, as vertical brushing technique has been found to be inadequate in cleaning gingival margins.[13]

Boyd 1983 conducted a study to evaluate the effect of plaque control measures on gingivitis and found that a structured plaque control program only was effective in reducing dental plaque and gingivitis, provided there was periodic reinforcement at 4- to 7-week intervals; otherwise, the gingivitis scores tend to increase to pre orthodontic treatment level, on cessation of reinforcement. [14,15]

Boyd et al. found that even in patients with periodontal diseases before orthodontic treatment, their periodontal health condition would be the same as general patients during and after treatment if they paid attention to oral hygiene care and followed periodontal conditions at regular times during orthodontic treatment. [14]

Zvi Rafe 2006 has done a study in which he concluded that orthodontic brushes gives better result than conventional brushes to improve tooth and gingival health in orthodontic patients with fixed appliances which is similar to this study. [1]

Previous studies have suggested that orthodontic appliances result in an increase in plaque, with a consequent increase in bacterial numbers and bacterial byproducts. [16]

Navneet et al 2019 presented a study in which he said that modified bass brushing technique is an important tool in maintaining good oral hygiene. [16]

Hobson et al. investigated the oral hygiene advice that orthodontists gave to patients undergoing routine orthodontic treatment. They found that all orthodontists gave advice on tooth brushing, 89.5% gave dietary advice, and 84% suggested that patients to use disclosing tablets. A fluoride rinse was recommended by 73% and a chlorhexidine mouthwash by 41.9% of orthodontists. Many orthodontists advocate appropriate oral hygiene measures, but the efficacy of such methods is determined by the patient's motivation. Therefore, orthodontists require skills in behavioral management. [17]

Repeated motivational sessions were demonstrated to the patients to all four groups.

Orthodontic toothbrush could be a better alternative to conventional toothbrush. Modified Bass Technique can be a better option than Vertical Brushing Technique as it concentrates the cleaning action on the cervical and interproximal part of the tooth, where the plaque is mostly accumulated.

LIMITATION

- Sample size was small.
- Duration of study was short.
- Microbial study would have given better results.

CONCLUSION

Orthodontic toothbrush could be a better alternative to conventional toothbrush. Modified Bass Technique can be a better option than Vertical Brushing Technique as it concentrates the cleaning action on the cervical and interproximal part of the tooth, where the plaque is mostly accumulated. Presence of brackets and wires decrease the efficacy of toothbrushing. The implementation of various motivational and educational therapy resulted in improvement of gingival and periodontal health. Within the limits of this study and based on the clinical significance of obtained results, it can be concluded that all 4 groups were effective in maintaining the oral hygiene of orthodontic patients, however it was suggested that Group 4 was more effective in these patients over a period of 1 month. Motivation of patients is essential to maintain good and fair oral hygiene status.

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Assessment of the Correlation of Dental Implants and Diabetes

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Abstract

Background: Diabetes mellitus is a chronic disorder of carbohydrate metabolism. The persistent hyperglycemia in diabetic individuals, inhibit osteoblastic activity and alters the response of parathyroid hormone that regulates metabolism of Ca and P, decreases collagen formation during callus formation, induces apoptosis in lining cells of bone and increases osteoclastic activity due to persistent inflammatory response. Hence; the present study was conducted for assessing the correlation of dental implants and diabetes.

Materials & Methods: A total of 50 diabetic subjects and 50 healthy controls were enrolled. Complete demographic and clinical details of all the subjects were obtained. Clinical examination was carried out. Radiographic examination of all the subjects was done. Dental implant procedures were carried out in all the patients. Follow-up was done and radiographic examination was carried out in all the patients. Prognosis of dental implants in diabetic and non-diabetic patients was evaluated and compared.

Results: Success rate of dental implants among diabetic and non-diabetic subjects was 80 percent and 90 percent respectively. Non-significant results were obtained while comparing the prognosis of dental implants among diabetic and non-diabetic subjects.

Conclusion: Prognosis of dental implants in patients with controlled diabetes is excellent.

Keywords: Dental, Implants

INTRODUCTION

Diabetes mellitus is a chronic disorder of carbohydrate metabolism characterized by hyperglycemia, reflecting distortion in physiological equilibrium in utilization of glucose by tissue, liberation of glucose by liver and production-liberation of pancreatic anterior pituitary and adrenocortical hormone. Today, dental implants are one of the restorative methods to replace missing teeth. Improvements in implant design, surface characteristics, and surgical protocols made implants a secure and highly

predictable procedure with a mean survival rate of 94.6 % and a mean success rate of 89.7 % after more than 10 years. Implant survival is initially dependent on successful osseointegration following placement. Any alteration of this biological process may adversely affect treatment outcome. Subsequently, as an implant is restored and placed into function, bone remodeling becomes a critical aspect of implant survival in responding to the functional demands placed on the implant restoration and supporting bone.[1- 3]The persistent hyperglycemia in diabetic individuals, inhibit osteoblastic activity and alters the response of parathyroid hormone that regulates metabolism of Ca and P, decreases collagen formation during callus formation, induces apoptosis in lining cells of bone and increases osteoclastic activity due to persistent inflammatory response. It also induces deleterious effect on bone matrix and diminishes growth and accumulation of extracellular matrix. The consequent result is diminished bone formation during healing, which is observed in number of experimental animal studies.[4- 7]Hence; the present study was conducted for assessing the correlation of dental implants and diabetes.

MATERIALS & METHODS

The present study was conducted for assessing the correlation of dental implants and diabetes. A total of 50 diabetic subjects and 50 healthy controls were enrolled. Complete demographic and clinical details of all the subjects were obtained. Clinical examination was carried out. Radiographic examination of all the subjects was done. Dental implant procedures were carried out in all the patients. Follow-up was done and radiographic examination was carried out in all the patients. Prognosis of dental implants in diabetic and non-diabetic patients was evaluated and compared. All the results were recorded and analyzed by SPSS software.

RESULTS

In the present study, a total of 50 diabetic and 50 non-diabetic subjects were enrolled. Mean age of the diabetic and non-diabetic subjects was 45.8 years and 42.3 years. Majority of the subjects of both the study groups were males. Overall, success rate of dental implants among diabetic and non-diabetic subjects was 80 percent and 90 percent respectively. Non-significant results were obtained while comparing the prognosis of dental implants among diabetic and non-diabetic subjects.

Table 1: Prognosis of Dental Implants

Prognosis	Diabetic group		Non- Diabetic group	
	n	%	n	%
Success	40	80	45	90
Failure	10	20	5	10
p- value	0.45			

DISCUSSION

In the past two decades, dental implants have become increasingly popular as a procedure to restore missing teeth. A number of patient and procedure related parameters determine the success of the implant treatment. Diabetes Mellitus (DM) is the most common systemic disease which is generally considered as a relative and not an absolute contraindication for implant therapy. Among men and women over 55 years of age, where the rates of edentulism are higher, about 18.4 percent of individuals have some form of diabetes affecting the whole body.[7- 10]Hence; the present study was conducted for assessing the correlation of dental implants and diabetes.

In the present study, a total of 50 diabetic and 50 non-diabetic subjects were enrolled. Mean age of the diabetic and non-diabetic subjects was 45.8 years and 42.3 years. Majority of the subjects of both the study groups were males. Inbarajan A et al evaluated the efficacy of implant supported tooth replacement in diabetic patients. The study involved placement of implants (UNITI implants, Equinox Medical Technologies, Zeist, Holland,

diameter of 3.7 mm and length 13 mm) in five diabetic patients (three females and two males) of age ranging from 35-65 years with acceptable metabolic control of plasma glucose. All patients included in the study were indicated for single tooth maxillary central incisor replacement, with the adjacent teeth intact. The survival of the restored implants was assessed for a period of three months by measurement of crestal bone heights, bleeding on probing and micro flora predominance. Paired t-test was done to find out the difference in the microbial colonization, bleeding on probing and crestal bone loss. P values of less than 0.05 were taken to indicate statistical significance. Results indicated that there was a significant reduction in bleeding on probing and colonization at the end of three months and the bone loss was not statistically significant. The study explored the hypothesis that patients with diabetes are appropriate candidates for implants and justifies the continued evaluation of the impact of diabetes on implant success and complications.[10]

In the present study, overall, success rate of dental implants among diabetic and non-diabetic subjects was 80 percent and 90 percent respectively. Non-significant results were obtained while comparing the prognosis of dental implants among diabetic and non-diabetic subjects. Sghaireen MG et al compared the failure rate of dental implants between well-controlled diabetic and healthy patients. A retrospective study of case-control design was conceptualized with 121 well-controlled diabetic and 136 healthy individuals. Records of subjects who had undergone oral rehabilitation with dental implants between the periods of January 2013 to January 2016 were retrieved. Post-operative evaluation was carried out for all patients for about three years to assess the immediate and long-term success of the procedure. From a total of 742 dental implants, 377 were placed in well-controlled diabetic patients (case group) and 365 in healthy subjects (control group). A comparable (9.81%), but non-significant (p = 0.422) failure rate was found in the case group in comparison to the control group (9.04%). A non-significant (p = 0.392) raised number (4.98%) of failure cases were reported among females in comparison to males (4.44%). In respect to arch, the mandibular posterior region was reported as the highest failure cases (3.09%; p = 0.411), with 2.29% of cases reported in the mandibular anterior (p = 0.430) and maxillary posterior (p = 0.983) each. The maxillary anterior region was found to have the least number (1.75%; p = 0.999) of failure cases. More (4.98%; p = 0.361) cases were reported to fail during the functional loading stage in contrast to osseointegration (4.44%; p = 0.365). A well-controlled diabetic status does not impose any additional risk for individuals undergoing dental implant therapy.[11]

CONCLUSION

Prognosis of dental implants in patients with controlled diabetes is excellent.

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Comparison of p53 Expression in Odontogenic Keratocyst and Dentigerous Cyst: An Immunohistochemical Study

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Abstract

Background: Odontogenic cysts comprise an important aspect of oral and maxillofacial pathology. These cysts arise from the same odontogenic apparatus, but with their different pathogenesis and differ considerably in their biological behavior in terms of aggressiveness. This could be due to the nature of their epithelium and alteration in their cell cycle control. The p53 protein, a product of the p53 tumor suppressor gene, and the mutations of p53 protein are closely related to the decreased differentiation of cells.

Objective: This study was carried-out to investigate the immunohistochemical expression of p53 protein in odontogenic keratocysts (OKC) and dentigerous cyst (DC).

Materials and Methods: Immunohistochemistry was performed with the p53 protein with fifteen cases of OKC and ten cases of DC.

Results: The mean scores of the marker used were found to be significantly higher in OKC in comparison to DC.

Conclusion: The higher p53 protein expression in OKC in comparison to DC suggest that p53 protein, contribute to the aggressive behaviour in OKCs.

Keywords: Immunohistochemistry, odontogenic keratocysts, dentigerous cyst, p53.

INTRODUCTION

The term cyst is derived from the Greek word "Kystis" which means a bladder or sac. Kramer has defined cyst as a pathological cavity having fluid, semi-fluid, or gaseous contents and which is not created by the accumulation of pus[1]. The term "Odontogenic Keratocyst" was introduced by Philipsen in 1956[2].

Odontogenic keratocysts (OKCs) constitutes 11.2% of all developmental odontogenic cysts. OKCs can develop from derivatives of embryologic dental lamina or it remains (Serres glands) as well as basal cell extensions from the overlaying epithelium.

Histologically, they have a consistent epithelial lining of parakeratinized-stratified squamous epithelium that is thin, ranging from six to ten cell layer thickness, and a well-defined basal layer made of columnar or cuboidal cells. OKCs are aggressive cystic lesions which have a tendency to recur if not treated properly and grow larger than other cysts with a mitotic activity observed in their epithelial lining which is more than that observed in dentigerous and radicular cysts[1]. OKCs have clinical importance due to its aggressive behavior, recurrence risk, and malignant potential[3].

Dentigerous cysts are the most frequent developmental cysts of the jaws, and they expand as osmotic pressure within their lumen increases[4]. Dentigerous cysts are benign odontogenic cysts that develop in the permanent teeth's crowns. They found more common in the mandible than the maxilla[5]. Histologically, the cyst wall of dentigerous cysts, is made up of connective tissue which lined by low cuboidal, stratified squamous epithelium of 2-3 cell layer thickness but in the presence of inflammation, the thickness of the lining epithelium may vary[1].

An increase in cell proliferation probably plays a role in the development of odontogenic cysts and tumours[6,7].

The p53 protein, which has a molecular weight of 53 kilodalton and is encoded by the p53 gene on chromosome 17, is a nuclear protein with a molecular weight of 53 kilodalton. Apoptosis, cell cycle, cell proliferation regulation, and genetic stability are all critical functions of this tumour suppressor gene[8,9,10].

Usually, the concentration of wild type p53 is low in cells due to its relatively short half-life which is approximately 20 min. Its concentration increases in cells when half-life is extended, which may found because of TP53 gene mutation, association of wild type p53 with other proteins, or disruption of p53 degradation pathway[11,12].

p53 protein is a product of mutations in the p53 gene which has an increased half-life, thus allowing this mutated protein to be expressed immuno-histochemically[13,14].

In our study p53 protein expression will be noted in OKCs and DCs to know the different biological behaviour of OKCs than DCs of oral cavity.

MATERIALS AND METHODS

This study was done on 25 archival paraffin blocks of odontogenic cysts. These cases were retrieved from the Department of Oral Pathology and Microbiology of RUHS College of Dental Sciences, Jaipur by random sampling. Ethical clearance was taken from ethical committee. The cases include 15 odontogenic keratocyst cases (OKC) and 10 dentigerous cysts (DC).

From every paraffin block, two 4 micron-thick paraffin sections were done. First section were stained with H&E and reviewed to confirm the histopathological diagnosis. The second section was processed immunohistochemically to assess P53 expression in odontogenic cysts. These sections were taken on Poly-L-Lysine adhesive coated glass slides or positive charged slides. Then the sections were deparafinized, rehydrated in graded alcohols (100%, 80%, 50%), treated with blocking reagent for 5 min and washed in phosphate buffer working solution (PBS) for 5 min. One drop of monoclonal mouse antibody to P53 (Biogenix) was then placed on each section. Then incubation was done over night in the humidity chamber with 2-3 drops of streptavidine enzyme placed on each slide. DAB (diaminobenzidine tetrahydro chloride) chromogen working solution was applied onto the slides for 1-2 minutes at room temperature. Sections were counterstained with Myer's hematoxylin, dehydrated by passing them through ascending grades of alcohol (50%, 80%, 100%) and mounted in DPX. Breast carcinoma sections for p53 protein (positive control) was run with every immunostaining to confirm the immunoactivity of the antibodies. Negative controls were used to confirm the specificity of the method and to asses nonspecific background staining by staining the test tissue in the absence of primary antibody.

The brown colored nucleus at the site of target antigen was considered immunopositive for p53. The immunoreactivity was assessed quantitatively by two investigators to overcome inter-observer variability. All positive stained cell from five randomly chosen high power fields in every case were counted while cells were scored as positive or negative. Positively stained cells were analyzed quantitatively by counting the total number of intact positively stained cells per high power field

(40x) of light microscope. Images were captured by digital camera attached with light microscope and analyzed using image analysis software (ij152-win-java8 image J).

Counting was done in five representative areas of epithelium in the OKC and DC. 200 cells were counted in per high field and the total 1000 cells immunoreactive for p53 protein was calculated. The mean of five values were calculated and expressed.

Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States). Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM).

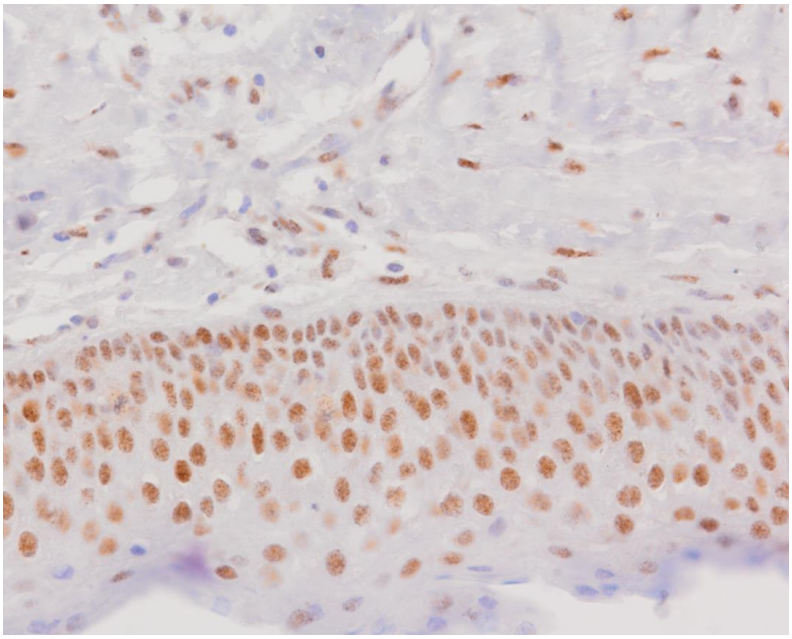


Figure 1: p53 Protein Stained Section of Odontogenic Keratocyst (40x)

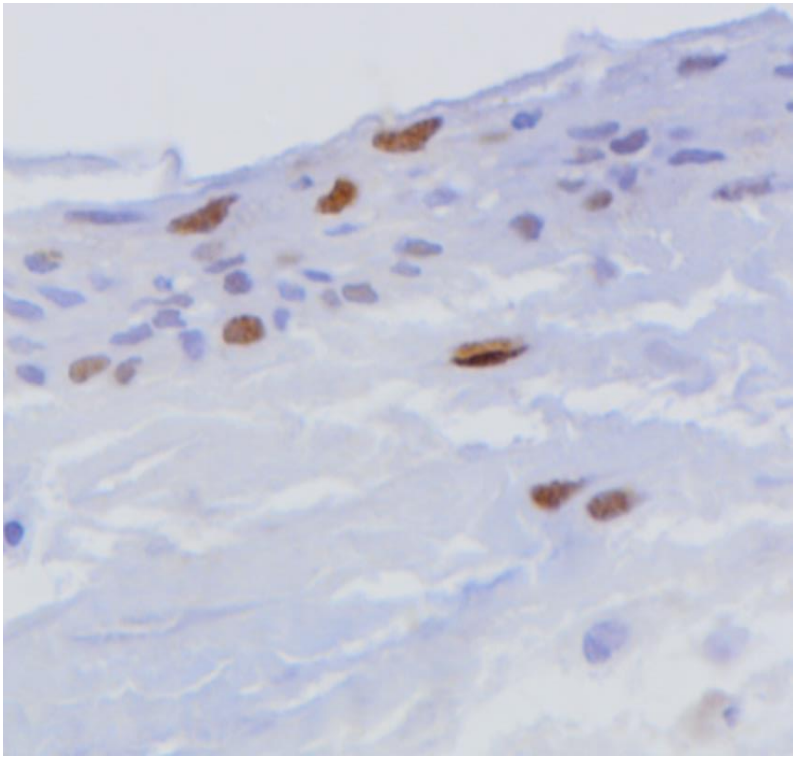
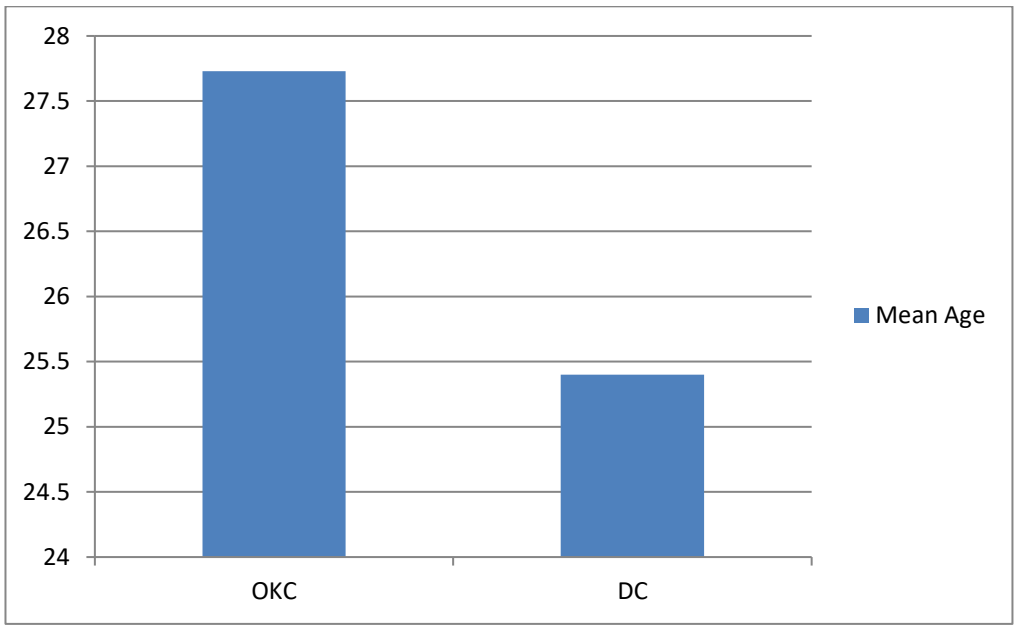


Figure 2: p53 Protein Stained Section of Dentigerous Cyst (40x)

RESULT

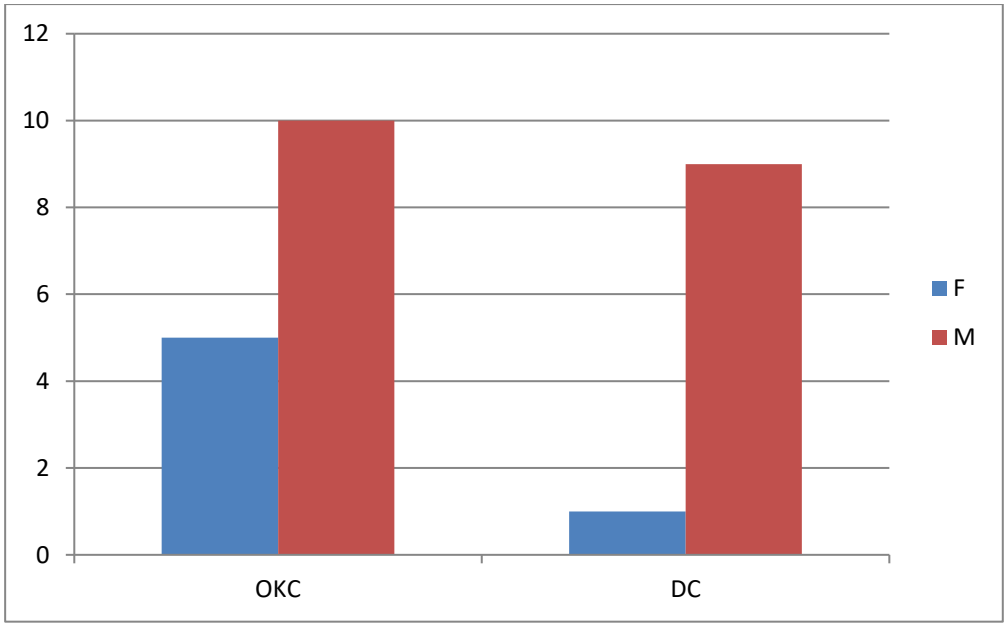
Expression of p53 in the OKC epithelium (Figure 1) is more than DC epithelium (Figure 2) was found.

Graph 1: Represents mean age of the subjects. For okc the mean age was 27.73 and for DC the mean age was 25.40.



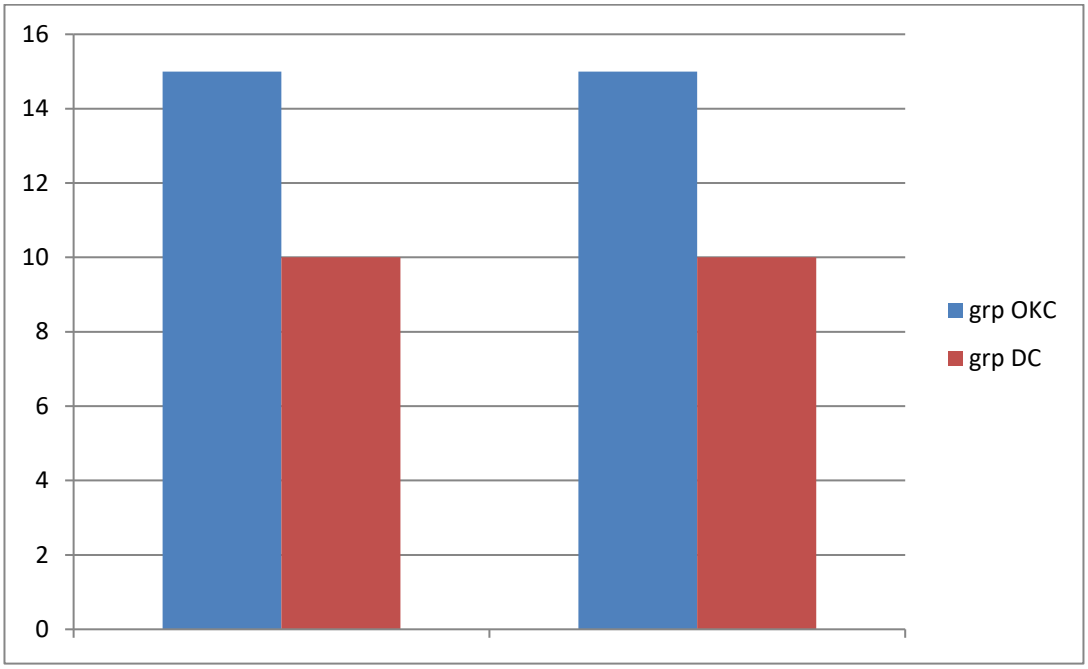
Graph 1: Comparison of Mean Age

Graph 2: Denotes distribution of two groups according to gender. In OKC & DC 66.7% & 90% were male respectively. Whereas 33.3% & 10% cases were female for OKC & DC respectively. Out of total cases 76% were male & 24% were female.



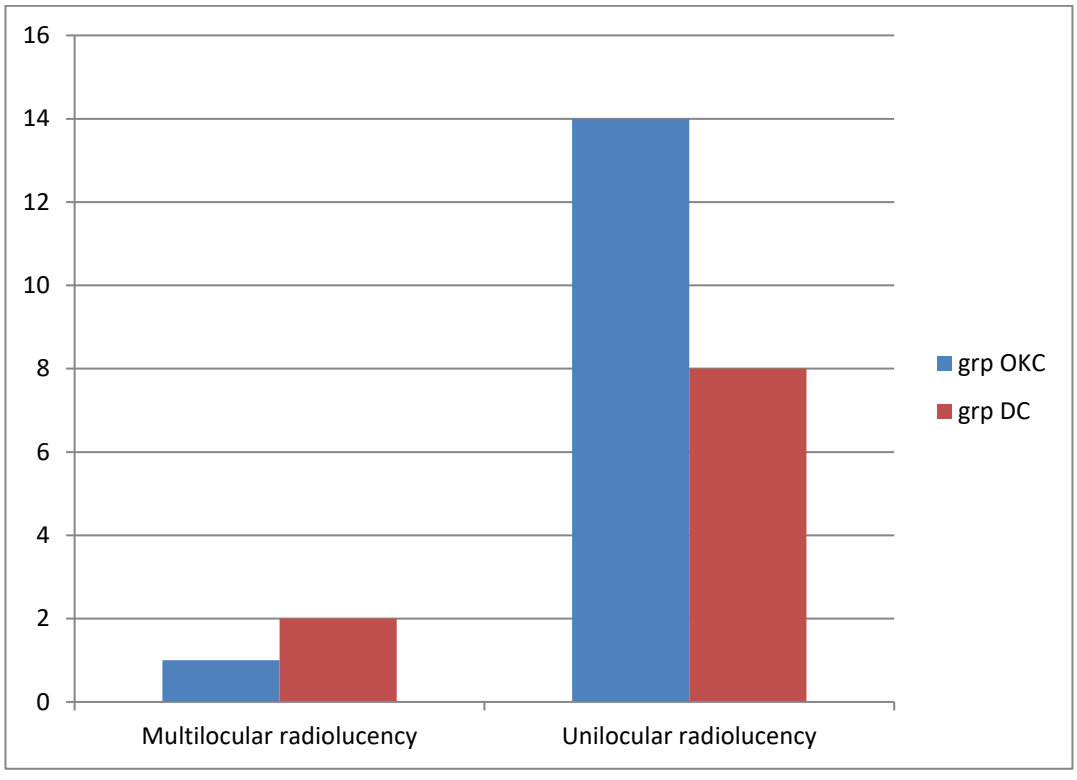
Graph 2: Distribution of different Groups according to Gender

Graph 3: Shows that in all cases the presentation was mainly swelling therefore, no statistics are computed because presentation is a constant.



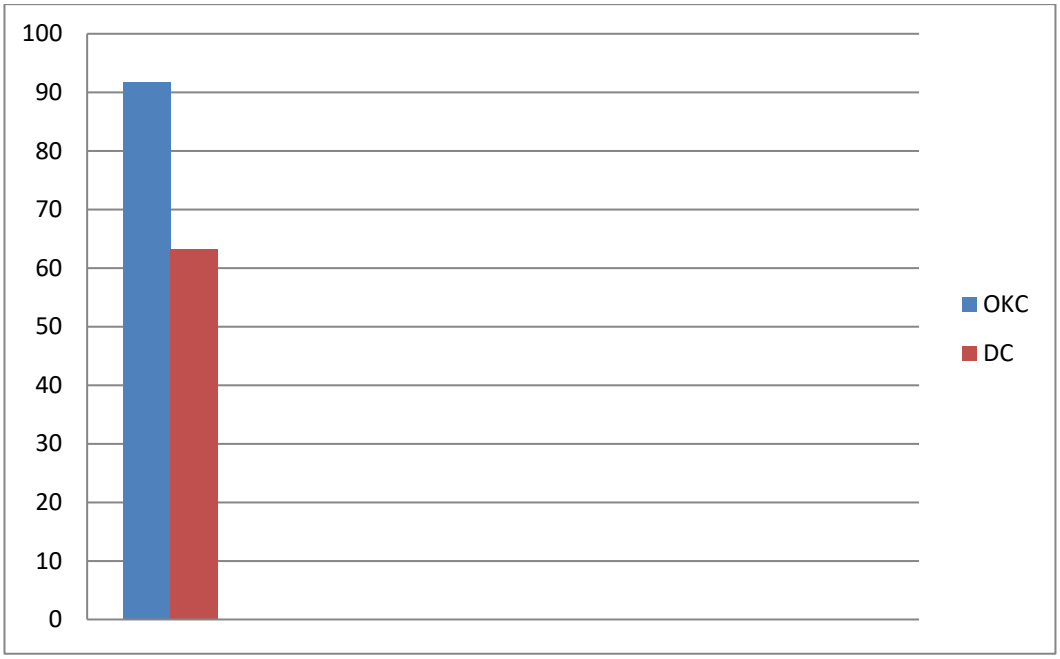
Graph 3: Clinical Presentation

Graph 4: Shows that in OKC 14 cases and in DC 8 cases presented as unilocular radiolucency while 1 and 2 cases of OKC and DC respectively showed multilocular radiolucency. There was statically non-significant difference in radiographic presentation of OKC and DC ($p>0.05$).



Graph 4: Distribution of different Groups according to Radiographic Appearance

Graph 5: Demonstrates inter group comparison of mean expression of p53 amongst OKC and DC. The mean expression for OKC was 91.72 and for DC 63.32.



Graph 5: Inter Group Comparison of Mean Expression

Table 1: Shows inter group comparison of mean expression of p53 protein quantitatively. There was a statistically no significant difference seen for the values between the OKC and DC groups (p>0.01).

Table 1: Inter Group Comparison of Mean Expression of p53 Protein Quantitatively

Group	Vs group	Mann-Whitney U value	Z value	p value of Mann-Whitney U test
OKC	DC	54.000	-1.165	0.244#

DISCUSSION

There are lots of studies which have investigated the mutations and changes in cell-cycle regulatory, proliferative, and apoptotic proteins in OKC and dentigerous cyst[15-21].

In normal cells, p53 is a negative regulator of cell division and inactivation of this gene is one of the most common genetic changes in human cancer[22], Changes of the p53 gene result in a gene product (p53 protein: p53) which has an increased half-life in comparison with the wild-type protein. Therefore, if one is able to demonstrate p53 immunohistochemically in an individual cell. It is often assumed that in that particular cell the p53 gene is abnormal. However, there is evidence that non-mutational stabilization of p53 can occur and that heightened or even normal levels of wildtype p53 may be detected depending on the methods employed in detecting the antigen[23,24,25].

In this study comparison of p53 expression between OKC and DC was done to assess the aggressiveness of cysts.

It was found that in this study the higher mean age in OKC (27.73 yrs) and lower in DC was (25.40 yrs) where as in Gaballah E T *et al*[26]. (2010) study the mean age was higher in OKC (37±16.1 yrs) and lower in DC (31±20.2 yrs).

The predominance of males in cases of the present study was reported in OKC and DC cases and similar finding was reported in Ochsenius *et al*[27]. (2007), Tortorici *et al*[28]. (2008) studies.

In this study the clinical presentation of both groups is swelling similarity with previously reported study conducted by Doll C *et al* [29]. (2018). Most Common radiographic appearance of both groups in this study is unilocular in accordance with Robert J *et al*[30]. (1999).

In our study the inter group comparison of mean expression of p53 amongst OKC and DC was done. The mean for OKC was 91.72 and for DC 63.32. The higher values in group OKC and lower in group DC which was in accordance with Piattelli A *et al*[31]. (2001), Slootweg PJ[7] (1995) and Li TJ *et al*[32]. (1996) where as De Oliveira MG *et al*[12]. (2008) concluded higher expression of p53 in DC followed by OKC.

CONCLUSION

In our study we found high expression of p53 in OKC compared to DC because the greater proliferation activities of the epithelial lining in OKC. A p53 gene mutation may be one of the causes of cell proliferation. The results suggest that p53, contribute to the aggressive behaviour in OKCs. In odontogenic cysts, p53 play an important role in the pathology of both inflammatory and developmental lesions.

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Endodontic Management of Extensive Dens Invaginatus treated with a Novel Approach: A Case Report

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Abstract

Background: Endodontic treatment of teeth that exhibit the dental anomaly called "Dens Invaginatus" is quite challenging due to the operator's inaccessibility to the diseased pulp in the complex root anatomy. Surgical intervention and extraction are the common approaches to deal with this condition. This case report describes a type three dens invaginatus of maxillary lateral incisor with atypical root canal anatomy that was successfully treated by non – surgical endodontics.

Keywords: CBCT, Dens in dente, unusual anatomy

INTRODUCTION

Dens Invaginatus (DI) is a developmental anomaly resulting in a deepening or invagination of the enamel organ into the dental papilla prior to calcification of the dental tissues.[1] Hovland and Block estimated the incidence as 0.04% to 10%, possibly occurring in any tooth, affecting either deciduous or permanent dentition and commonly involving the upper lateral incisors (43% of all cases). Cases of bilateral and multiple occurrences have also been reported. This condition is also known as "Dens in Dente", "Dilated composite odontome" "Gestant odontoma", "Dentinoid in dente" or "Telescopic tooth". Hallet introduced the term Dens Invaginatus in order to clarify the point that enamel is located centrally and the dentine peripherally due to the invagination. Since then it has been a preferred term, although dens in dente is a more commonly used term.[2] It was described for the first time in 1794 by **Ploquet** who found this malformation in a whale's tooth. A dentist by the name of **Socrates** in 1856 was the first to report a dens in dente in human teeth. The etiology of dens invaginatus malformation is controversial and remains unclear. Over the last decades several theories have been proposed to explain the aetiology of dental coronal invaginations.[3,4] **Kronfeld** speculated that dens invaginatus is caused by a failure in growth of the internal dental epithelium while at the same time there is also a proliferation of the surrounding normal epithelium, producing a static area of engulfing. Most authors meanwhile consider Dens Invaginatus as a deep folding of the foramen coecum during tooth development which in some cases even may result in a second apical foramen. On the other hand, the invagination also may start from the incisal edge of the tooth. Genetic factors cannot be excluded. Most cases of dens invaginatus are detected after a routine

radiographic evaluation with a panoramic x-ray and confirmed with a periapical film.[5] Clinically, a morphologic alteration of the crown or a deep Foramen Coecum can serve as an indication for the diagnosis of dens invaginatus. Histological, fragile hypomineralized enamel is frequently seen at the site of the invagination; this condition facilitates the formation of dental caries and the penetration of microorganisms from the saliva directly into the pulp, leading to pulp necrosis and the development of a periradicular inflammatory process. Endodontic treatment of such teeth is challenging due to complex root canal anatomy and difficult access to the canals and the apices. The most commonly advocated treatment for such teeth has been the extraction of dens and the root canal treatment of the remaining tooth.[6] This report describes a case of unilateral type III Dens Invaginatus associated with the maxillary lateral incisor that was treated with a novel approach without extracting the Dens in dente.

CASE REPORT

A 27-year-old female reported with a chief complaint of swelling in the upper left front of the jaw. The patient described diffuse swelling in the left front of the cheek, which had resulted in elevation of the ala of her nose. On intraoral examination, a deep pit was observed on the labial surface of the permanent maxillary left lateral incisor with slight discoloration of the crown (Fig. 1A and 1B). The tooth responded positively to vertical percussion. Examination of a preoperative radiograph showed the presence of dens invaginatus of the maxillary left lateral incisor with an apical radiolucent area (Fig. 1C). A diagnosis of type III (Oehlers) Dens Invaginatus with dento-alveolar abscess was made. The patient had a noncontributory medical history. Cone Beam Computed Tomography (CBCT) scans were performed to precisely identify the root canal anatomy. Examination of the computed tomography scans revealed a complex anatomy of the tooth with multiple canals (Fig. 1D and 2A). Radiographically, one can observe an uncommon morphology of the crown and root, as well as the presence of periapical lesion**,** increasing size of the pulp chamber and root canal ending in two apices. A diagnosis of irreversible pulpitis with chronic apical abscess was made and decided to carry out nonsurgical root canal therapy. The treatment plan was explained to the patient and her consent obtained. After administering local anaesthesia (Lignox 2% A, Warren, Indoco) the tooth was isolated under rubber dam and access cavity prepared. Magnifying loops (Seiler) were used to help locate the canals. A No. 10 K-flex file (Dentsply, Maillefer) was inserted, and radiographs were obtained. The working length was determined with No. 15K file. (Fig. 2B), and the canals were cleaned and shaped with a No. 25K file using a standardized technique. As a result, the canal in the invagination was treated as a separate canal, and we performed root canal treatment. If the invaginations are minor, burring through the invagination reduces the chance of lateral perforation and, hence, the root canal treatment of such teeth can be carried out more easily.

Sometimes, the invagination must be treated as a separate root canal. In the present case, the invagination was left for two important reasons.

- The first reason was the invagination was thick and its removal would have weakened the tooth structure.
- The second reason was the inadequate length of bur and insufficient accessibility to the invagination.

Because of the enamel invagination, the dens invaginatus filling has a wide and bulky cavity, requiring an obturation with filling material. The three canals were finally obturated with a cold lateral compaction technique using a resin based sealer (Fig. 2C). As the patient could not afford full coverage crown the labial surface was restored with composite resin (Fig. 2D) to enhance the aesthetics.

DISCUSSION

Dens invaginatus has been defined as a defect in tooth development, characterized by invagination of the enamel organ before the calcification phase.[7] Several authors have proposed to classify the radiographic and clinical presentations of DI, however, Oehlers'(1957) classification appears to be

the most popular, due to its simple nomenclature and easy application.[4] He categorized invaginations into three classes determined by how far they extend radiographically from the crown into the root:

Type I: the invagination is minimal and enamel-lined; it is confined within the crown and does not extend beyond the level of the external amelo-cemental junction.

Type II: the invagination is enamel-lined and extends into the pulp chamber but remains within the root canal with no communication with the periodontal ligament.

Type III: the invagination extends through the root until the apical foramen and communicates with the periodontal ligament. Usually, there is no communication with the pulp.

Teeth with invagination are more susceptible to carious lesions as a consequence of the pulpal topography that serves as retention material, as well as structural defects at these areas, where the enamel is badly formed or is not present.[1] Numerous thin canals allow communication with the pulp, making it possible for microorganisms and their products to reach the pulp, leading to pulpal infection and necrosis, as in the present case. The gender predilection for DI i.e., male to female ratio is 1:1.7, with a slight female predilection. Our study co-related this finding, wherein we observed that the male to female ratio was 1:1.2, with female predilection.[8] Dens invaginatus is clinically significant due to the possibility of the pulp being affected. As pulpal involvement of teeth with coronal invaginations may occur shortly after tooth eruption, an early diagnosis is mandatory to instigate preventive treatment. Clinical examination may reveal a deep fissure or pit on the surface of an anterior tooth. Due to the tortuous lingual anatomy, it is possible for caries to develop inside the invagination without any clinically detectable lesion. Since the enamel lining is thin and in close proximity to the pulp chamber, a carious lesion could easily perforate the pulp chamber. Further, there are sometimes thin canals within the enamel of the dens invaginatus, forming a direct communication with the pulp. Hence pulpitis and necrotic pulps are often associated with this anomaly. The other reported sequelae of undiagnosed and untreated coronal invaginations are retention of neighboring teeth, displacement of teeth, cysts and internal resorption.[6] Early diagnosis of dens invaginatus is crucial and requires thorough clinical examination of all teeth, especially lateral incisors. The examination should check for the presence of palato-radicular groove and deep pits on the palatal surfaces of maxillary anterior teeth, particularly the lateral incisors.[9] The present condition can be seen as soon as the maxillary anterior teeth erupt in the oral cavity by the age of 7 to 10 years. The condition can be diagnosed based on clinical and radiographic findings. The invagination provides a place for bacterial growth and may endanger the integrity of the main canal. Early detection and sealing of the invagination's opening with acid-etch resin can effectively prevent these complications.

If no radiographic signs of pulp necrosis are present and no communication exists between the invagination and root canal, a pulp sensivity test should be performed and followed by a adequate filling of the invagination with a suitable restorative materials. Root canal treatment is indicated when the invagination has a separate apical or lateral foramen, as in the present case report.In some situations, burring through the invagination to reach the apical foramen may be possible. When minor forms of invaginations are eliminated, root canal treatment typically will not present further problems.[10]

CONCLUSION

Dens invaginatus can be recognized before the eruption of the tooth from periapical radiographs. So these teeth should be treated prophylactically as soon as possible after tooth eruption. Early diagnosis and intervention can definitely prevent pulpal necrosis and the potential loss of tooth. The nonsurgical endodontic management of the complex root canal morphology of these teeth is a successful alternative to the more invasive surgical intervention. Operator skill in locating these abnormal courses of the root

canals will eliminate the procedural errors which could occur while searching for the canal in its normal position. Knowledge about such unexpected variations in root canal anatomy and its immediate conservative treatment is the key to the successful management of the anomalies of tooth.

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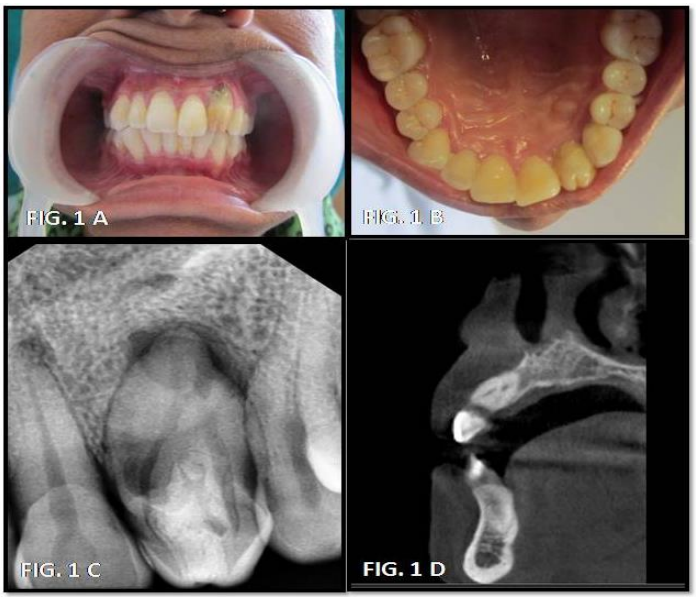

Fig.1 A Pre operative intra oral frontal view of left maxillary lateral incisor. Note the perforation in the cervical third of labial surface.

Fig.1 B Pre-operative occlusal view.

Fig.1 C Pre operative intraoral periapical radiograph. Note the well-defined type III dens invaginatus with the canal morphology.

Fig.1 D Pre operative CBCT (Sagittal section).

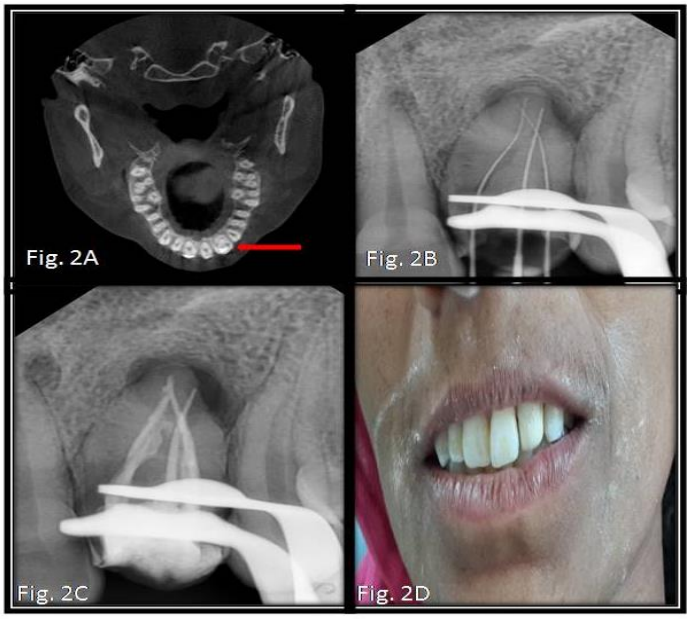

Fig.2 A Pre operative CBCT (Axial section). Note the three coronal orifices
Fig.2 B Working Length Radiograph. All three canals are negotiated to the apex.
Fig.2 C Post Obturation radiograph.
Fig.2 D Post operative frontal view after restoring the defect with resin-based composite.

Surgical Management of Gingival Recession Using Free Gingival Autograft: Case Series

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Abstract **Background:** The aim of this clinical case series is to describe surgical management of Miller's Class II recession in lower anterior using Free Gingival autograft. The free gingival graft is an effective treatment in increasing the width of mandibular keratinized tissue and maintain an inflammation free state.

Keywords - Gingival recession, FGG, Keratinized gingiva

INTRODUCTION

Gingival recession is characterized by apical migration of marginal gingiva, which may lead to compromised esthetics, root sensitivity, root caries, and/or pulp hyperemia. Several techniques are there for of management of gingival recession, those are, free gingival grafts [FGGs], subepithelial connective tissue graft, pedicled grafts, lateral and coronal, etc1 FGGs were initially described by Bjorn, in 1963.2 The term FGG was coined by Nabers.3 Since then, they have been used to cover denuded root surfaces, to increase the width and thickness of attached gingiva. The benefits of FGG are its high predictability and relative ease of technique.

In the following manuscript, we are reporting two cases of free gingival graft with respect lower anterior

CASE REPORT

Case 1

A 31-year-old female patient reported to the Department of Periodontology, RUHS- College of Dental Sciences, Jaipur with a chief complaint of progressive downward shifting of gum in lower front teeth region along with tooth sensitivity. There was no obvious medical history.

Clinical examination revealed moderate plaque accumulation, simplified Oral hygiene index score was 1.9. Gingival Recession was Miller's class II with respect to 41. The gingival biotype was thin. The width of attached gingiva was 1mm and had

coronal frenum attachment. The recession noted was 'U' type recession with 4 mm apicocoronal height and 3 mm mesio-distal width. (Figure 1)

Case 2

A 32 years female reported to the Department of Periodontology, RUHS- College of Dental Sciences, Jaipur with a similar chief complaint. There was no obvious medical history.

Clinical examination revealed moderate plaque accumulation, simplified Oral hygiene index score was 2.2 . Gingival Recession was Miller's class II with respect to 31. The gingival biotype was thin and had coronal frenum attachment. The recession noted was 'U' type recession with 3 mm apicocoronal height and 3 mm mesio-distal width. (Figure 2).

PROCEDURE

Preparation of Recipient Site

The purpose of this step was to prepare a firm connective tissue bed to receive the graft. After local anesthesia with 2% lignocaine and intraoral disinfection was done with 0.2 % chlorhexidine mouthrinse. The recessed tooth was planned thoroughly with a Gracey 1-2 curette in both the cases. The site was prepared by with # 15 blade. Horizontal incisions were made in the two interdental papillae adjacent to the recession area to be covered. These incisions were made at the level of the cementoenamel junction and were extended to the line angles of the adjacent teeth. The horizontal incisions were made at a 90degree angle to the gingival surface, creating a well-defined butt joint margin. Two oblique vertical incisions were then placed at the distal ends of the horizontal incisions and were extended beyond the mucogingival line. Periosteum was left covering the bone. A partial thickness flap was elevated and excised apically and a recipient bed measuring 12 mm × 7 mm was prepared.

Root biomodification was done by tetracycline hydrochloride 50 mg/ml for 3 minutes.

Preparation of Donor Site

The graft consists of epithelium and a thin layer of underlying connective tissue. The graft was planned to be retrieved from distal to anterior palatine rugae area with respect to tooth number 24, 25, and 26. Greater palatine nerve block was given using same anesthetic solution as used for the recipient site. Tin foil template of 15×7 mm was placed on the donor site and bleeding points were induced. # 15 blade was inserted to desired thickness at one edge of the graft. The graft was elevated from one edge and was held with tissue forceps. The graft was separated with the blade by lifting it gently. Thus, a graft was obtained from the palate. The underside of graft was checked for any fatty or glandular tissues. The tissue tags and fatty tissues were removed and graft of uniform thickness of about 1.5 mm thickness was prepared using #15 scalpel.

Transfer and immobilize the graft

Excess clot was removed from the recipient site. The graft was positioned and adapted firmly to the recipient site. The graft was secured in the recipient site with interrupted sutures. The graft was completely immobilized.

DISCUSSION

Gingival recession defects create unfavourable contour of the gingival margin and creates an esthetic defect.4

Various mucogingival surgeries have been described for the treatment of gingival recession to maintain an inflammation free area and retain a stable level of attachment for prolonged periods of time.5 FGG accomplish three objectives those are enhances plaque removal around gingiva, improves esthetic and ensure an adequate epithelial seal.6

There are two basic surgical techniques for the free gingival graft for root coverage. The technique proposed by Miller7 is a one-step procedure or the direct approach whereas the other one described by Bernimoulin et al 8 involves two surgical steps and is referred to as the indirect approach. Both the above cases were performed by direct approach.

The survival of the graft depends on the re-storing of an adequate blood supply in its new position. Anything that disturbs the nourishment of the grafted tissue will have a negative impact on its survival. Healing is divided into three phases initial (plasmic circulation) phase, (re)vascularization phase and tissue maturation (organic union) phase.9 Primary root coverage, occurs immediately following grafting, is due to bridging that is persistent of grafted soft tissue on avascular root surfaces, whereas secondary root coverage is due to creeping attachment as described by Goldman. 10

This creeping attachment is a postsurgical migration of the gingival margin in an upward direction, to cover partially or completely previously exposed root surface.

FGG produces significant results and improvements in the recession depth, probing depth, CAL and width of keratinized gingiva. The surgical outcome highly depends on the case selection based on the patient-related and tooth/site-related factors, technical factors, and operator's skill and experience.11

SUMMARY

Successful and predictable root coverage has been reported using free gingival autografts. Despite the fact that other effective root coverage techniques have been developed, the free gingival graft is still the treatment of choice for gingival recession, specially when an increase in the apicocoronal dimension of the keratinized gingival tissues is a desirable treatment outcome in cases with shallow vestibular depth and cases with inadequate gingival tissue where restorations with subgingival margins are to be placed.

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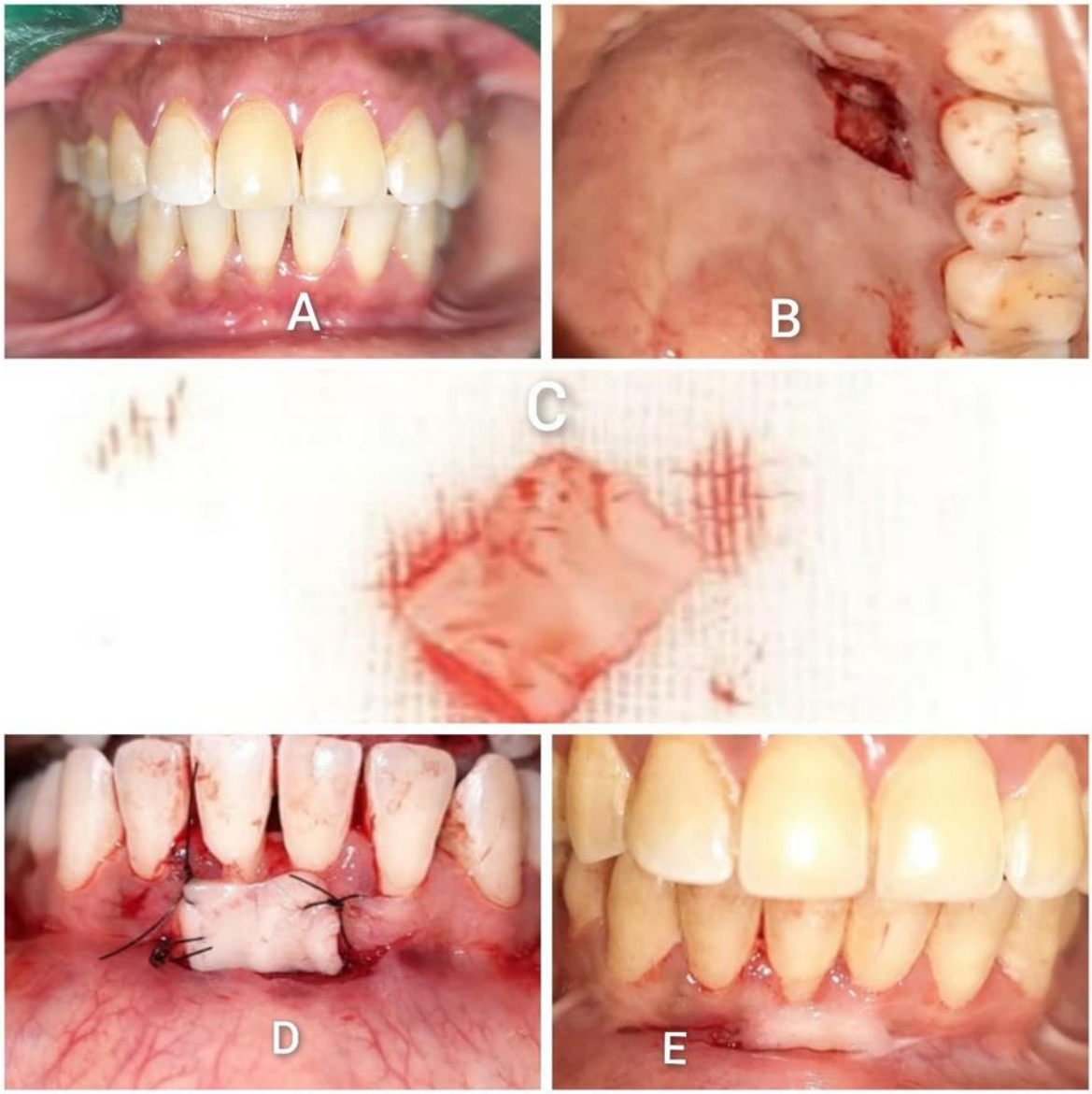

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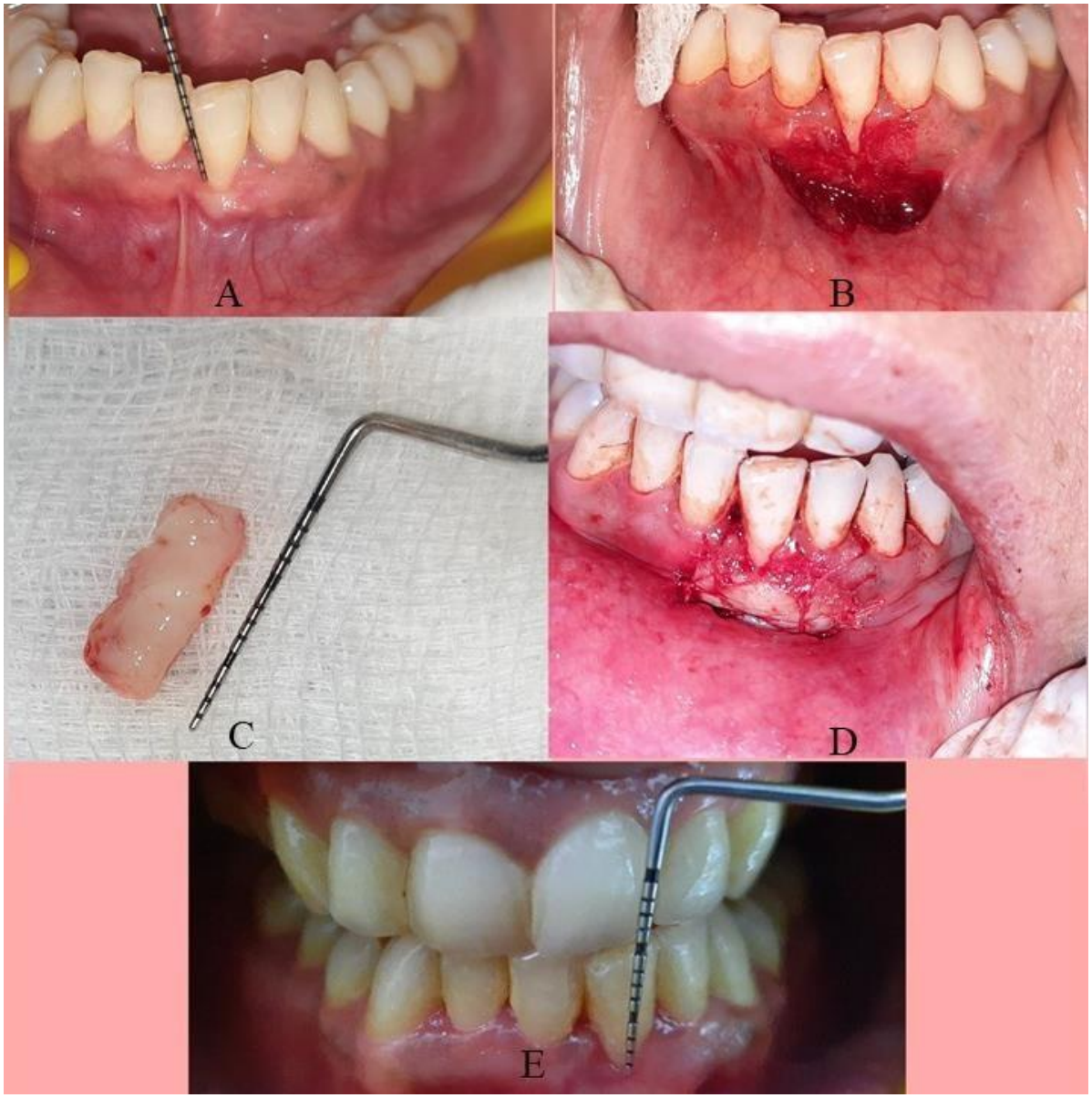

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coronal frenum attachment. The recession noted was 'U' type recession with 4 mm apicocoronal height and 3 mm mesio-distal width. (Figure 1)

Case 2

A 32 years female reported to the Department of Periodontology, RUHS- College of Dental Sciences, Jaipur with a similar chief complaint. There was no obvious medical history.

Clinical examination revealed moderate plaque accumulation, simplified Oral hygiene index score was 2.2 . Gingival Recession was Miller's class II with respect to 31. The gingival biotype was thin and had coronal frenum attachment. The recession noted was 'U' type recession with 3 mm apicocoronal height and 3 mm mesio-distal width. (Figure 2).

PROCEDURE

Preparation of Recipient Site

The purpose of this step was to prepare a firm connective tissue bed to receive the graft. After local anesthesia with 2% lignocaine and intraoral disinfection was done with 0.2 % chlorhexidine mouthrinse. The recessed tooth was planned thoroughly with a Gracey 1-2 curette in both the cases. The site was prepared by with # 15 blade. Horizontal incisions were made in the two interdental papillae adjacent to the recession area to be covered. These incisions were made at the level of the cementoenamel junction and were extended to the line angles of the adjacent teeth. The horizontal incisions were made at a 90degree angle to the gingival surface, creating a well-defined butt joint margin. Two oblique vertical incisions were then placed at the distal ends of the horizontal incisions and were extended beyond the mucogingival line. Periosteum was left covering the bone. A partial thickness flap was elevated and excised apically and a recipient bed measuring 12 mm × 7 mm was prepared.

Root biomodification was done by tetracycline hydrochloride 50 mg/ml for 3 minutes.

Preparation of Donor Site

The graft consists of epithelium and a thin layer of underlying connective tissue. The graft was planned to be retrieved from distal to anterior palatine rugae area with respect to tooth number 24, 25, and 26. Greater palatine nerve block was given using same anesthetic solution as used for the recipient site. Tin foil template of 15×7 mm was placed on the donor site and bleeding points were induced. # 15 blade was inserted to desired thickness at one edge of the graft. The graft was elevated from one edge and was held with tissue forceps. The graft was separated with the blade by lifting it gently. Thus, a graft was obtained from the palate. The underside of graft was checked for any fatty or glandular tissues. The tissue tags and fatty tissues were removed and graft of uniform thickness of about 1.5 mm thickness was prepared using #15 scalpel.

Transfer and immobilize the graft

Excess clot was removed from the recipient site. The graft was positioned and adapted firmly to the recipient site. The graft was secured in the recipient site with interrupted sutures. The graft was completely immobilized.

DISCUSSION

Gingival recession defects create unfavourable contour of the gingival margin and creates an esthetic defect.4

Various mucogingival surgeries have been described for the treatment of gingival recession to maintain an inflammation free area and retain a stable level of attachment for prolonged periods of time.5 FGG accomplish three objectives those are enhances plaque removal around gingiva, improves esthetic and ensure an adequate epithelial seal.6

There are two basic surgical techniques for the free gingival graft for root coverage. The technique proposed by Miller7 is a one-step procedure or the direct approach whereas the other one described by Bernimoulin et al 8 involves two surgical steps and is referred to as the indirect approach. Both the above cases were performed by direct approach.

The survival of the graft depends on the re-storing of an adequate blood supply in its new position. Anything that disturbs the nourishment of the grafted tissue will have a negative impact on its survival. Healing is divided into three phases initial (plasmic circulation) phase, (re)vascularization phase and tissue maturation (organic union) phase.9 Primary root coverage, occurs immediately following grafting, is due to bridging that is persistent of grafted soft tissue on avascular root surfaces, whereas secondary root coverage is due to creeping attachment as described by Goldman. 10

This creeping attachment is a postsurgical migration of the gingival margin in an upward direction, to cover partially or completely previously exposed root surface.

FGG produces significant results and improvements in the recession depth, probing depth, CAL and width of keratinized gingiva. The surgical outcome highly depends on the case selection based on the patient-related and tooth/site-related factors, technical factors, and operator's skill and experience.11

SUMMARY

Successful and predictable root coverage has been reported using free gingival autografts. Despite the fact that other effective root coverage techniques have been developed, the free gingival graft is still the treatment of choice for gingival recession, specially when an increase in the apicocoronal dimension of the keratinized gingival tissues is a desirable treatment outcome in cases with shallow vestibular depth and cases with inadequate gingival tissue where restorations with subgingival margins are to be placed.

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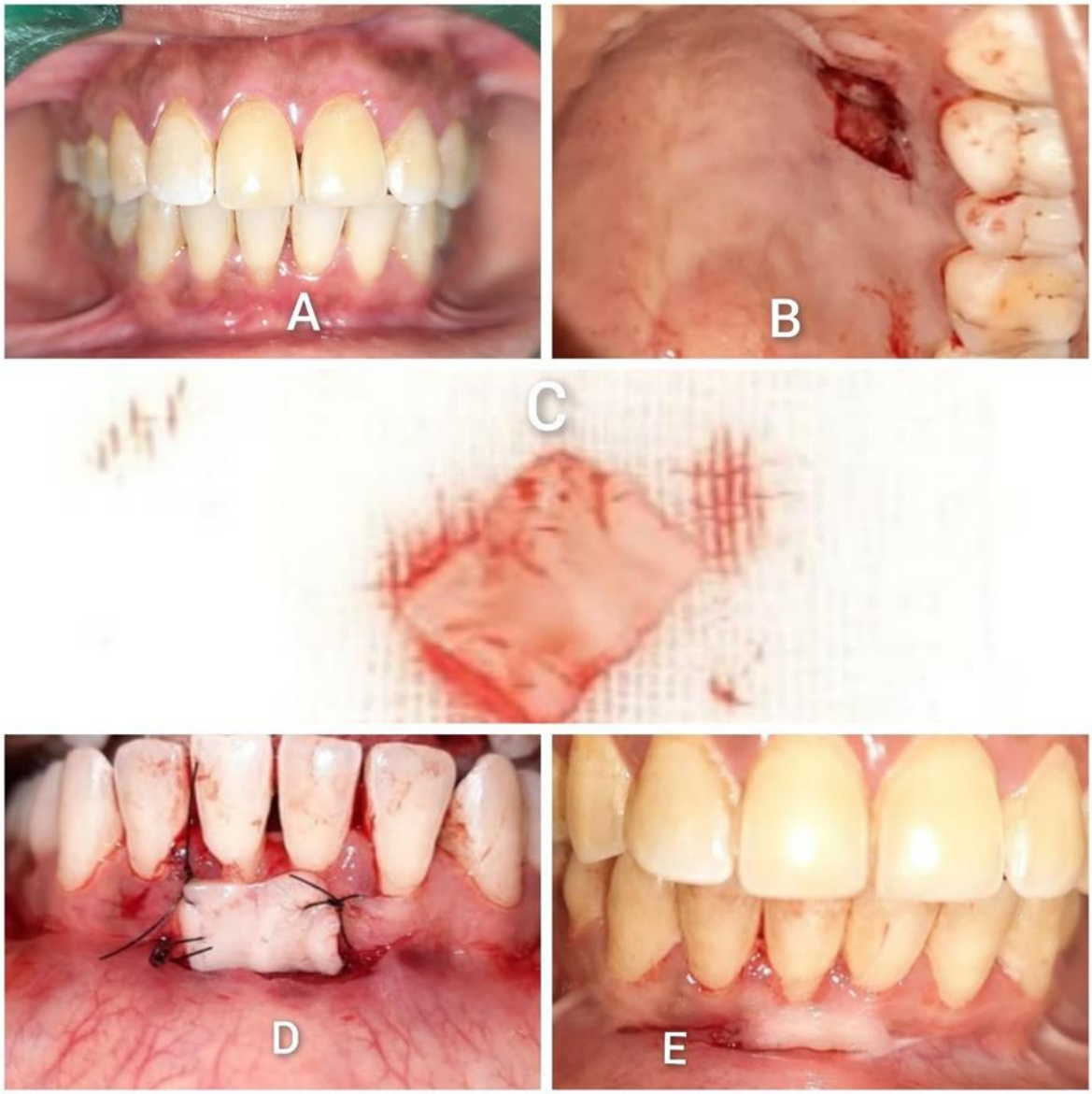
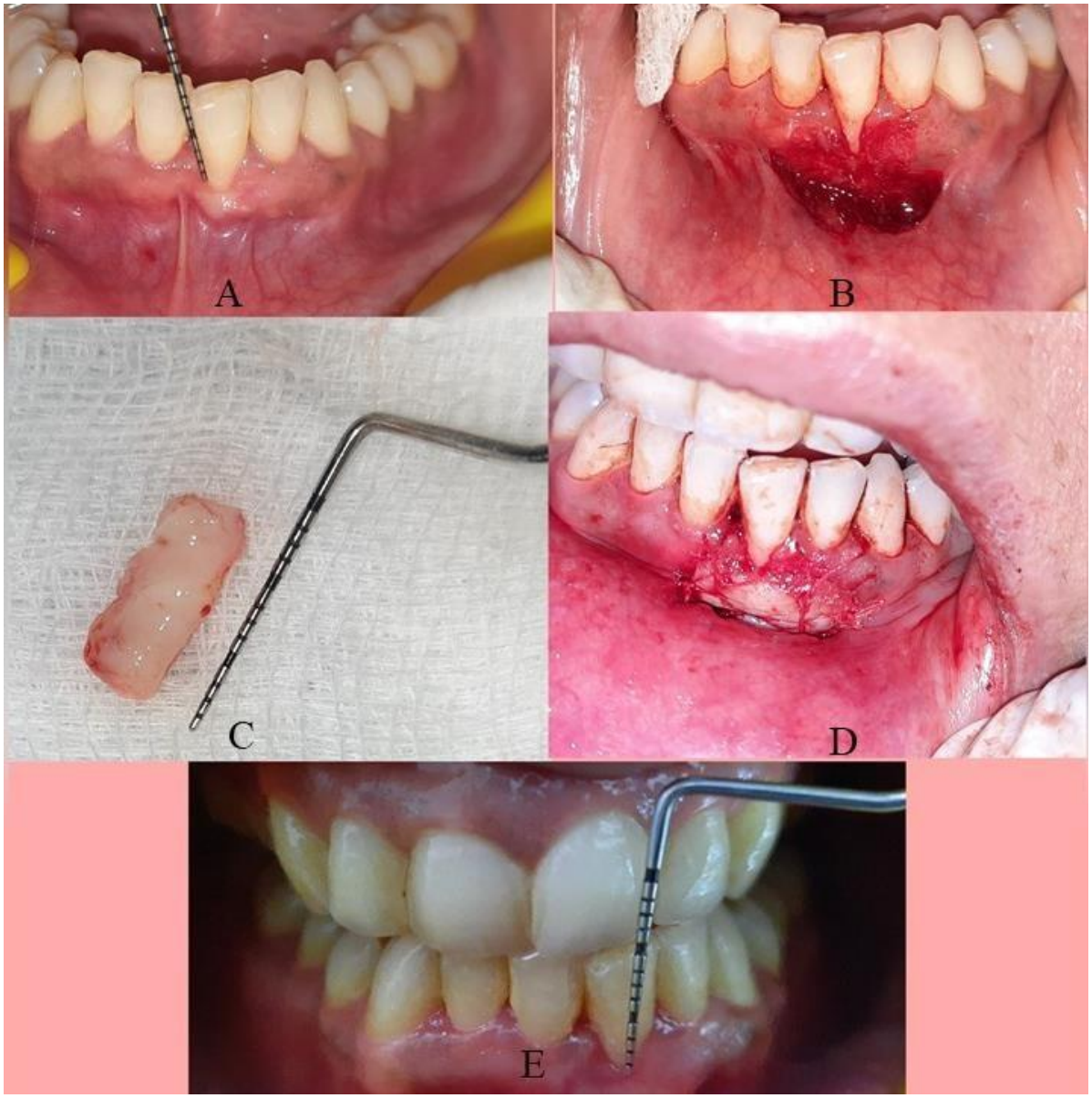
CASE 1



CASE 2



Assessment of Influence of Soft Tissue Compensation in Patients with Facial Asymmetry: Photographic and Frontal Cephalometric Study

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Abstract

Introduction: Imbalances in facial areas can be noted as facial asymmetry which can be measured directly on face and indirectly with the help of photographs.

Aim: The aim of this study was to assess the contribution of soft tissue components compensating underlying skeletal imbalances in patients with facial asymmetry compared to the symmetrical or moderately symmetrical faces.

Material and Method: Frontal facial photographs and postero-anterior cephalograms were taken for 45 patients and divided into 3 groups viz- no asymmetry, moderate facial asymmetry and severe facial asymmetry. Soft tissue landmarks were identified on photographs and hard tissue landmarks were identified on PA cephalogram and measurements were subjected to statistical analysis.

Results: The result showed that patients with severe facial asymmetry had more degree of skeletal asymmetry as compared to soft tissue asymmetry.

Conclusion: soft tissue compensates for hard tissue asymmetry.

Key words: Frontal facial photographs, Postero-anterior cephalograms, facial asymmetry

INTRODUCTION

Symmetry refers to a sense of harmonious and beautiful proportion and balance. Facial symmetry and asymmetry are of prime importance in judging the face to be attractive or unattractive. The art of facial beauty, the symmetry and the asymmetry related to it, are an important part of field of the art, plastic surgery, orthognathic surgery, orthodontics and psychology.[1] Imbalance in facial areas can be noted in the amount or difference of left and right side of face.[2] Both side of face should coincide with each other in size, shape and volume with respect to the mid-sagittal plane if the face is symmetrical.[3] Asymmetry is seen in faces where the bilateral structures are not equidistant from the mid-sagittal plane.[4] Asymmetry either can be measured directly by taking the measurement on the face i.e., anthropometry or indirectly by measuring on the photographs.[5] Asymmetry can be noted and measured using different radiographic views like the lateral cephalograms, the panoramic radiographs, sub mento-vertex view, the postero-anterior cephalogram and the computed tomographic view.[6] In this study we investigated the imbalance of faceby comparing frontal photographs with postero-anterior cephalograms.

AIMS AND OBJECTIVES

The aims and objectives of this study were to assess the relationship between soft tissue asymmetry and bone tissue asymmetry using photographs and postero-anterior cephalograms and to investigate the contribution of soft tissue components compensating underlying skeletal imbalances.

MATERIALS AND METHODS

Patients who reported to the Department of Orthodontics,Mahatma Gandhi Dental College and Hospital for undergoing orthodontic treatment were included in the study. Postero-anterior cephalogramsand Frontal photographs of the patients were taken as a part of pretreatment records. Prior consent was taken from patient.

Postero-anteriorcephalograms were taken in postero-anterior projection with a distance of 5 feet between the X-ray focus and the films. Postero-anterior cephalograms were printed on films with a 1.15 magnification using a Kodak 8000C Digital panoramic and cephalometric system. (Figure 1,2,3)

Figure 1, 2: OPG and Lateral Cephalogram Machine and A Patient for Recording PA Ceph

Figure 3: P A Cephalogram

Facial photographs were taken using a digital single-lens reflex with a distance of 1.5m between the patients and focus. The patients were seated in an upright position on a chair with natural head position. (Figure 4,5).

Figure 4, 5: Canon Camera for Facial Photograph and Patients Frontal Photograph Showing Facial Asymmetry

Inclusion Criteria

1. No congenital abnormalities in maxillofacial region.
2. No prior surgery or injury involving maxilla or mandible.
3. Patients with permanent dentition.

Exclusion Criteria

1. Patients undergoing orthodontic treatment.
2. Prior surgery involving maxillofacial region.
3. Having congenital abnormalities in maxillofacial region.

100 standardized facial frontal photographs were screened and 45 photograph with little or no facial asymmetry, moderate facial and severe facial asymmetry were chosen. Final sample consisted of 45 photographs. 5 orthodontist from Dept. of Orthodontics and Dentofacial Orthopedics of Mahatma Gandhi Dental College and Hospital judged and selected 45 photographs and classified them in three groups.

Group One - with little or no facial asymmetry, **Group Two** - with moderate facial asymmetry, **Group Three** - with severe facial asymmetry.

Photographic and postero-anterior cephalometric measurements were recorded and correlated using statistical methods. These are some planes and index used for analysis.

S.No	Reference Line	Definition
1.	**Midsagittal Reference Line**	The line passing from Glabella to Sub-nasale.
2.	**Horizontal Reference Line**	The line perpendicular to the midsagittal line passing through the midpoint of both pupils.
3.	**Gonion Canting**	Deviation of Gonion (Go) point from Horizontal reference line.
4.	**Chin Deviation**	Deviation of the Menton (Me) point from the midsagittal reference line.
5.	**Asymmetry Index for Vertical Go (%)**	The ratio of right and left vertical Go´ length.
6.	**The Asymmetry Index for Horizontal Go (%)**	The ratio of right and left horizontal Go' length

Reference Plane and Index for Photographic as well as PA Ceph Analysis

The soft-tissue landmarks used in this study were taken the same as proposed by Farkas and hard tissue land marks were the same as suggested by Grummons. To assess the influence of soft tissue camouflage on hard tissue four common landmarks were gonion canting, chin deviation, asymmetric index horizontal, asymmetric index vertical was measured from asymmetry on frontal photographs and postero-anterior cephalograms.

Statistical Analysis

Software used for statistical analysis was-- IBM SPSS 23.0. Student t- test was used for comparison of soft tissue and hard tissue of group 1, group 2 and group 3. ANOVA one way test was used for comparison between group 1,group 2and group 3.Post hoc test was used to compare multiple components of different variables of group 3 with group1 and group 2.

RESULTS

The present study was conducted on 45 subjects which were divided in group one for symmetry subjects, group two for average subjects, group three for asymmetry subjects. The frontal facial photograph and postero-anterior cephalogram of patients were taken. The data so obtained was subjected to statistical analysis to achieve a correlation between soft tissue and skeletal imbalance and comparison between group 1, group 2, group 3 for soft tissue and hard tissue land marks. The results showed statistically significant differences between the soft and hard tissue parameters in all the 3 groups (Table 1 a, b and c). Intergroup comparison showed statistically significant variation between group 3 and group 1 and 2. Comparison of soft tissue land marks including gonion canting, chin deviation, asymmetry index horizontal and asymmetry index vertical of asymmetry group 3 with symmetry and average group and the result showed soft tissue discrepancy as well as skeletal discrepancy more in group 3 (Table 2a, and 2b). Group three had more degree of skeletal asymmetry as compared to soft tissue asymmetry, suggesting that soft tissue compensate for hard tissue asymmetry.

GROUP 1

		Mean	N	Std. Deviation	Std. Error Mean	P-Value
Pair 1	**Gonion Canting Soft Tissue**	.633	15	.5164	.1333	.001
	Gonion Canting Hard Tissue	1.267	15	.4952	.1279	
Pair 2	**Chin Dev Soft Tissue**	.533	15	.5164	.1333	.001
	Chin Dev Hard Tissue	1.167	15	.4880	.1260	
Pair 3	**Asymmetric Index Horizontal Soft Tissue**	1.7513	15	.52371	.13522	.001
	Asymmetric Index Horizontal Hard Tissue	2.7180	15	.61804	.15958	
Pair 4	**Asymmetric Index Vertical Soft Tissue**	2.3040	15	.80393	.20757	.001
	Asymmetric Index Vertical Hard Tissue	2.9993	15	.91955	.23743	

GROUP 2

		Mean	N	Std. Deviation	Std. Error Mean	P-Value
Pair 1	**Gonion Canting Soft Tissue**	1.100	15	.6036	.1558	.000
	Gonion Canting Hard Tissue	1.867	15	.4806	.1241	
Pair 2	**Chin Dev Soft Tissue**	.367	15	.4419	.1141	.000
	Chin Dev Hard Tissue	1.200	15	.3684	.0951	
Pair 3	**Asymmetric Index Horizontal Soft Tissue**	2.8967	15	1.51145	.39025	.000
	Asymmetric Index Horizontal Hard Tissue	4.0180	15	1.50490	.38856	
Pair 4	**Asymmetric index Vertical soft tissue**	2.6033	15	1.28285	.33123	.005
	Asymmetric index Vertical hard tissue	3.7300	15	1.79707	.46400	

GROUP 3

		Mean	N	Std. Deviation	Std. Error Mean	P-Value
Pair 1	**Gonion Canting Soft Tissue**	2.300	15	1.2071	.3117	.015
	Gonion Canting Hard Tissue	3.467	15	1.2882	.3326	
Pair 2	**Chin Dev Soft Tissue**	2.067	15	1.1629	.3003	.000
	Chin Dev Hard Tissue	3.000	15	1.1952	.3086	
Pair 3	**Asymmetric Index Horizontal Soft Tissue**	5.1373	15	2.30017	.59390	.003
	Asymmetric Index Horizontal Hard Tissue	6.9700	15	2.87610	.74261	
Pair 4	**Asymmetric Index Vertical Soft Tissue**	5.4973	15	3.99464	1.03141	.002
	Asymmetric Index Vertical Hard Tissue	7.5933	15	4.28796	1.10715	

Table 1 (a, b, c): Comparison between Soft Tissue and Hard Tissue Land Marks in 3 Groups

SOFT TISSUE

Dependent Variable			Mean Difference (I-J)	P-Value
Gonion Canting Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	1.6667*	.001
		Average Group 2	1.2000*	.001
Chin Dev Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	1.5333*	.001
		Average Group 2	1.7000*	.001
Asymmetric Index Horizontal Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	3.38600*	.001
		Average Group 2	2.24067*	.001
Asymmetric Index Vertical Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	3.19333*	.003
		Average Group 2	2.89400*	.007

HARD TISSUE

Dependent Variable			Mean Difference (I-J)	P-Value
Gonion Canting Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	2.2000*	.001
		Average Group 2	1.6000*	.001
Chin Dev Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	1.8333*	.001
		Average Group 2	1.8000*	.001
Asymmetric Index Horizontal Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	4.25200*	.001
		Average Group 2	2.95200*	.001
Asymmetric Index Vertical Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	4.59400*	.001
		Average Group 2	3.86333*	.001

Table (2a, 2b): Comparison of Soft Tissue and Hard Tissue Variables of Group 3 With Group 2 and 1

* The mean difference is significant at the 0.05 level.

DISCUSSION

Perfect bilateral symmetry seldom exists in living organisms. The facial symmetry is considered as the prime requisite for the esthetically pleasing faces. Always right and left side differences are present in nature. These slight facial asymmetries are acceptable esthetically. However, significant asymmetry may cause functional as well as esthetic problems.

In this study 45 subjects were selected by panel of five orthodontists to divide them in to three groups to remove any bias. Photographic and radiographic standardization were used for the subjects involved in this study.

Previous studies have usedpostero-anterior cephalograms to assess facial asymmetry in subjects.[7,8]Some studies were undertaken only for mandible using facial photograph and postero-anterior cephalogram.[9]Some studies were done in subjects with facial asymmetry but having skeletal symmetry.[10]So, the aims and objectives of our study were to assess the relationship between soft tissue asymmetry and bone tissue asymmetry using photographs and postero-anterior cephalograms and to investigate the contribution of soft tissue components compensating underlying skeletal imbalances.

In our study, soft tissue land marks were compared to hard tissue land marks in all 3 groups (Table 1 a, b and c) and result showed that skeletal discrepancy is more than soft tissue discrepancy. In group 3 with severe facial asymmetry this discrepancy was highly significant. Comparison of soft tissue land marks including gonion canting, chin deviation, asymmetry index horizontal and asymmetry index vertical of asymmetry group 3 with symmetry and average group was done and the result showed soft tissue discrepancy as well as skeletal discrepancy more in group 3 (Table 2a, and 2b). These results correlated with the study done using postero-anterior cephalogram by **Shah M et al.[11]**

The study assessed the relationship between soft tissue asymmetry and bone tissue asymmetry using the standardized photographs and the postero-anterior (PA) cephalometric radiographs. Severity of skeletal asymmetry is often masked by compensatory soft tissue contributions,our result showed statistically significant contribution of soft tissue compensation to camouflage skeletal asymmetry and these findings are the same as the studydone by **Lee SM et al[12],Lee et al[9]**and **NaoyaMasuoka etal.[10]**

Haraguchi et al[13]and Farkas et al[14]found that people considered to have symmetry and harmony in clinical examination were found to have some facial asymmetry in radiographic examinations in Class III. The results of our study were coinciding with the study of **Ferrario et al[15] and Haraguchi et al[13]** but our study did not consider any specific malocclusion.

The limitation of the present study was that it was carried out on a small sample of patients. Future studies can be carried out on an increased sample size.

CONCLUSIONS

Within the limitation of the study, following conclusions can be drawn:

- There is relationship between soft tissue component and skeletal component of facial asymmetry subjects.
- Assessment of facial asymmetry subjects using frontal photographs and skeletal asymmetry using postero-anterior cephalograms clarified that there is difference between soft tissue asymmetry and skeletal asymmetry of same subject. Skeletal asymmetry is greater than soft tissue asymmetry and soft tissue components compensate underlying skeletal imbalance.

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Comparative Evaluation of Effect of Resinbased, Calcium Hydroxide - Based and Bioceramic - Based Root Canal Sealers on Postoperative Pain

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Abstract

Aims: The aim of this in-vivo study is to compare and evaluate the effect of AH Plus, Sealapex and MTA Fillapex on postoperative Pain.

Material and Method: 60 patients requiring root canal treatment on 60 single rooted teeth with irreversible pulpitis were randomly divided into 5 Groups: **Group-I:** (n=20) AH Plus (Dentsply) Root Canal Sealer Group **Group-II:** (n=20) MTA Fillapex (Angelus) Root Canal Sealer Group **Group-III:** (n=20) Sealapex (Kerr Sybron Endo) Root Canal Sealer Group Patients were recalled at 6 hours, 12 hours, 24 hours, 48 hours and 72 hours to evaluate the postoperative pain in treated tooth.

Result: There was a statistically non significant difference seen for the values of Visual Analogue Scale between the groups ($p>0.05$) at all time intervals.

Conclusion: Within the limitation of present in vivo study, in all three groups, post endodontic pain represented with highest values after 6 hours of treatment, moderate pain after 12 hours, mild after 24 hours, trivial after 48 hours and reduced to almost nil after 72 hours.

INTRODUCTION

Modern endodontics offers advancements in technologies, procedures and materials, giving you many treatment options to save your natural teeth.1 Post-operative pain is defined as pain of any degree that occurs after initiation of root canal treatment.[2] The causes of postoperative pain can be classified as mechanical, chemical and/or microbiological injuries to the peri-radicular tissues. Factors identified that contribute to post-operative pain after single- visit root canal treatment consist of the following: age, sex, tooth type or location,

preoperative pain, periapical radiolucency, pulpal status, prophylactic drug, anesthetic agent, working length method, instrumentation, irrigation, use of lasers, obturation technique, occlusal reduction, postoperative drug, and operator.[3]

Number of treatment related parameters associated with the presence of postoperative pain, including working length (WL) estimation with an apex locator connected to every file, the number of visits, the choice of instrumentation, and the choice of root canal sealer. [4,5,6,7]

Sealers placed in the root canals interfere with periodontal tissues through the apical foramina, lateral canals, or leaching and can potentially affect the healing process in the periodontium.8 Therefore, it can be expected that root canal sealers may stimulate an inflammatory response and activate sensory neurons.[9,10,11] Thus, the local inflammation caused by root canal obturation materials may result in postoperative pain. The intensity of inflammatory reactions depends on a number of different factors, including the composition of the sealer.8

The un-polymerized residues remain due to formation of oxygen inhibition layer in the mixture of AH Plus sealer, which is responsible for maintaining its toxic effect.[12]

Sealapex is one of calcium hydroxide based root canal sealer. Sealapex show pain due to cytotoxic potential. After setting Sealapex becomes unstable and disintegrates.[13]

MTA Fillapexcomes in contact with water, CaO present in it can be converted into and calcium hydroxide dissociated into Ca+2 and OH-. The diffusion of hydroxyl ions from the root canal increases the pH at the surface of the root, possibly interfering with osteoclastic activity and promoting alkalization in the adjacent tissues, which favors healing.[14]

Aim

The aim of this in-vivo study is to compare and evaluate the effect of AH Plus, MTA Fillapex and Sealapex sealers on postoperative Pain.

Objectives of the Study

The objective of this study is to record post-operative pain on a Visual Analogue Scale after single visit root canal treatment in single rooted mandibular premolars.

Materials and Methods

The present study titled “Comparative Evaluation of Effect of Resin-based, Calcium Hydroxide-based and Bioceramic-based Root Canal Sealers on Postoperative Pain" was carried out in the Department of Conservative Dentistry and Endodontics, RUHS College of Dental Sciences, Jaipur.

The institutional ethical clearance was obtained. A comparative study was carried out in 60 patients requiring root canal treatment on 60 single rooted teeth with irreversible pulpitis.

INCLUSION CRITERIA:

Selection of Teeth for the Study are:

- Carious, exposed and symptomatic single rooted teeth.
- Sign and symptoms consistent with irreversible pulpitis.
- A sharp and lingering pain on thermal stimulus.
- Vital pulp.

EXCLUSION CRITERIA:

- Patients who are taking non-steroidal anti-inflammatory drug or corticosteroid prior to time of treatment
- Teeth with calcified canal
- Grossly decayed teeth where rubber dam isolation is difficult
- Periodontally compromised teeth
- Medically compromised patient (with immunosuppressive/ systemic diseases, patient on medication)

Selected patients were randomly divided into three groups of 20 patients each:

Group-I: (n=20) AH Plus (Dentsply) sealer group

Group-II: (n=20) MTA Fillapex (Angelus) sealer group

Group-III: (n=20) Sealapex (Kerr Sybron Endo) sealer group

Patients were recalled at 6 hours, 12 hours, 24 hours, 48 hours and 72 hours to evaluate the postoperative pain.

Armamentarium and material used in study are as follows:

- Explorer (GDC)
- Tweezers (GDC)
- RVG machine (KODAK 5200)
- Rubber dam (GDC Dental Dam)
- Barbed Broaches (Mani, Inc, Japan)
- ISO 0.02 taper files (Mani, Inc, Japan)
- Lantulo Spiral (Mani, Inc, Japan)
- Neo endo Flex files (Orikam Health Care)
- lidocaine 2% with 1:200000 epinephrine (Alves Healthcare Pvt Ltd., India)

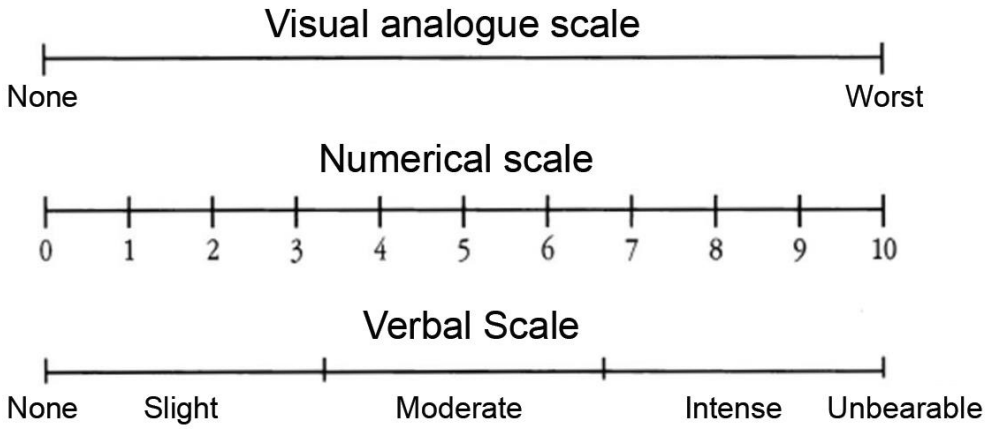
- 3% Sodium hypochlorite (Neelkanth, Orthodent Pvt. Ltd.)
- 30-G side vented needle (Orikam Health Care)
- Endomotor (X-MART, DentsplyMaillefer, Ballaigues, Switzerland)
- Electronic apex locater (I ROOT, META SYSTEM)
- Paper point (Millimeter Marked, DiaDent, Korea)
- GP Points 15-40 (Meta Biomed Co. Ltd., Korea)
- GP Point 0.04 and 0.06 (Dentsply, Mallifer, India)
- AH Plus sealer (Dentsply, Maillefer, Switzerland)
- MTA Fillapex sealer (Angelus, Londrina, Brazil)
- Sealapex sealer (Kerr Sybron Endo, USA)
- 17% EDTA (Prime Dental Pvt. Ltd., India)

METHODOLOGY

Oral and written informed consent was obtained from the patients for study and understood the need to attend follow up sessions.

Visual Analogue Scale (VAS)

The Visual Analogue Scale (VAS) included a 10 cm straight horizontal line numbered at each centimetre with following criteria;0, no pain; 1-3, mild pain; 4-6, moderate pain; 7-9, severe pain and 10, the worst pain experienced.



Clinical Procedure:

- All 60 patients were treated in single visit to minimize the number of procedure and potential effect of intracanal medication.
- Preoperative Visual Analogue Scale (VAS) score was taken from patients.
- The standard procedure for all groups was infiltration of local anaesthetics (2% lidocaine with 1:200000 epinephrine), rubber dam application was done and access preparation made in conservative manner.
- After the access cavity preparation, pulp chamber was flooded with 3% NaOCL solution.
- A fine barbed broach was used for extirpation of pulpal tissue. Coronal shaping and enlargement was performed 30/0.08 % Neoendo Flex Files to obtain straight line access to the apical third of each root. The canals were irrigated with 2 ml 3% NaOCL using 30- G side vented needle after each file.
- The working length was determined with K-file from a coronal reference point to a distance 0.5-1 mm short of the radiographic apex i.e apical constriction with the aid of radiovisiogarphy and i-ROOT Electronic Apex Locator. The instrumentation was carried out using hand K-files and Neoendo Flex Files. The files were driven by an endodontic motor (DENTSPLY MAILLEFER'sX-SMART) and used with a continuous brushing motion according to the manufacturer's instructions. Canal patency was maintained by passing a #10 no. stainless steel file approximately 0.5-1.0mm beyond the working length. Final irrigation was performed with each solution (ie, 2.0 mL NaOCl,2.0 mL 17% EDTA, and 2.0 mL NaOCl per canal).

Root Canal Obturation

Following the completion of biomechanical preparation obturation was done.

In Group-I obturation was done using AH Plus sealer and gutta-percha.

In Group-II obturation was done using MTA Fillapex sealer and guttapercha.

In Group-III obturation was done using Sealapex sealer and guttapercha.

After drying with paper point, a small amount of sealer was introduced into canal with paper point. A gutta-percha point was adapted and canal was obturated by cold lateral condensation technique. The coronal cavity was sealed by direct composite restoration and post obturation RVG image was taken.

Fig1: AH Plus Root Canal Sealer

Fig2: MTA Fillapex Root Canal Sealer

Fig3: Sealapex Root Canal Sealer

Assessment of Postoperative Pain

The primary study outcome was postoperative pain. Each patient received a Visual Analogue Scale (VAS) to record pain intensity at 6 hours, 12 hours, 24 hours, 48 hours and 72 hours. The patient was asked to mark his or her perceived postoperative pain level on the line. The patients was contacted at 5 consecutive time period to record pain scores.

Follow up and Evaluation Criteria:

- The patients were instructed to report immediately in case of unbearable pain or swelling.
- Patient were also asked to report prior of intaking any analgesic in case of severe pain.
- For follow up patients were recalled after 6 hours, 12 hours, 24 hours, 48 hours, 72 hours and there post-operative pain was revaluated on the basis of VAS score.

RESULT

In all three groups, post endodontic pain represented with highest values after 6 hours of treatment, moderate pain after 12 hours, mild after 24 hours, trivial after 48 hours and reduced to almost nil after 72 hours. In an intergroup comparison, at all-time intervals, the mean value of pain scores among three groups were not statistically significant ($p>0.05$). (Table: 2)

Statistical Procedures

- Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States).
- Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM).
- Descriptive Mean & SD for numerical data was depicted.

Inter group comparison (>2 groups) was done using Kruskall Wallis ANOVA followed by pair wise comparison using Mann Whitney U test.

For all the statistical tests, $p<0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.

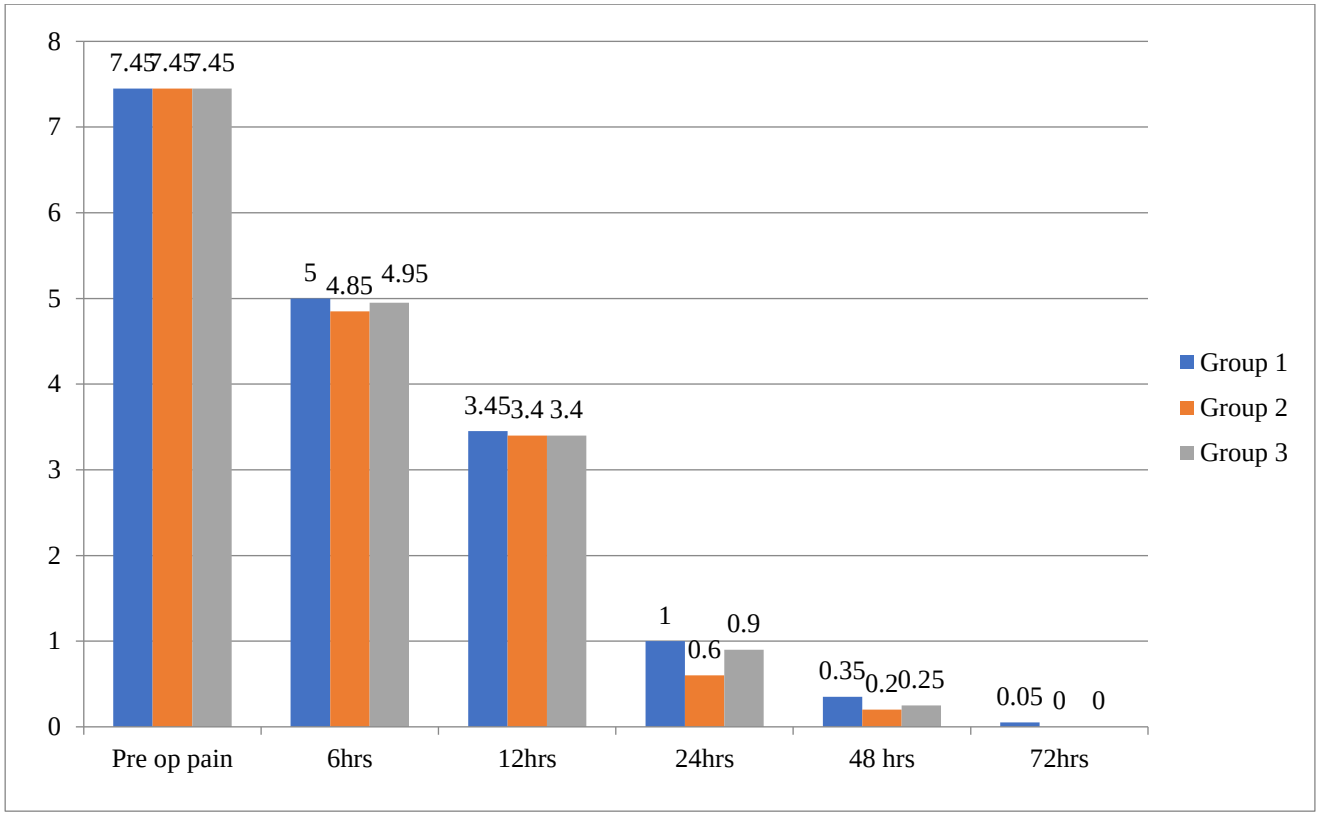
Table 1: Comparison of Mean Pain Scores between Patients in both the Groups

Time (Hours)	Mean±SD		
	Group 1 (n=20)	Group 2 (n=20)	Group 3 (n=20)
Pre-Operative Pain	7.45±1.191	7.45±1.191	7.45±1.191
6	5±1.124	4.85±0.875	4.95±0.999
12	3.45±0.999	3.40±0.821	3.40±0.833
24	1.00±1.076	0.60±0.883	0.90±1.071
48	0.35±0.587	0.20±0.410	0.25±0.444
72	0.05±0.224	0.00±0.000	0.00±0.000

SD - Standard Deviation

Table 2: Intragroup and Intergroup Comparison of VAS Pain Scores among the Groups with the Mean, Median and Standard Deviation

Groups	VAS preop	VAS 6 Hours	VAS 12 Hours	VAS 24 Hours	VAS 48 Hours	VAS 72 Hours	P of Intra Group Comparison	Wilcoxon Signed Rank Test for Pairwise Comparison
Group 1 (n=20)								
Mean	7.45	5.00	3.45	1.00	0.35	0.05	.000**	6hr, 12 hr, 24hr, 48 hr, 72hr
Standard Deviation	1.191	1.124	0.999	1.076	0.587	0.587		
Median	7.5	5	3.5	1	0	0		
Group-2 (n=20)								
Mean	7.45	4.85	3.40	0.60	0.20	0	.000**	6 hr, 12hr, 24h, 48hr, 72hr
Standard Deviation	1.191	0.875	0.821	0.883	0.410	0		
Median	7.5	5	3	0	0	0		
Group-3 (n=20)								
Mean	7.45	4.95	3.40	0.90	0.25	0	.000**	6hr,12hr,24h, 48hr,72hr
Standard Deviation	1.191	0.999	0.833	1.071	0.444	0		
Median	7.5	5	3	0	0	0		
P of Inter Group Comparison	1.000#	0.888#	0.970#	0.442#	0.725#	0.368#		



Graph1: Comparison of VAS scale between the groups

DISCUSSION

The basic biological rationale for achieving ultimate success with root canal treatment consists primarily of eliminating microorganisms from the entire root canal system and creating an environment that is most favorable for healing.15

Post endodontic pain most often occurs during the first 24 to 48 hours after obturation. The incidence of post endodontic pain was reported to range from 3-58%.16 The pain could be initiated by biological (microorganisms) or non-biological (chemical or mechanical) factors.17 Mechanical factors, including over instrumentation or extrusion of root filling material, have been associated to the presence of postoperative pain suggesting that root canal instrumentation and obturation techniques may influence postoperative pain.18,19

Microbial factors like, preexisting infection, apical extrusion of infected debris, incomplete bio-mechanical debridement of the root canal and secondary intra-radicular infection can lead to postoperative pain with endodontic therapy.

Chemical factors like irrigation solutions, intracanal medicaments and sealers are used within root canal. They invariably contact the periapical tissues can cause postoperative pain or flare ups.

Endodontic sealers may release chemical irritants during the setting process and may induce local inflammation in the periapical region.20,21 Biochemical mediators such as reactive oxygen species (ROS) and oxidative stress are strongly correlated with inflammatory pain.22 In an in Discussion 46 vitro study, reactive oxygen species (ROS) production increased 4–7-fold when human pulp cells were exposed to root canal sealers.23

In the present study, a 10-cm Visual Analogue Scale was used to assess pain. Two equally sized intervals on a Visual Analogue Scale are always interpreted as two equally sized differences by respondents. This makes it possible to calculate the arithmetic mean. 24

A complete sealing of the root canal system after cleaning and shaping is critical for a successful endodontic treatment.25 Root canals are traditionally filled with gutta-percha cones and a root canal sealer.26,27The present study aimed to evaluate postoperative pain following their use (MTA Fillapex) compared with a resin-based (AH Plus) and calcium hydroxide root canal sealer (Sealapex). In a recent clinical study, no significant difference was observed between the resin-based sealer (AH plus) and a bioceramic sealer (Total Fill)

in terms of postoperative pain after single-visit root canal treatment.28

Among all the sealers, AH Plus was associated with the highest pain intensity post 12 hr evaluation. This signifies the increased toxic effect of AH Plus sealer then Sealapex. AH Plus contains both epoxy resins and amines which have toxic effect.29Increase in cytotoxicity as time progressed might be due to the volatilization of formaldehyde during the hot incubation or setting process of the AH Plus sealer.30

In Sealapex group, severe pain was experienced by three patients at 6 hr and five patients at 12 hr interval. This can be correlated to its cytotoxic potential. Sealapex after setting becomes unstable and disintegrated.31Its cytotoxicity is due to components Calcium Hydroxide itself because of its high pH.32

In an initial period MTA Fillapex was more irritating to bone tissue than AH Plus and did not improve bone tissue repair.33The severe toxicity of MTA Fillapex may be attributed to the presence of resinous components, mainly salicylate resin.34

The results of the present study reported that the Postoperative pain with the use of AH Plus sealer, MTA Fillapex and Sealapex is statistically nonsignificant.

CONCLUSION

Within the limitation of present in vivo study, it can be concluded:

1. Post-operative pain was present in almost in all the patient after single visit root canal treatment; in the range of trivial to severe.
2. AH plus, MTA Fillapex and Sealapex sealers were not significantly different in terms of the severity of postoperative pain after single visit root canal treatment.

Future studies are needed because there are few studies investigating the effect of bioceramic sealer type on postoperative pain.

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A Clinical Study to Compare the Condylar Guidance Measured By the Conventional Method and CBCT

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Abstract

Condylar guidance is the mandibular guidance generated by the condyle and articular disc traversing the contour of glenoid fossa. The angle formed by the path of the condyle, within the horizontal plane compared with the median plane is the Horizontal condylar guidance. Recording condylar guidance accurately is essential for the success of a prosthesis. The present clinical study was conducted to evaluate the relationship between sagittal condylar guidance obtained by cone beam computed tomography imaging modality and two different clinical methods through extraoral tracer at the time of jaw relation and interocclusal wax records at the time of try-in, and to compare difference between right and left condylar guidance angles within the same subject. Within the limitations of the study it was observed that the condylar guidance value/angle is influenced by the stage at which the record is made. The condylar guidance value/angle obtained from the radiographs was higher than those obtained during jaw relation and try-in. However, the mean condylar guidance values recorded during try-in were nearer to the mean condylar value recorded on radiograph.

Keywords: Horizontal condylar guidance, Sagittal condylar guidance, Cone beam computed tomography, Try in, Extraoral tracers.

INTRODUCTION

Prosthetic rehabilitation depends a lot on restoring what is lost, and every attempt is made to rehabilitate them back to natural function. A successful treatment not only depends on accurate findings, but also depends on exact replication and recording of these findings. Studies of the condylar mechanism and attempts to register mandibular movement date back to the late 18th century. The goal for such recording of movements is to re-establish the patient's occlusion and mandibular movement patterns as precisely as possible on articulator [1]

Mandible is the only part capable of independent motion in the Stomatognathic system. It is vital to simulate the similar mandibular movements on the articulator while fabricating a prosthesis. The mandibular movement can be titled as condylar movement. In restorative as well as prosthodontic treatment the mandibular movements recording become essential as they influence cusp angles and for making of complete denture to provide balanced occlusion in it.[2,3] 'Condylar guidance is the mandibular guidance generated by the condyle and articular disc traversing the contour of glenoid fossa.

It is also defined as the mechanical form located in the upper posterior region of an articulator that control movement of its mobile member (GPT-9).[4]'The angle formed by the path of the condyle, within the horizontal plane compared with the median plane is the Horizontal condylar guidance.

Difficulties faced while recording the protrusive and lateral interocclusal records are cumbersome as the record base in many instances becomes loose and unstable. The patient's inability to hold the mandible while these records were made due to the absence of periodontal proprioceptors, make such records erroneous and fallacious in many instances[5]Literatures[6-8] indicate the use of radiograph for recording the condylar guidance. Panoramic radiograph is used commonly for the diagnosis in completely edentulous patient. In Prosthodontic field, Cone Beam Computed Technology (CBCT) has brought revolution especially in area of maxillofacial imaging. Gilboa et al [8], studied dry human skulls and evaluated the outline of the articular eminence and the glenoid fossa of the temporal bone on panoramic radiographs and suggested to be of valuable aid in determining condylar guidance angle in semi-adjustable articulators. This study was done to compare the inclination of the condylar path obtained by panoramic radiograph and protrusive interocclusal records in completely edentulous patients.

Usually Horizontal condylar inclination (HCI) is obtained with protrusive interocclusal records [9]. The influence of condylar paths over the movements of the mandible can be registered by protrusive inter occlusal records. It facilitates the condylar guidances of the articulator to be set to an approximation of the paths of the condylar movements in patients [10].

Studies have shown that radiographic methods can record condylar guidance more accurately than other methods[11]. The inconvenience and radiation exposure concerns are said to be the main disadvantage for widespread usage of radiographic methods to estimate condylar guidance[12]. Additionally, there is little evidence in literature to suggest it in comparison with the prevalent methods. Lately, digital Cone Beam CT scans have made them safer, more accurate and comparatively cheaper resulting in their widespread application in many areas of dentistry. It can be argued that application of advanced imaging is unwarranted in Prosthodontics. The higher levels of safety, and ultimate patient benefit from advanced digital imaging suggests that time may be ripe for its introduction into prosthodontics.

However, evidence based adoption of digital CBCT scans for stomatognathic measurements [13] and calibration of the dental articulator's calls for definitive comparative studies in this area. The purpose of this study thus was to compare both right and left condylar guidance values obtained using Cone Beam CT scans, extra- oral tracer and interocclusal wax records in healthy adults. Null hypothesis is that, there is difference in mean condylar values between jaw relation and radiograph was found to be statistically significant (P\0.001). Similarly, the difference in mean condylar values between try-in and radiograph was found to be statistically significant (P\0.001)

METHODOLOGY

The present clinical study was conducted to evaluate the relationship between sagittal condylar guidance obtained by cone beam computed tomography imaging modality and two different clinical methods through extraoral tracer at the time of jaw relation and interocclusal wax records at the time of try-in, and to compare difference between right and left condylar guidance angles within the same subject. This study was conducted at Mahatma Gandhi Dental College and Hospital, Jaipur, in department of Prosthodontics &Crown & Bridge. Study participants were selected from inpatient and outpatient department of Mahatma Gandhi Dental College and Hospital. All the participants were well-informed about the purpose and methods of the study and signed the informed consent. The sample size selected for the study was 15 edentulous patient irrespective of gender.The study was done after obtaining approval from the Institutional Ethical Committee. Subjects that were included in the study were those who were willing for voluntary participation and signed consent, edentulous subjects with good general health and between the age of 50-70 years who had no signs and symptoms of temporomandibular disorder, facial asymmetry and congenital facial defect. Subjects with any

temporomandibular disorder or restricted mandibular movement and poor general health were excluded from the study.

RADIOGRAPHIC METHOD

Radiographic Parameters:

Frankfort's Horizontal reference plane

Posterior slope of articular eminence

Radiographic sagittal condylar Guidance Angle

CBCT of whole skull was recorded. Articular eminence and mandibular fossa was identified for both right and left sides. Tangent of the Posterior slope of the articular eminence was drawn in the digital image. A line joining the superior most point of the external auditory meatus (Porion) and Inferior most point in the margin of the orbit (Orbitale) was marked. The angles between these two lines represent the Radiographic condylar guidance. (Fig 15)

CLINICAL METHOD

Clinical Parameters:

Centric interocclusal record

Protrusive inter occlusal record

Sagittal condylar Guidance Angle

Primary and secondary impressions were made, a final cast was obtained, face bow transfer was done and jaw relation records were made, and extra oral tracing was thereafter carried out with the help of tracers attached to the rims. In Gothic arch tracing, when definite arrow point tracing with a sharp apex was made, the subjects were asked to retrude the mandible to the most retruded position i.e centric relation. The bite registration material was injected between the central bearing device and allowed to set. From the apex of the arrow point tracing the distance of 6 mm was measured on the protrusive tracing and was marked and then protrusive interocclusal records were made. (Fig 13)

PROGRAMMING THE ARTICULATOR

The horizontal condylar adjustments were made by releasing the locknuts. The protrusive records were seated on the mandibular cast and the maxillary cast was seated on the record. The maxillary articulator member was gently manipulated into position using precise fit of the maxillary split cast to determine the condylar guidance angulation. The condylar guidance values/angles were recorded for the right and left sides.

Try In

After ideal teeth arrangement the trial dentures were placed on the articulator and then a line was drawn on the first upper premolar and an another line drawn 6 mm posterior on the lower premolar so that when the upper member is retruded, the line will coincide. The horizontal relation of the upper to lower anterior teeth and the relationship of the lower and upper midlines were observed carefully. The locknuts were tightened in that position.

Aluwax was immersed in a water bath of 54 °C for 30 s and was placed on the lower trial denture. The upper member of the articulator was pressed into the warm wax. Then wax record was chilled thoroughly. Then the trial dentures were placed in patients mouth and the patient was trained to perform 6mm protrusive movement and then alu wax records were placed in patients mouth and the patient was asked to hold the jaw in these indentations. After satisfactory closure, wax records were cross checked by registering protrusive using O-bite registration paste. (Fig 14)

PROGRAMMING THE ARTICULATOR (Fig:15)

The trial dentures were placed on the articulator along with the interocclusal record and programming was done. The maxillary articular member was gently manipulated into position using precise fit of the maxillary split cast to determine the condylar guidance angulation. The condylar guidance values/angles were recorded.

Statistical Analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 20 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) Windows software program. Descriptive statistics included computation of percentages, means and standard deviations. The data was checked for normality before statistical analysis using Shapiro–Wilk test. Quantitatively were analyzed using Mann–Whitney Utest. The analysis of variance (ANOVA) was used for quantitative data comparison of all clinical indicators. Level of significance was set at $P \leq 0.05$.

OBSERVATIONS & RESULTS

Fig 1 shows the insignificant statistical difference in the right and left condylar guidance with p value of 0.94

- Mean value of right condylar guidance with GROUP I came out to be 44.60 degrees +- 3.979.
- Mean value of left condylar guidance with GROUP I came out to be 44.47 degree +- 5.592.
- The condylar guidance measured in Sub group A shows higher mean value than Sub group B.

The bar graph comparing right and left condylar guidance in CBCT is represented on fig 2

Fig 3 shows the insignificant statistical difference in the right and left condylar guidance with p value of 0.06

- Mean value of right condylar guidance with Group II came out to be 22.33 degrees +- 3.773.
- Mean value of left condylar guidance with Group II came out to be 25.67degree +- 5.678.
- The condylar guidance measured in Sub group B shows higher mean value than Sub group A

The bar graph comparing right and left condylar guidance in Jaw Relation is represented in Fig 4

Fig 5 shows the insignificant statistical difference in the right and left condylar guidance with p value of 0.79

- Mean value of right condylar guidance with Try in came out to be 35.87 degrees +- 4.749.
- Mean value of left condylar guidance with Try in came out to be 36.33 degree +-5.192.
- The condylar guidance measured in Sub group B shows higher mean value than Sub group A.

The bar graph comparing right and left condylar guidance in Try in is represented in Fig 6

Fig 7 shows the significant statistical difference in the right condylar guidance between Group I, II, & III with p value of 0.001

- Mean value of condylar guidance with Group II came out to be 22.33 degrees +- 3.77.
- Mean value of condylar guidance with Group III came out to be 35.86 degree +-4.74.
- Mean value of condylar guidance with Group I came out to 44.6 degree +- 3.97.
- The condylar guidance measured in Group I shows higher mean value than the Group III and Group II.

The bar graph comparing right side mean condylar guidance between jaw relation, Try in and CBCT is represented in **Fig 8.**

In Fig 9, On applying post hoc Bonferroni test:

- On comparing Group II to Group III, there is a mean difference showing the significant difference in condylar guidance that is of 13.53 degree
- On comparing group Group II and Group I, there is a mean difference showing the significant difference in condylar guidance that is of 22.26 degree
- On comparing Group I and III, there is a mean difference showing the significant difference in condylar guidance that is of 8.733 degree

Fig 10 shows the significant statistical difference in the left condylar guidance between Group I,II and III with p value of 0.001

- Mean value of condylar guidance with Group II came out to be 25.66 degrees +-5.67.
- Mean value of condylar guidance with Group III came out to be 36.33 degree +-5.19.
- Mean value of condylar guidance with Group I came out to 44.46 degree +- 5.59.
- The condylar guidance measured in group I shows higher mean value than the Group II and III.

The bar graph comparing left side mean condylar guidance between jaw relation, Try in and CBCT is represented in **Fig 11.**

In Fig 12, On applying post hoc Bonferroni test on right side:

- On comparing Group II to Group III, there is a mean difference showing the significant difference in condylar guidance that is of -10.66 degree
- On comparing Group II and Group I, there is a mean difference showing the significant difference in condylar guidance that is of -18.80* degree
- On comparing Group I and III, there is a mean difference showing the significant difference in condylar guidance that is of 8.133 degree

DISCUSSION

Successful prosthodontic procedure results most likely in cases where the condylar path of the patient is simulated accurately using an articulator. This can restore the effective shape of the occlusal surface resulting with trouble free restorations [14]. Therefore, usefulness of articulator is unaltering whether the

required restoration is removable or fixed, single unit or a complex restoration, for recording of this condylar guidance.

The face-bow transfer and the centric, lateral and protrusive jaw relation records together establish the simulation of the mandibular movements on the articulator [15,16]. However the degree of correlation between the patient and articulator depends on many factors including biological considerations and the properties of the material used during process of transferring the maxillomandibular relations from the patients to the articulators [17,18].

Various methods of recording condylar pathways are available, ranging from simple interocclusal method to recently available advanced methods such as pantronic, computerized jaw tracking devices which records precise condylar pathways. The choice of technique depends on the specific clinical needs of occlusal rehabilitation rather than an overriding concern for precise condylar pathways. Hence the simplest and the most convenient method which would suit the particular clinical situation should be chosen to serve the purpose.[19]Three general classes of records are used for transferring maxillomandibular relations from the patients to the articulator. It may be either directly by the hinge axis records and pantographic records to the articulator or indirectly by the interocclusal records [20] to the articulator or by radiographic methods [21].

This clinical study is oriented towards comparing two different clinical methods in reproducing sagittal condylar guidance angulations when programmed using protrusive record with the condylar guidance value obtained by Cone beam Computed Tomography. The left and right condylar guidance angles were measured of all subjects using three methods, Condylar guidance values from CBCT image, Condylar guidance values from extra oral Tracer Method, and Condylar guidance values from interocclusal Wax Records. The difference attained between the left and right measurements from all methods was statistically insignificant.

Weinberg[22] and Gilboa *et al*.[8]reported a high degree of correlation between articular eminences anatomically and radiographically and suggested that the inclination of the articular eminence in a panoramic image may coincide with the anatomic articular eminence. They also stated that compared to clinical methods, radiographic measurement has the advantage of using stable bony landmarks and ability of being standardized and repeatable.

Galagali *et al*.[23]also reported a correlation between the condylar guidance angles obtained by protrusive interocclusal records, panoramic radiograph, and the lateral cephalogram radiograph methods. They found that lateral cephalogram radiographs were more positively related than the panoramic radiograph, and the values of lateral cephalogram radiographs were closer to the interocclusal records on the articulator as separate radiographs for the left and right side were taken, making the amount and quality of image distortionless.

Studies conducted by Gheriani[24], Winstanley, Zamacona[25] reveled high variability in the values of right and left side. But graphic registration was done in their study and all the subjects considered by them were patients with tempomandibularjoint disorder.

Literature indicates the use of lateral cephalograms, panoramic radiograph,tomographs, digital CT scan used for recording condylar guidance [8,26.] WhenCephalometric technique was used to find out the condylar guidance values there was adifference in readings for the same patient even when a standardized procedure was followed [27]. Magnetic resonance imaging has also been used to find out the articulareminence morphology and inclination in the past. At recent days the advent of digital CBCT scans has ruled out these.

Davis Et Al [28] concluded digital imaging and Interactive computer processing have added benefits of high quality images, speed of application, direct analysis and as accurate as manual technique with high precision as the earlier.

In this study, condylar guidance values obtained from wax interocclusal record exhibited high level of significance when compared with CBCT, while extra-oral method revealed low significant difference. Also, there was no statistical significant difference found when right and left sides were compared from all three methods. In general, it could be derived from the present study that none of the clinical methods were recognized to be giving condylar guidance angle values comparable with the CBCT. Accounting the excellent accuracy, meticulousness and chemo-mechanical properties of procedures and materials, it is only obvious to imply

that Cone Beam computerized tomographical methods of determining condylar guidance values must be introduced into the clinical work flow. However, it is not recommended, on the basis of these results to invalidate the application of these techniques as clinical methods are more practical, economical and are dependable with each other. A few limitations of the study are the small sample size, the radiographic exposure could have been reduced by limiting the exposure to TMJ area, and that the articulator has a numerical scale with increments of 5 degree, and difficulty in distinguishing articular eminence from zygomatic arch.

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FIGURES AND LEGENDS

Fig 1: GROUP I: CBCT (Mann–Whitney U-test)

	Mean	Std. Deviation	Minimum	Maximum	P value
Right (Subgroup A)	44.60	3.979	40	53	0.94
Left (Subgroup B)	44.47	5.592	33	56	
Total	44.53	4.769	33	56	

Fig 2

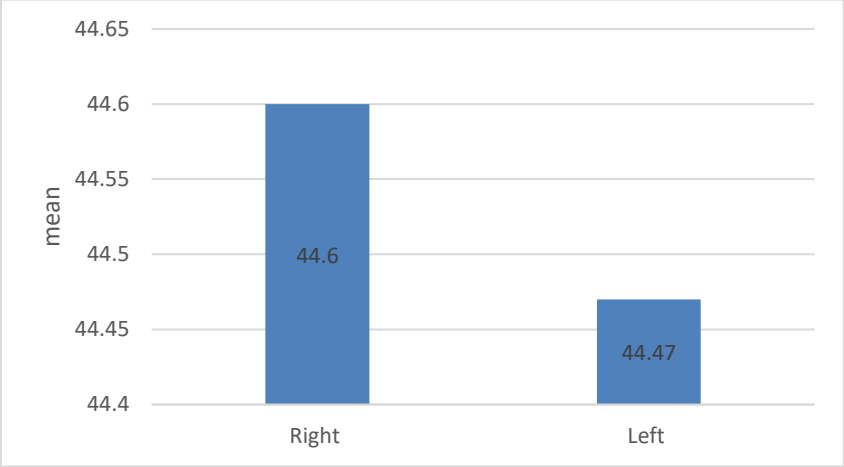


Fig 3

	Mean	Std. Deviation	Minimum	Maximum	P value
Right	22.33	3.773	15	28	0.06
Left	25.67	5.678	15	35	
Total	24.00	5.031	15	35	

Fig 4

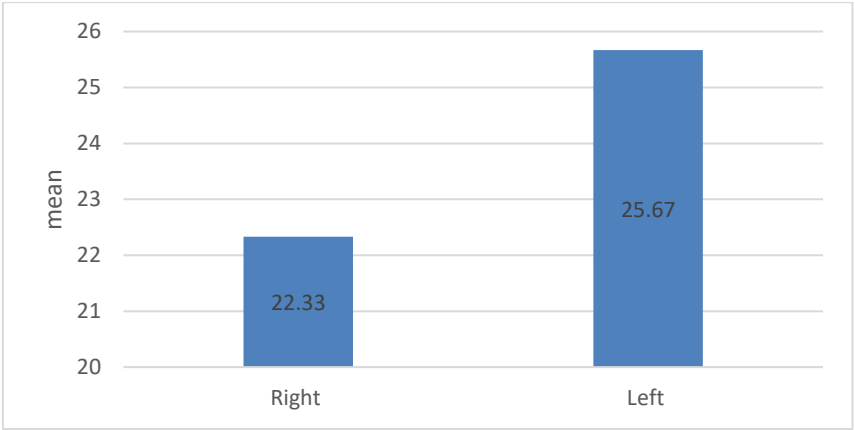


Fig 5: GROUP III: Try in (Mann–Whitney U-test)

	Mean	Std. Deviation	Minimum	Maximum	P value
Right	35.87	4.749	30	45	0.79
Left	36.33	5.192	30	45	
Total	36.10	4.894	30	45	

Fig 6

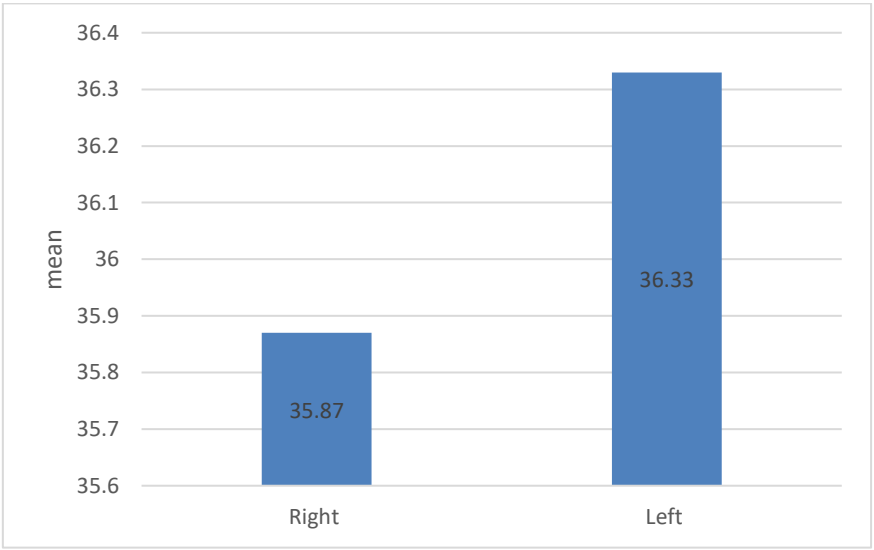


Fig 7: Inter-Group comparison of right side (ONE WAY ANOVA test)

	Mean	Std. Deviation	Minimum	Maximum	P value
Jaw relation (Group II)	22.33	3.77	15.00	28.00	0.001 (S)
Try in (Group III)	35.86	4.74	30.00	45.00	
CBCT (Group I)	44.6	3.97	40.00	53.00	
Total	34.26	10.12	15.00	53.00	

Fig 8

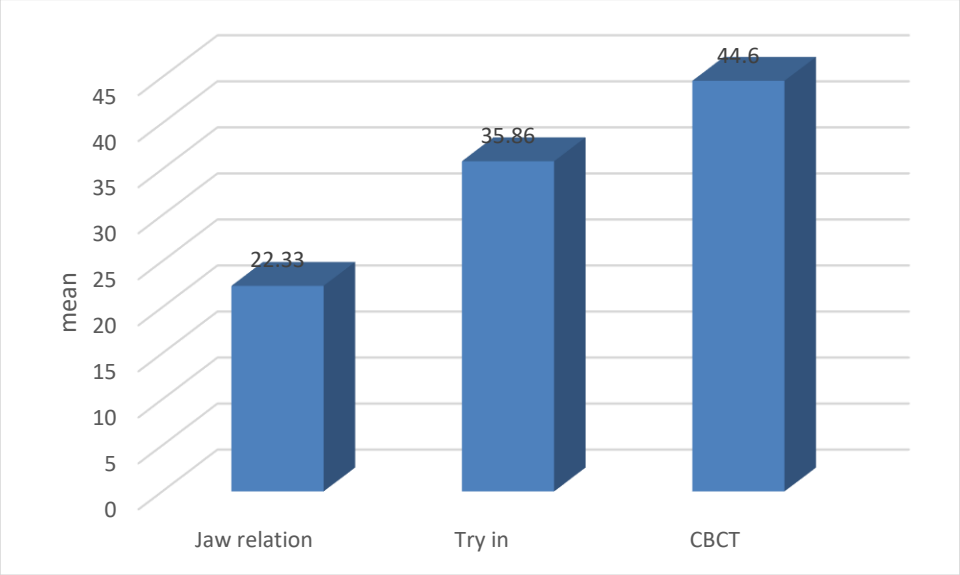


Fig 9: Intra-Group comparison of right side (post hoc Bonferroni test)

		Mean Difference	P value
Jaw Relation (Group II)	Try in	-13.53333*	.000 (S)
	CBCT	-22.26667*	.000 (S)
Try in (Group III)	Jaw relation	13.53333*	.000 (S)
	CBCT	-8.73333*	.000 (S)
CBCT (Group I)	Jaw relation	22.26667*	.000 (S)
	Try in	8.73333*	.000 (S)

Fig 10: Inter-Group comparison of left side (One Way ANOVA)

	Mean	Std. Deviation	Minimum	Maximum	P value
Jaw relation	25.66	5.67	15.00	35.00	0.001 (S)
Try in	36.33	5.19	30.00	45.00	
CBCT	44.46	5.59	33.00	56.00	
Total	35.48	9.45	15.00	56.00	

Fig 11

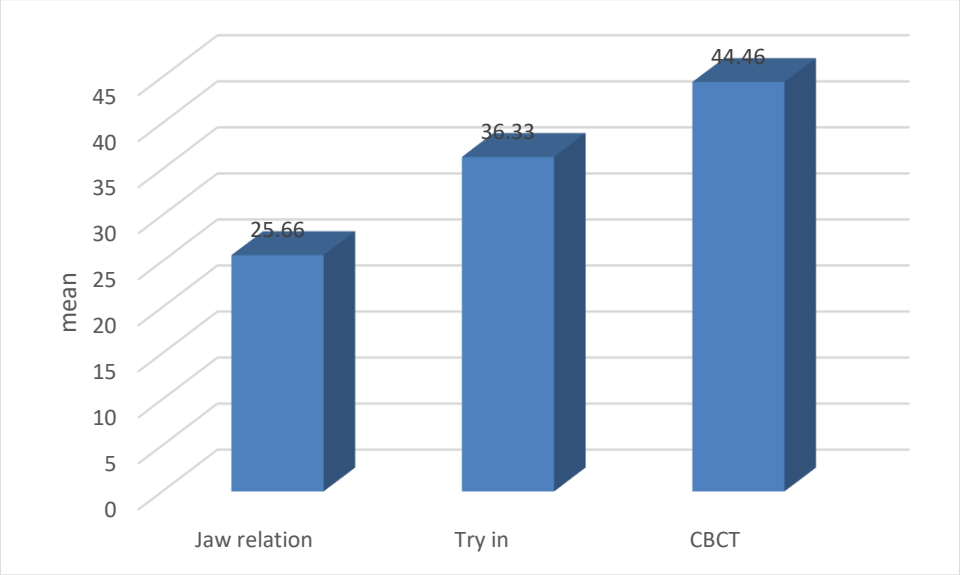


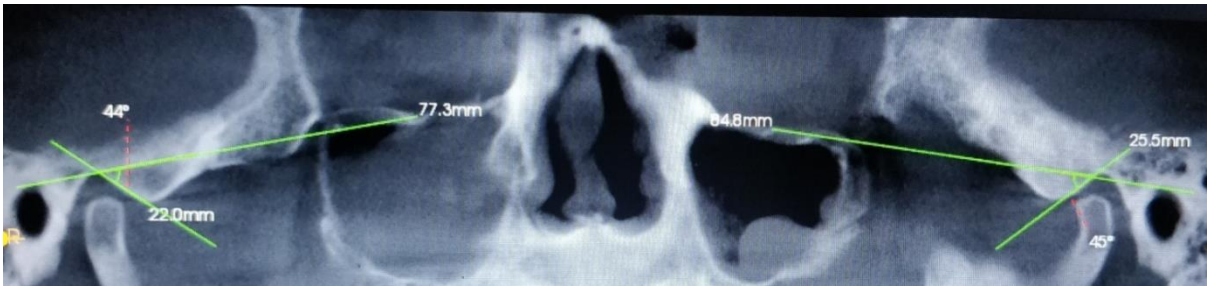
Fig 12: Intra-Group comparison of left side (post hoc Bonferroni test)

		Mean Difference	P value
Jaw relation (Group II)	Try in	-10.66667*	.000 (S)
	CBCT	-18.80000*	.000 (S)
Try in (Group III)	Jaw relation	10.66667*	.000 (S)
	CBCT	-8.13333*	.001 (S)
CBCT (Group I)	Jaw relation	18.80000*	.000 (S)
	Try in	8.13333*	.001 (S)

Fig 13

Fig 14

Fig 15


44°
77.3mm
84.8mm
25.5mm
22.0mm
45°