Clinical Outcome of Three Different Bone Graft Materials in The Management of Periodontal Infrabony Defects : Clinical Research

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Abstract

The present study was based on clinical evaluation and comparision of the efficacy of bovine derived xenograft with or without chlorhexidine and □-Tricalcium phosphate among themselves and with access flap alone in the management of infrabony defects eighteen subjects with twenty-four, two wall infrabony defects were equally divided into four groups. Open flap debridement was done in control group with no graft material placed in infrabony defects. In Experimental group I, intra-osseous defects were filled with HA/Collagen/ Chlorhexidine composite graft material. In Experimental group II, HA/Collagen graft was used. In Experimental group III, □ricalcium phosphate was used in infrabony defects.

Clinical measurements included both soft and hard tissue analysis, with the help of an acrylic stent.In the present study all Experimental groups were compared with Control group and intergroup comparison was also done. All bone graft materials showed regenerative potential in infrabony defects as assessed by various soft and hard tissue parameters.All experimental groups demonstrated statistically significant improvement in probing pocket depth reduction, clinical attachment gain and defect fill from the control group.On inter-group comparison, probing pocket depth reduction and gain in clinical attachment level was greater in HA/Collagen/ Chlorhexidine followed by HA/Collagen and than β-Tricalcium phosphate but this difference was not statistically significant.
HA/Collagen/Chlorhexidine group showed highest defect fill and percentage of defect fill but statistically insignificant with HA/Collagen group and significant with β-Tricalcium phosphate group. HA/Collagen group showed statistically significant results when compared with β-Tricalcium phosphate group in defect fill, but insignificant in percentage of defect fill.Statistically insignificant change was observed in alveolar crest height in all Experimental groups when compared with Control group however, minimum change in alveolar crest height was observed in Tricalcium phosphate group. Statistically insignificant difference was observed in all Experimental groups.

Keywords: Bone Substitutes, Xenografts, Bioceramics, Tricalcium Phosphate, Osteointegration.

The regeneration of the periodontium reduced by periodontitis is an object central to periodontal treatment. Anorganic bovine derived xenograft was developed for regenerative procedures in intra-osseous defects. The grafting material is a natural, porous, cancellous bone mineral derived from bovine bone embedded in a biodegradable collagen matrix of porcine origin (10%), from which all native organic materials has been removed by a chemical low heat (300^{0}C) extraction process, maintaining the physical architecture of bone intact[1].

The alloplastic material such as bioceramics is primarily composed of calcium phosphate. The two most widely used forms are HA and Tricalcium phosphate. Biodegradable Tricalcium phosphate has been associated with repair of lost periodontium[2]. It possesses the potential to inhibit osseous resorption[3]. It is well tolerated by the tissues[4] and, requires no processing to render it non-antigenic. It serves as biologic filler, which is partially resorbable and allow bone replacement of the implant material[5].Little data is available in literature about the use of xenograft containing chlorhexidine, albeit membranes containing chlorhexidine have been used[6-7] for periodontal regeneration. Recently a bovine derived composite graft with chlorhexidine was developed, which possessed both osteoegenerative property and antibacterial property.The aim and objectives of this study was to clinically evaluate and compare the efficacy of Bovine derived xenograft with and without chlorhexidine and Tricalcium phosphate among themselves and with Access flap alone in the management of infrabony defects.

Materials & Method

Eighteen Subjects with twentyfour, two wall infrabony defects, in the age group ranging from 20 to 50 years irrespective of their sex were selected and equally devided in to four groups.

Control Group: Subjects treated with open flap debridement alone.

Experimental Group-I: In this group the intra-osseous defects were filled with the composite graft material comprising of collagen, hydroxyapatite & chlorhexidine.

Experimental Group-II: Bovine derived xenograft material that containing hydroxyapatite and collagen was used in infrabony defects.

Experimental Group-III: In this group subjects were treated with alloplastic bone substitute *i.e.*, tricalcium phosphate.

Pre-surgical Management: Subjects

Table -4

Comparison between Experiment Group for Gain in Clinical Attachment Level

	't'	'p'
Experimental Group I vs. Experimental Group II	0.47	0.52
Experimental Group I vs. Experimental Group III	1.10	0.30
Experimental Group II vs. Experimental Group III	0.36	0.73

Table 4 On intergroup comparison gain in clinical attachment level was maximum in HA/Collagen/Chlorhexidine (Experimental group I), followed by HA/collagen (Experimental group II) and minimum in β-Tricalcium phosphate (Experimental group III). The 'p' value does not show statistically significant difference between all Experimental groups.

Hard Tissue parameters

Table 5

Comparison between Control group and Experimental groups I, II, & III for hard tissue parameters

	Defect Fill (Mean ± SD)	% of defect fill (Mean ± SD)	Change in Alveolar Crest height mm (Mean ± SD)
Control Group	1.83 ± 1.17	34.72 ± 5.62	- 0.67 ± 0.52
Ex. Group I	3.67 ± 0.52	62.08 ± 9.80	- 0.50 ± 0.55
Ex. Group II	3.50 ± 0.84	55.22 ± 4.19	- 0.50 ± 0.55
Ex. Group III	2.00 ± 0.63	47.22 ± 12.55	- 0.33 ± 0.52

In Table 5 mean±standard deviation defect fill was 1.83±1.17mm, 3.67±0.82, 3.50±0.84 and 2.0±0.63 mm in Control group, Experimental group I, II and III respectively. Mean change in alveolar crest height was 0.67±0.52, -0.50±0.55,-0.50±0.55 and 0.33±0.52mm in Control group, Experimental group I, II and III respectively. Percentage of defect fill was 34.72 ± 5.62%, 62.08 ± 9.80%, 55.22 ± 4.19% and 47.22 ± 12.55% in Control group, Experimental Groups I, II and III respectively.

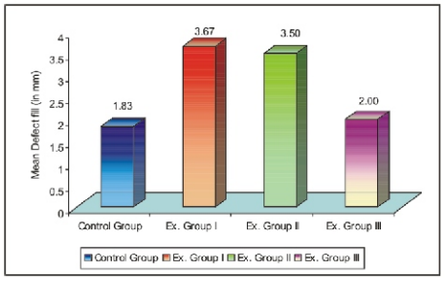


Table 6

Comparison between Control Group & Experimental groups I, II, & III for hard tissue Parameters

	Defect Fill (mm)		% of Defect Fill		Change in alveolar Crest height (mm)	
	't'	'p'	't'	'p'	't'	'p'
Control Vs. Experimental Group I	3.16	<0.01	5.93	<0.001	0.55	0.60
Control Vs. Experimental Group II	2.84	<0.05	7.16	<0.001	0.55	0.60
Control Vs. Experimental Group III	0.31	0.76	2.23	<0.05	1.13	0.28

Table 6 shows defect fill was statistically significant in Experimental group I and II when compared with Control group. Defect fill as observed in Experimental group III was insignificant when compared with control group although Experimental group III showed higher defect fill than control group. Highest defect fill was observed in Experimental group I followed by Experimental group II and minimum in Experimental group III. Percentage of defect fill was statistically significant in Experimental groups I, II and III when compared with Control group. Change in alveolar crest height was insignificant in all Experimental groups when compared with Control group.

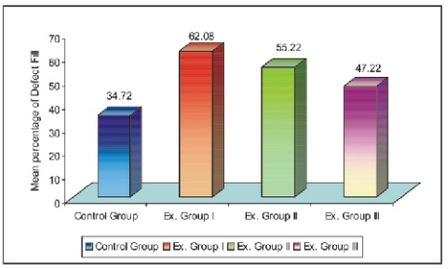
Table 7

Comparison between Experimental groups I, II & III for hard tissue parameters

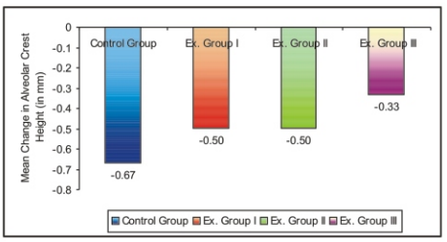
	Defect Fill (mm)		% of Defect Fill		Change in alveolar Crest height (mm)	
	't'	'p'	't'	'p'	't'	'p'
Ex. Group I Vs. Ex. Group II	0.35	0.73	1.57	0.15	0	1
Ex. Group I Vs. Ex. Group III	3.96	<0.01	2.29	<0.25	0.55	2.60
Ex. Group I. Vs. Ex. Group III	3.52	<0.01	1.48	0.17	0.55	2.60

In Table 7 on intergroup comparison between Experimental group I and Experimental group II, insignificant difference was observed in defect fill in mm and percentage of defect fill. Although't' 'p' value was higher in Experimental group I. On comparing Experimental group I, and III, 't' value was highly significant (<0.01) in defect fill in mm and significant (<0.05) in percentage defect fill. In Experimental group II vs. Experimental group III highly significant 'p' <0.01 bone fill was observed in defect fill in mm. However, percentage of defect fill was insignificant. No significant change was observed in change in alveolar crest height on intergroup comparison.

Comparison between Control group and Experimental groups I, II, & III for percentage of defect fill



Comparison between control group and Experimental groups for change in alveolar crest height in mm



Discussion

Histologic evidence in human indicates that bone grafting is the only treatment that leads to regeneration of bone, cementum, and a functionally oriented new periodontal ligament coronal to the base of a previous osseous defect[8]. Clinical[9,10,11,12] and histological[13,10,14] studies promoted the use of anorganic bovine bone for grafting in intraosseous defects. Bovine derived xenograft (HA/Collagen) is a low crystalline appetite (approximately 100 x 200 x 500 A) with a 7% content of carbonate, calcium content of 37.1±0.7% and a phosphorous content of 17.8±0.5%, corresponding to a Ca-p ratio of 2.1±0.1[85]. It has been reported to have natural osteotrophic properties with good tissue acceptance and no fibrous tissue or space

between the HA and newly formed bone is found[15] Majority of the evidence indicates that the presence of bacterial biofilm may interfere with periodontal regeneration and lead to decreased clinical success[16-17], therefore a bovine derived composite graft material with incorporation of chlorhexidine (HA/Collagen/ Cholrh- exidine) was used in the present study.

Tricalcium phosphate ceramic [$Ca_3(PO4)_2$] implant have been evaluated in both animals and humans[18-21]. It is a porous form of calcium phosphate. The proportion of calcium and phosphate is similar to bone with a calcium to phosphate ratio of 1.5, is mineralogically β-whitlockite. This material acted as effective defect fillers. It has been manufactured using a mechanochemical method. It is a bone substitute that is biodegradable and demonstrated a resorbable property.In this study the regenerative efficacy of grafting material was assessed by the probing method, although, histological method is the standard method in assessing true periodontal regeneration[5]. Maturation of the connective tissue portion of the wound is continuous until 3 months, a definite attachment to the root was observed at 6 months with definitive collagen bundles present(H.M Goldman et al.,1990). Therefore re-entry procedure was performed at 6 months.Re-entry procedure seems to be most accurate means of determining osseous defect response (Crestal change as well as change with in the defect) because of direct visualization surgery. Although performed mainly for documentation, such secondary surgery also provided for any needed revisionary treatment, and is usually minor and a beneficial procedure for the subject.In the present study in control group, mean reduction in probing pocket depth obtained was 2.5m. HA/Collagen/Chlorhexidine, HA/Collagen and β-Tricalcium phosphate showed significant improvement in mean probing pocket reduction from the control group, which was 4.1, 3.6 and 3.5mm respectively . However, all experimental groups showed no statistically significant difference with each other The results revealed a mean clinical attachment level gain of 1.6mm, 3.3mm, 3mm and 2.8mm for Open flap debridement, Collagen/ HA/Chlorhexidine and HA/Collagen and β-Tricalcium phosphate respectively with a statistically significant difference from the initial readings . Clinical attachment gain was significantly better in experimental groups than control group. When interpreting the clinical results it was found that there is statistically insignificant difference between the experimental groups. Collagen/HA/Chlorhexidine showed highest gain in clinical attachmentlevel followed by HA/Collagen and β-Tricalcium phosphate. An evaluation of hard tissue findings at six months re-entry revealed that all experimental groups I, II and III had improved significantly over baseline values with regard to defect fill and percentage of defect fill . Average defect fill in both HA/Collagen/ Chlorhexidine group was 3.5mm, while the HA/Collagen group demonstrated an average defect fill 3.6mm; and 2.0mm was obtained in β-Tricalcium phosphate group. On intergroup comparison, both HA/Collagen and HA/Collagen/ Chlorhexidine showed higher mean defect fill as compared to β-Tricalcium phosphate. Tricalcium phosphate group showed higher mean defect fill over control group but difference was not significant. HA/Collagen/ Chlorhexidine and HA/Collagen showed statistically significant defect fill when compared with Tricalcium phosphate group as well as with control group. The mean of 1.8mm of defect fill was evaluated in control group.Mean percentage of defect fill was 34.72% in control group. The mean percentage of defect fill obtained was 62.08%, 55.2% and 47.22% in HA/Collagen/Chlorhexidine, HA/Collagen and β-Tricalcium phosphate groups respectively. The result showed percentage defect fill was statistically significant than the control group. On intergroup comparison HA/Collagen/Chlorhexidine group showed insignificant difference with HA/Collagen group but significant with Tricalcium phosphate group. HA/Collagen group was insignificant with Tricalcium phosphate group in percentage of defect fill. Greater percentage of defect fill (62.08%) observed in HA/Collagen/Chlorhexidine group, might be due to the presence of Chlorhexidine, which seemed to be good enough for the prophylaxis of infective/ inflammation processes in the surgical site, thereby enhancing periodontal regeneration.

M.M. Solovyen *et al.,* (1994)[22] in his study demonstrated that HA/Collagen/ Chlorhexidine showed regenerative potential with no toxic or allergic reactions. Our study differs from the study of Chuyev *et al.,* (1996)[23]who demonstrated 87% of defect fill around the implants with the use of HA/Collagen/ Chlorhexidine as compared to 34% defect fill in control group.

In present study, 47.22% of defect fill was observed in β-Tricalcium phosphate group. The 2.0mm of infrabony defect fill in six months re-entry with use of β-Tricalcium phosphate in our study was also supported by 2.8mm bone fill in the study done by Synder *et al.,* (1984)[24]. It was observed histologically in humans that Tricalcium phosphate, when placed in periodontal defects have demonstrated osseous fill and probing depth reduction, but showed limited evidence of new connective tissue attachment[25,18]. In another study Wada *et al.,* (1989)[26] observed osteoblast and osteoids around β-Tricalcium phosphate particles. However, it is not osteoinductive because it does not contain the proteins necessary to induce bone formation.

27.36%, 20.5% and 12.5% greater defect fill was observed by HA/Collagen/

Chlorhexidine, HA/Collagen and β-Tricalcium phosphate respectively when compared with control group. HA/Collagen/ Chlorhexidine group demonstrated 6.88% and 14.86% greater defect fill than HA/Collagen and β-Tricalcium phosphate respectively. HA/Collagen showed 8% greater defect fill in comparison with β-Tricalcium phosphate.

The alveolar crest resorption of 1mm at 4 sites out of 6 subjects was noticed in control group with a mean of 0.67mm. In HA/Collagen/Chlorhexidine and HA/Collagen group, the average crestal resorption was 0.5mm in 3 sites out of 6 subjects, which was statistically insignificant from the control group whereas in β-Tricalcium phosphate group only two sites showed crestal resorption out of six defect sites with a mean crestal resorption of 0.3mm, which was also statistically insignificant from the control group as well as on comparison with HA/Collagen/Chlorhexidine and HA/Collagen group. Minimum alveolar crest resorption was observed in □-Tricalcium phosphate, possesses the potential to inhibit bone resorption (hawley et al1981)[3].In this study all sites were healed without any complications. Some site showed negligible inflammatory response but that was improved after proper maintenance of oral hygiene. Clinically, no adverse reactions with any grafted material were apparent during the six months postoperative period. The subjects receiving HA/Collagen/ Chlorhexidine graft showed better soft tissue healing in comparison to other grafted sites. This might be due to the presence of chlorhexidine, which decreases the bacterial biofilm load and might lead to improved clinical results and more predictable regeneration[27].

Result

Maximum pocket depth reduction (4.17mm) was observed in HA/Collagen/ Chlorhexidine group and minimum in Tricalcium phosphate group (3.50mm). HA/Collagen group showed 3.67mm probing pocket depth reduction. In non-grafted site probing pocket depth reduction was 2.50mm. Same trends were observed in gain in clinical attachment level.

infrabony defect fill in HA/Collagen/ Chlorhexidine group and HA/Collagen group was 3.67mm and 3.50mm respectively, which is statistically significant with Control group (1.83mm). Tricalcium phosphate group showed 2.00 mm defect fill, which is higher than Control group but statistically insignificant with Control group. On intergroup comparison HA/Collagen/Chlorhexidine group and HA/Collagen group demonstrated significant difference with Tricalcium phosphate group but insignificant difference was observed between HA/Collagen/Chlorhexidine group and HA/ Collagen group.

Highest percentage defect fill of 62.08% was present with HA/Collagen/ Chlorhexidine group and 55.22% in HA/Collagen group but difference was insignificant. Minimum percentage defect fill of 47.22% seen in Tricalcium phosphate group, which was statistically significant when compared with HA/Collagen/ Chlorhexidine group but difference was insignificant when compared with HA/Collagen group.

Statistically insignificant change was observed in alveolar crest height in all Experimental Groups, when compared with Control group. HA/Collagen with or without Chlorhexidine were identical *i.e.,* -0.50mm. 0.33mm change was observed in Tricalcium phosphate group. Non-grafted site or control group showed maximum change in alveolar crest height. *i.e.* 0.67mm.

References

1. Sculean A, Chiantella GC, Windisch P, Arweiler NB, Brecx M, Gera I. Healing of intra-bony defects following treatment with a composite bovine derived xenograft (Bio-Oss Collagen) in combination with a collagen membrane (Bio-Gide Perio). J Clin Periodontal 2005; 32:720-724.
2. Levin, M.P., GeHen, L., Gutright, D.E., Bhaskar, S.N. Bio degradable ceramics in periodontal defects. Oral Surg 38: 344, 1974.
3. Hawley, C.E. Snyder, A.J: and Heath, J.R.: Evidence of inhibition of bone resorption by Tricalcium phosphate ceramics (Abstr 1149). J Dent Res. 60:596; 1981.
4. Nery, B, Lunch, K., Hirthe, W; and Mueller K.: Bio ceramic implants in surgically produced infrabony defects. J. Peridontal 46: 328, 1975.
5. Mary E. Aichelmann Reidy and Raymond A. Yukna. Advances in periodontics, Part II. Dental clinics of North America. Vol. 42, No. 3, July 1998.
6. Cortellini P, Pini Prato W, Tonetti M.S., Periodontal regeneration of human intrabony defects with bio-resorbable membranes. A controlled clinical trail. J Periodontol 1996; 67:217-223.
7. Zaura-Arite E, Van Marle J. ten Cate J.M. Conofocal microscopy study of undisturbed and chlorhexidine treated dental bioflim. J Dent Res. 2001; 80:1436-1440.
8. Bowers G.M., Chad rolf B, Carnevale R, et al.: Histologic evaluation of new attachment apparatus formation in humans : Part III. J Periodontol 60:683,1989.
9. Richardson CR, Mellonig JT, Brunsvold MA, McDonnell HT, Cochran DL : Clinical evaluation of Bio-Oss : A bovine derived xenograft for the treatment of periodontal osseous defect in humans. J Clin Periodontol 1999;26:421-428.
10. Sculean, A., Windisch, P., Keglevich, T., Chiantella, G.C., Gera, I. And Donos, N. (2003a) clinical and histologic evaluation of human intrabony defects treated with an enamel matrix protein derivative combined with a bovine-derived xenograft. The international Journal of Periodontics and Restorative Dentistry 23, 47-55.
11. Stavropoluos A., Karring T., Five year results of guided tissue regeneration in combination with deproteinized bovine bone (Bio-Oss) in the treatment of intrabony periodontal defects : a cases series report. Clin Oral Investing. 2005 Jul 12; : 1-7.
12. Hanna R., Trejo P.M., Weltman R.L. Treatment of intrabony defects with bovine derived xenograft alone and in combination with platelet rich plasma: a randomized clinical trial. J Periodontol. 2004 Dec.; 75(12):1668-77.
13. Camelo, M., Nevins, M. L., Schenk, R., Simion, M., Rasperini, G., Lynch, S. and Nevins, M. (1998) Clinical radiographic and histologic evaluation of human periodontal defects treated with Bio-Oss and Bio-Gide. The International Journal of Periodontics and Restorative Dentistry 18, 321-331.
14. Mellonig, J. (2000) Human histologic evaluation of a bovine derived xenograft in the treatment of periodontal osseous defects. The international Journal of Periodontics and Restorative Dentistry 20, 19-29.
15. Callan P. Donald and Rohrer D. Michel. Use of

Bovine Derived hydroxyapatite in the treatment of endentulous ridge defects : A human clinical and histologic case report. J Periodontol 1993; 6:575-582.
16. Magnusson I, Listgarten M.A. Histological evaluation of probing depth following periodontal treatment. J Clin Periodontol 1980; 7:26-31.
17. Van der Velden U. Probing force and the relationship between gingival inflammation and resistance to probe penetration. J Periodont Res. 1979;14:239-243.
18. Baldock, W.T., Hutchens, L.H., Jr., McFall, W.T., and Simpson D. M.: An evaluation of tricalcium phosphate implants in human periodontal osseous defects of two patients. J Periodontol 56:1,1985.
19. Levin, M.P.: Biodegradable ceramic as a bone implant material. J Hawaii Dent Assoc 9: 23, 1976.
20. Stahl S.S., Froum S. Histological evaluation of human intraosseous healing responses to the placement of tricalcium phosphate ceramic implants. I. Three to eight months. J Periodontol 1986; 57211.
21. Morabito G. Periodontal osseous defects treated with tricalcium phosphate. Dent Cadmos. 1989 Jan 31;57(1):52-6, 59-60.
22. M.M. Solouyev, A.I. Protsevich; Protocol of clinical trials of stimuli OSS Dentistry "Covermennaya stomatologia" Issue No. 1, 1994, pages 13-16.
23. Chuyev V.M., Kurdyumov S.P., Grishin G.P., Use of resorbable hydroxyapatite-collagen chlorhexidine plug on immediate post-extraction sites : a clinical and histological study. "Stomatologia" No. 5, 1996, Russia, Moscow, Pages: 17-19.
24. Bye F., Krause M., Regezi J., Caffesse R.: Histologic evaluation of periodontal implants in a biologically "closed" model. J Periodontol 1986; 58:110-114.
25. Froum S. Coran M. Thaller B, Kushner L, Scopp I, Stahl S. Periodontal healing following open debridement flap procedures. I. Clinical assessments of soft tissue and osseous repair. J Periodontol 1982:53:8-14.
26. Grower, M.F., Horan M., Miller, R. and Getter L. (1973) Bone inductive potential of biodegradable ceramic in Millipore filter chambers. IADR Abstracts # 407.
27. Bowen J.A. et al. Comparison of decalcified freeze-dried bone allograft and porous particulate hydroxyapatite in human periodontal osseous defects. J. Periodontol. 60:647, 1989.

Legends

Fig. 1 Infrabony defect depth distal of 36 at the time of initial surgery (Open flap debridement : Control Group)

Fig. 2 Infrabony defect depth distal of 36 at the time of re-entry surgery (Open Flap Debridement : Control Group)

Fig. 3 Infrabony defect depth distal of 14 at the time of initial surgery (HA/Collagen/ Chlorhexidine : Exp. Group-I)

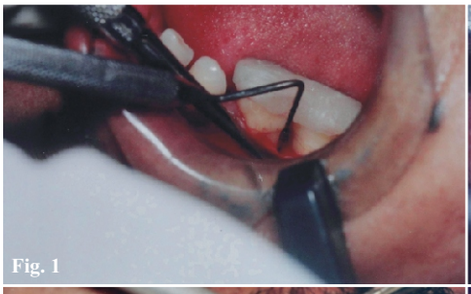
Fig. 4 Infrabony defect depth distal of 14 at the time of re-entry surgery (HA/Collagen/ Chlorhexidine : Exp. Group-I)

Fig. 5 Infrabony defect depth mesial of 36 at the time of initial surgery (HA/Collagen : Exp. Group-II)

Fig. 6 Infrabony defect depth mesial of 36 at the time of re-entry surgery (HA/Collagen : Exp. Group-II)

Fig. 7 Infrabony defect depth at the time of initial surgery (Tricalcium Phosphate : Exp. Group-III)

Fig. 8 Infrabony defect depth distal of 43 at the time of re-entry surgery (Tricalcium Phosphate : Exp. Group-III)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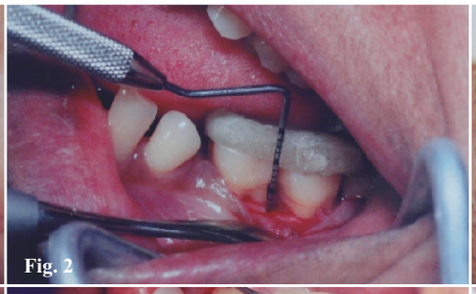
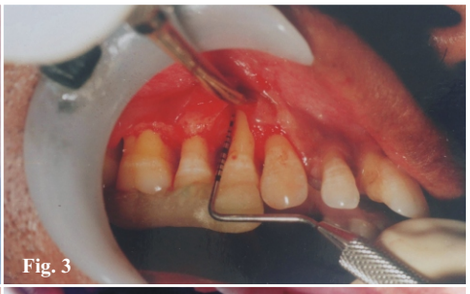


Fig. 2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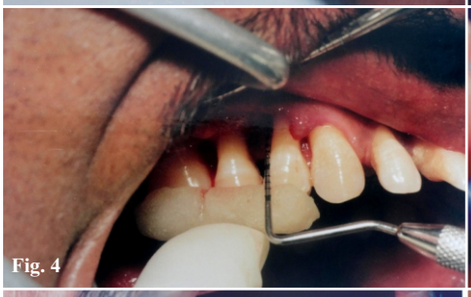
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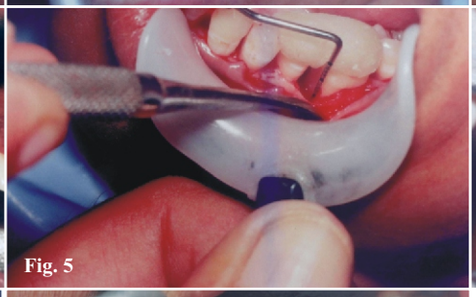
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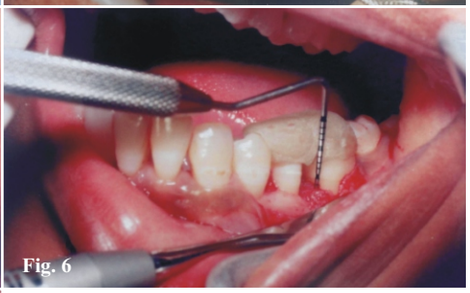
Fig. 6

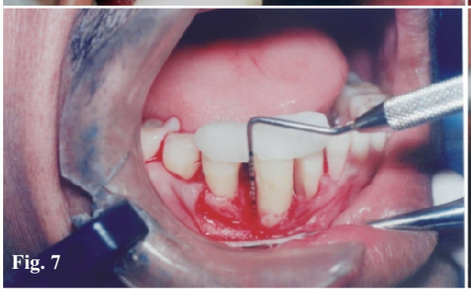
Fig. 7

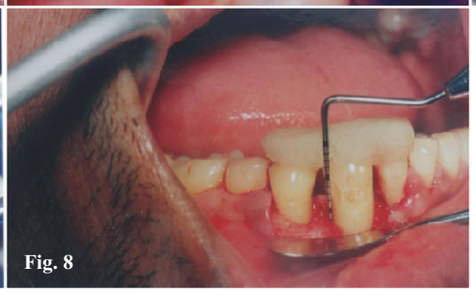
Fig. 8

Restoring Function & Esthetics in a Trauma-Hit Patient : Clinical Report

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Abstract

The Crown and Sleeve-coping removable telescopic partial denture utilizes the basic concept of an overdenture. While functioning as an overdenture it also serves the therapeutic role of a periodontal splint. It is the best treatment modality in patients with weakened periodontal situation where the main challenge of therapy is to salvage the remaining abutment teeth, the periodontal apparatus and the alveolar bone support. The Crown and Sleeve-coping prosthesis is used as a therapy rather than a mere replacement.

CAD/CAM based zirconia ceramics are popular contemporary ceramics with excellent physical properties, biocompatibility and superior esthetics.

Key words: Crown and Sleeve coping, telescopic denture, CAD/CAM ceramics.

Introduction

The Crown and Sleeve-coping prosthesis consists of three components: The sleeve-copings, the secondary crowns and a frame work. The sleeve-copings are cemented individually to the abutment teeth. The secondary crowns are either solder connected or cast to the frame work to which the missing teeth and saddle segments are processed. The secondary crowns 'telescope' or cover the sleeve-copings and serve as removable retainers for the prosthesis. The frame work is a major connector to which the secondary crowns are solder connector or cast. Denture teeth can be attached to the frame work with processed acrylic resin or cemented to the pin receptacles with dental cement.

The zirconium oxide based ceramics are the most popular among the recent ceramics as they possess superior mechanical, biological and esthetic properties. They are based on high technology CAD/CAM techniques eliminating conventional laboratory procedures with their attendant complications and errors. This system produces more precise and life likes dental restorations

Case report

A 20 years old male reported to the Department of Prosthodontics, Surendra Dental College and Research Institute who had met with an automobile accident a month back. In the accident he lost a few mandibular teeth and had fractured maxillary anterior teeth.

The patient had no other significant medical or dental history. A preliminary examination revealed the following:-

- Ellis Class IV fracture of 11, 12, 13, 21, 22, 23.
- Missing 32, 33, 34 and 36.
- Grade 2 mobility in 31, 41.
- Fractured restoration of 15.

Treatment Plan

After a thorough diagnostic study, radiographic survey the following treatment was planned: -

- Post and core supported metal-free ceramic crowns for maxillary anterior teeth. (11, 12, 13, 21, 22, 23)
- Crown and Sleeve-coping prosthesis for mandibular arch.
- Ceramo-metal crown for maxillary right second premolar.

Clinical Procedure

- Maxillary anterior teeth were endodontically treated and prepared to receive post. Individual patterns were fabricated in blue inlay wax and cast in silver alloy. These post and cores were finished and cemented to the teeth.
- The maxillary anterior teeth were prepared to receive metal free Ceramic crowns and the maxillary right second premolar was prepared to receive ceramo-metal crown.
- The crowns were fabricated in zirconium oxide using CAD/CAM system. They were tried in patient's mouth, glazed then cemented with resin based cement.
- Mandibular central incisors and right first premolar were prepared to receive white metal sleeve-copings. Then provisional crowns were cemented to the prepared mandibular teeth.
- Sleeve-copings were cast, finished and cemented
- Impression for frame work was made in polyvinyl siloxane.
- The frame work and secondary crown-copings were cast in single unit. It was finished, polished and tried in patient's mouth.
- Then porcelain was fired to secondary crown copings
- The missing teeth were replaced by porcelain teeth. These teeth were attached to the frame work by processed acrylic resin
- The final prosthesis was finished and delivered to the patient. The prosthesis was evaluated for function, esthetics and phonetics.

Discussion

For the restoration of fractured maxillary anterior teeth metal free zirconium based ceramics were used as they provided better esthetic compared to conventional ceramometal crowns. To