

## Retrospective Analysis on Type of Scaffolds Used in Revascularisation-A Institutional Based Study

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### ABSTRACT

*Aim: To aim of the study is to analysis on type of scaffolds used in revascularisation*

*Background: Root canal therapy helps to save many diseased teeth over years. The treatment is most desired when the tooth is diseased or nonvital pulp is replaced with healthy tissue pulp which has the ability to revitalize the teeth by the regenerative endodontics. The scaffolds like Platelet rich fibrin, Stem cells, Natural and artificial scaffolds, Platelet rich plasma used from the year 1982–2015. Tissues are arranged as three dimensional structures, and the correct scaffolding is needed to provide a spatially correct position of cell location and for differentiation, proliferation, or metabolism of the stem cells. Extracellular matrix molecules help in controlling the stem cell differentiation, and the correct scaffold might selectively join and localize cells that contain growth factors, and undergo biodegradation over time. Different scaffolds allow the regeneration of various tissues. To ensure a successful regenerative procedure, it is essential to have a good knowledge about the suitable scaffold for the required tissue.*

*Materials & methods: The study was conducted in the outpatient of Dental College and Hospital. The data was reviewed and analysed between June 2019-July 2021. A total of 27 patients underwent a revascularization procedure aged between 6 to 40 yrs. The data includes the type of scaffolds used in revascularisation (CGF, PRF, COLLA COTE). Then the data was manually verified by 1-2 reviewers and finally tabulated and SPSS imported and got the results.*

*Results: Total subject population was 18 and their age group ranged from (1-40) years, total Males were 9 and females were 9. Both Male patients and Female patients are equal in population. In our study the majority of males patients (40.7%) CGF type of scaffolds are used whereas for female patients (22.2%) PRF type of scaffolds is used. In our study the majority of patients under (21-30)yrs old used CGF (25.9%) followed by colla cota (14.8%). And the majority of revascularization procedures (44.44%) was done in teeth number 11 followed by (40.74%) was done in teeth number 21.*

*Conclusion: From the present study it is clear that Majority of the patients CGF is used followed by PRF and colla cote. Which gives more success rate in revascularization therapy?*

**Key words:** Concentrated growth Factor (CGF), Colla Cote, Platelet rich fibrin (PRF), Revascularisation, Scaffolds, Innovative

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### INTRODUCTION

Regenerative dentistry has become popular because of advancements in biologic therapies that apply growth and differentiation factors which induced natural

biological regeneration. Hermann in 1920 found the application of calcium hydroxide in the vital pulp which gave a foundation for regeneration of pulp tissues. In 1961 Nygaard Ostby evaluated a revascularization process for re-establishing a pulp dentin complex in permanent teeth with pulpal necrosis. The three key ingredients for regeneration are morphogens, progenitor cells, and the extracellular matrix (ECM) scaffold [1]. Tissue engineering is based on the Regenerative endodontics concept. Regenerative endodontic procedures (REPs) is biologically-based procedures designed for replacement of damaged structures, includes dentin and root structures, and the cells of pulp-dentin complex with viable tissues of the same origin, that is capable

of restoring the normal physiologic functions of the pulp-dentin complex [2]. Pulp revascularization is re-introduction of vascularity in the root canal. Even though blood vessels are indispensable constituents of dental pulp, pulp regeneration is incomplete without formation of odontoblastic layer that lines the dentin surface, nociceptive as well as sympathetic and parasympathetic nerve fibers, added to that interstitial fibroblasts and most importantly, progenitor cells that serve to allows all the pulp cells to regenerated pulp whenever undergo apoptosis and turnover [3]. Pulp tissue regeneration is an ideal alternative treatment for the root canal treatment. The present concept of pulp tissue regeneration includes two approaches [4]. One is revascularization, where a new pulp tissue grows into the root canals from the underlying remaining tissues from the root canal apex. The second one is replacement of the diseased pulp with a healthy tissue that has the ability to revitalize the tooth and restore the dentin formation process. Gene therapy, Stem cell therapy, three-dimensional (3D) cell printing, pulp implantation and scaffold implantation are suggested for this approach [5]. There is a significant difference between regeneration and revascularization. Pulp revascularization is equal to induction of angiogenesis in endodontically-treated root canal, Pulp regeneration is equal to pulp revascularization and added to that restoration of functional odontoblasts and nerve fibers [3]. Scaffolds can be classified as natural and artificial (synthetic). Natural scaffolds are more biocompatible and have the advantage of providing specific cell interactions [5,6]. Scaffolds will be biocompatible structures that support cell growth and give a correct environment for tissue formation. Good scaffolds should allow cell attachment, proliferation, migration, differentiation, and provide mechanical support for the extracellular matrix generation [7,8]. Like this various studies have been done in our institutions [9-28].

**MATERIALS AND METHODS**

The study was conducted in the outpatient of Dental College and Hospital. The study consisted of 27 patients between the age group of 6-40yrs. This is because the available data with similar ethnicity was collected from the particular geographic location. The trends in the other location were not assessed in the study setting. Ethical approval was done by the universal ethical committee before the start of the study. The approval number given was [SDC/SIHEC/2020/DIASDATA/0619-0320]. The data was reviewed and analysed between June 2019-March 2021. The case sheet was manually reviewed and cross verified in order to avoid errors. To minimize the sampling bias all available data was included and the sorting process was done. All the samples diagnosed as revascularization patients were included. This particular time was considered as internal validity and a prescriptive pattern was followed to analyse external validity. All the data like the patient's name, age, gender and their field value was included in the study. The data

which are obtained were entered in the excel sheet and Tabulated and finally SPSS imported was done including the chi square test.

**RESULTS**

The majority of males patients (40.74%) CGF type of scaffolds are used whereas for female patients (22.2%) PRF type of scaffolds is used. Result showed the p value was found to be (0.082) greater than 0.05. Therefore there was no significant difference found between gender and different types of scaffolds (Figure 1). Association between age group and scaffold used showed significant difference (p =0.037), p<0.05. Patient age group of 21-30 yrs had a maximum revascularization procedure (Figure 2). The majority of revascularization procedures (44.44%) was done in teeth number 11 followed by (40.74%) was done in teeth number 21. Where the p value was found to be greater than 0.05. Therefore there was no significant difference found between teeth number and different types of scaffolds (Figure 3).

**DISCUSSION**

In our study we found that the majority of males patients (40.74%) CGF type of scaffolds are used whereas for female patients (22.2%) PRF type of scaffolds is used. Whereas in other studies they found that on clinical examination the patients were found asymptomatic throughout the study period. On Radiographic examination all cases showed an improvement in apical closure, root lengthening, and periapical healing and dentinal wall thickening. Collagen and PGF gave better results when compared with placentex and chitosan in terms of apical closure, root lengthening, periapical healing and dentinal wall thickening. Revascularization procedure is more effective and conservative when compared with apexification in the treatment of necrotic immature permanent teeth. Their study showed that PRF and collagen are better scaffolds when compared

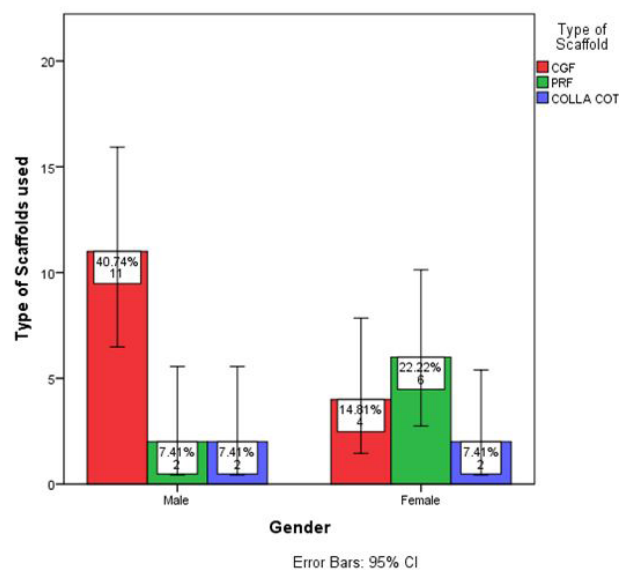


Figure 1: Comparison between gender and scaffolds.

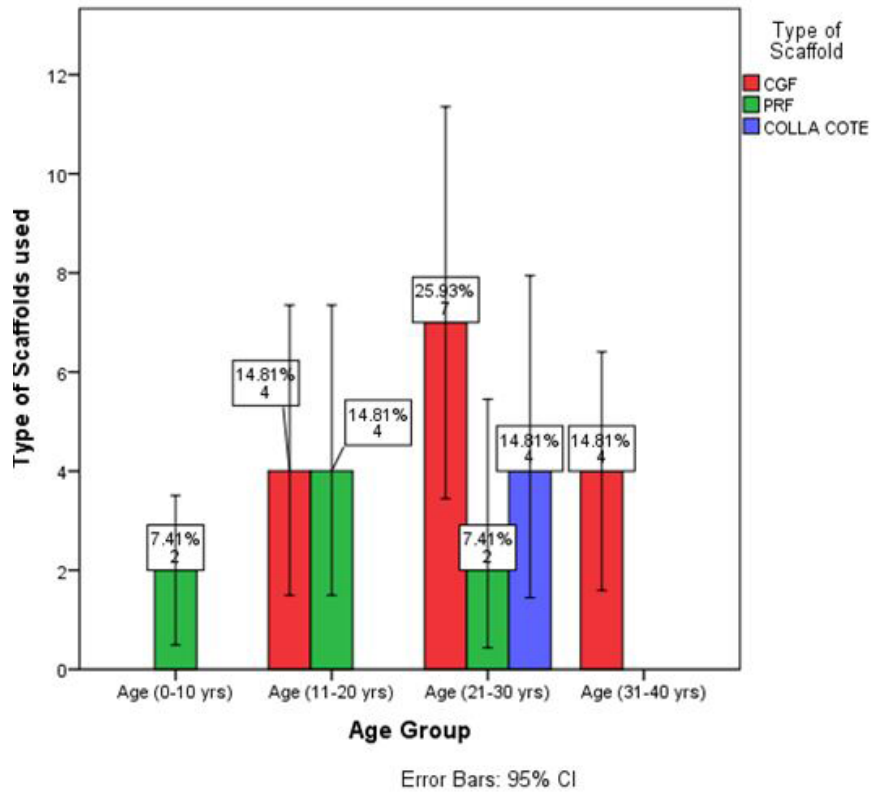


Figure 2: Comparison between age and scaffolds.

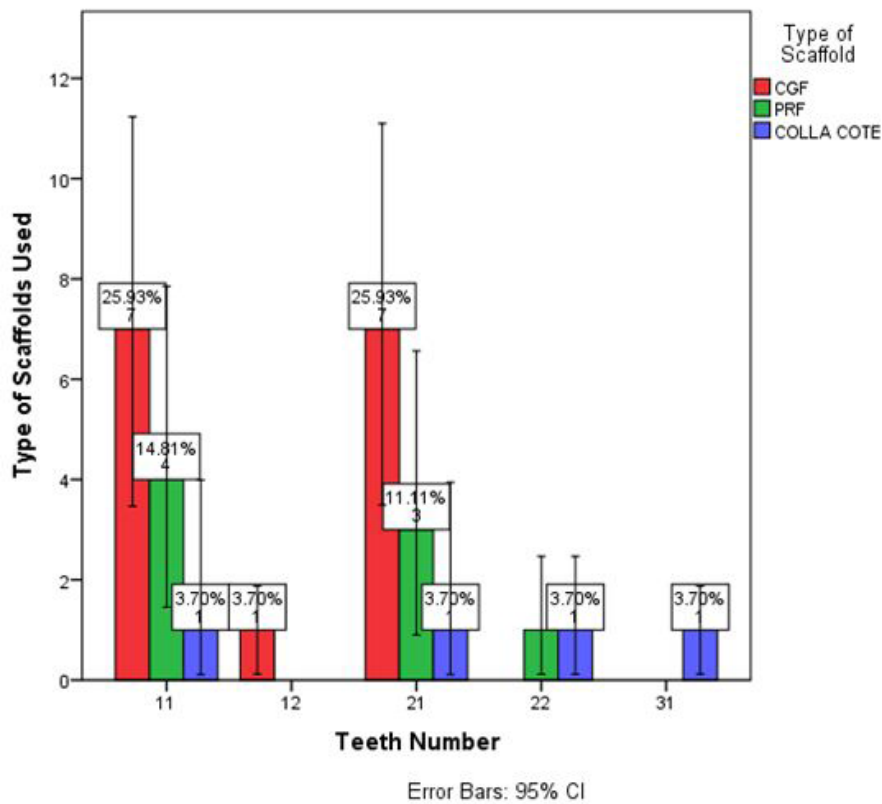


Figure 3: Comparison between teeth number & scaffolds.

with placentrex and chitosan for inducing apexogenesis in immature necrotic permanent teeth [29,30]. In our study the majority of patients under (21-30) yrs

old used CGF (25.9%) followed by colla cota (14.8%). PRF appears to be superior to (Bio-Gide) collagen as a scaffold for human periosteal cell proliferation.

PRF membranes are correct for in vitro cultivation of periosteal cells for bone tissue engineering [31]. In other study they suggested that because of increased release of growth factors like (PDGF-AB, TGF- $\beta$ 1, VEGF, and EGF) from PRF for around first 60 minutes, it should be used on before the period has elapsed in the surgical sites preferred. In their study the protocol and prepared PRF was used within this period [32]. Under microscope, the morphology of cells incubated over 7 days with the scaffolds appeared healthy with COLL. Cells which are in contact with PLGA showed signs of degeneration and apoptosis. MTT assay showed that at  $5.0 \times 10^4$  hDPSCs, COLL demonstrated significantly higher cell proliferation rates than cells in media only (control,  $p < 0.01$ ) or cells co-incubated with PLGA ( $p < 0.01$ ). In the ELISA test there are no significant differences observed between cells with media only and COLL at 1, 3, and 6 days. Cells incubated with PLGA expressed significantly higher IL-8 than the control at all-time points ( $p < 0.01$ ) and compared to COLL after 1 and 3 days ( $p < 0.01$ ). The COLL showed more biocompatibility and that is suitable for endodontic regeneration purposes [33]. In our study the majority of revascularization procedures (44.44%) was done in teeth number 11 followed by (40.74%) was done in teeth number 21. Yamauchi et al in their study demonstrated that use of a collagen scaffold which is cross linked can cause bleeding induction, in teeth with improper root development and periapical periodontitis significantly rise in the formation of mineralized tissues. Increase in healing of the apical periodontitis is seen when the collagen scaffold group with the osteoinductive properties of the scaffold is used [34].

### CONCLUSION

From the present study it is clear that the majority of patients under (21-30) yrs. old used CGF followed by colla cota. Majority of males patients CGF type of scaffolds are used whereas for female patients PRF type of scaffolds are used. Majority of the patients CGF is used followed by PRF and colla cote, sustained release of growth factors resulting in more successful results on the use of CGF. Which gives more success rate in revascularization therapy? And the majority of revascularization procedures was done in teeth number 11 followed by 21.

### LIMITATIONS

There are few limitations in our survey. There is a small sample size used for our survey which cannot be generated for a large population. And the survey doesn't represent the ethnic group and population.

### FUTURE SCOPE

The survey should be done in a larger population. Multicenter surveys should be done including other criteria's.

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