International Journal of Research in Health and Allied Sciences

Journal home page: www.ijrhas.com

Official Publication of "Society for Scientific Research and Studies" [Regd.]

ISSN: 2455-7803

Original Research

Effect of silver diamine fluoride as indirect pulp capping agent in permanent dentition

[1]Seema Gulzar, [2]Benefsha Shabir, [3]Shagufta Bano, [4]Dr. Pradyumna Misra, [5]Dr. Supratim Tripathi

[1,2,3]Post Graduate student, [4]H.O.D, [5]Professor, Department of Conservative Dentistry and Endodontics, Career Post Graduate Institute of Dental Sciences, Lucknow, Uttar Pradesh, India

ABSTRACT:

Background: To study the effect of silver diamine fluoride as indirect pulp capping agent. **Materials & methods:** A total of 20 subjects were enrolled. In permanent dentition, 10 had group I with dycal and 10 teeth in group II with silver diamine fluoride. Complete screening was done. Radiographic evaluation was done at the end of 1 month and 6months. Data was collected and results were analysed using SPSS software. P value was considered to be significant as less than 0.005. **Results:** There were no treatment failures in any case at 1 week followup. 2 patients reported with pain in mandibular first molar at 1 month which was treated with Dycal as an IPC material. The clinical and radiographic evaluation was done and success rate at 1 month was found to be 100% in permanent dentition with 38% SDF and 80% in teeth with calcium hydroxide. **Conclusion:** SDF can be used as potential substitute to Calcium hydroxide for Indirect pulp capping.

Keywords: silver diamine fluoride, permanent dentition, indirect pulp capping.

Received: 22 May, 2022 Accepted: 28 June, 2022

Corresponding author: Benefsha Shabir, Post Graduate student, Department of Conservative Dentistry and Endodontics, Career Post Graduate Institute of Dental sciences, Lucknow, Uttar Pradesh, India

This article may be cited as: Gulzar S, Shabir B, Bano S, Misra P, Tripathi S. Glass ionomer cement as restorative material. Int J Res Health Allied Sci 2022; 8(4):98-100.

INTRODUCTION

Maintaining pulp vitality is an important aspect for deep caries management. Evidence-based practice suggests stepwise excavation and selective caries removal to soft dentin to reduce the risk of mechanical pulp exposure. [1,2] The intact dentin barrier not only protects the dental pulp but also releases growth factors to stimulate a reparative process. [3] Clinically, it is difficult to determine the precise amount of carious tissue overlying the pulp while there is a lack of consensus on how much caries can be left without any adverse consequences. Therefore, decision making regarding the need for reentry, which increases the risk of pulp exposure, is subjective. If the sealed active carious lesion could turn into an inactive lesion completely and pulp-dentin defenses occur effectively regardless of the amount of residual carious lesion, a one-step incomplete caries removal procedure in deep cavities may be more favorable.In deep dentinal caries, dentin discoloration occurs far in advance of the infection by microorganisms, and as much as 2 mm of the softened or discolored dentin is not infected. Carious dentin actually consists of two distinct layers having different ultramicroscopic and chemical structures. [4] The outer carious layer is irreversibly denatured, infected and incapable of being remineralized and should be removed. The inner carious layer is reversibly denatured, not infected, and capable of being remineralized and should be preserved. [5]To prevent pulp exposure, indirect pulp capping (IPC) is done, in which caries is excavated and the tooth is restored with suitable IPC material. Over the years, calcium hydroxide has emerged as gold standard for IPC. Glass ionomer cement (GIC) has seen its popularity as a restorative material, as it was identified that fluoride release has an anticariogenic property. [6] Type VII GIC, which is a high-fluoride releasing material, was introduced for pit and fissure sealing. In addition, it has an excellent sealing property.

Calcium hydroxide has remineralizing potential due to its unique mechanism of action which has been tested and used for many years, and considered gold standard for indirect pulp capping. [7] It has two

enzymatic properties: The property of inhibiting bacterial enzymes by means of hydroxyl ions that act on the cytoplasmic membrane of bacteria (generating the antibacterial effect) and that of activating tissue enzymes, such as alkaline phosphatase, leading to its mineralizing effect. The pH for activation of this enzyme varies with the type and concentration of substrate, with temperature and with the source of enzyme. The formation of mineralized tissue after contact with calcium hydroxide has been observed from about the 7th to the 10th day. [8,9]

Silver diamine fluoride (SDF) has also been used as a cariostatic agent. Various clinical studies have reported its utility in the treatment and prevention of caries. [10] SDF helps in the deposition of silver phosphate to restore mineral content, resulting in rehardening of tooth structure. It also releases fluoride. Hence, this study was conducted to study the effect of silver diamine fluoride as indirect pulp capping agent.

MATERIALS & METHODS

A total of 20 subjects were enrolled. In permanent dentition, 10 had group I with dycal and 10 teeth in group II with silver diamine fluoride.Complete screening was done. Calcium hydroxide (dycal) was mixed according to manufacturer's instructions and was applied in the cavity. Silver diamine fluoride was applied to the floor of the cavity. Radiographic evaluation was done at the end of 1 month and 6months. Data was collected and results were analysed using SPSS software. P value was considered to be significant as less than 0.005.

RESULTS

A total of 20teeth (SDF-10; Dycal-10 teeth) was to be followed up at the end of 1 month and 6 months.

There were no treatment failures in any case at 1 week followup. 2 patients reported with pain in mandibular first molar at 1 month which was treated with Dycal as an IPC material. The clinical and radiographic evaluation was done and success rate at 1 month was found to be 100% in permanent dentition with 38% SDF and 80% in teeth with calcium hydroxide.

Table 1: evaluation of materials according to time

Groups	Number of teeth (n =20)	Success rate
Group I (DYCAL)	8/10	80%
Group II (SDF)	10/10	100%

Reparative dentine formation in both the groups was analysed. The mean thickness of reparative dentine after 1 month follow up in group I was 0.122 and in group II was 0.002. The mean reparative dentine thickness after 6months in group I was 0.168 and in group II was 0.009. The amount of reparative dentin formed was highest in the Dycal group followed by SDF group.

Table 2: Mean reparative dentine thickness.

Time	Groups	Mean	P - value
1 month	Group I	0.122	0.004*
	Group II	0.002	
6 months	Group I	0.168	<0.001*
	Group II	0.009	

* : significant

DISCUSSION

Silver diamine fluoride (SDF) may be a promising agent to use adjunctively with the selective caries removal method in deep cavities. Current studies suggest that the action modes of SDF include (i) inhibiting cariogenic bacterial growth [11] , (ii) slowing down the demineralization of carious dentin[12] (iii) promoting the remineralization of demineralized dentin [13] and (iv) inhibiting collagen degradation. [14] In this regard, the extent of silver particle penetration and distribution is a crucial factor for safety and effectiveness, especially when applying SDF in deep carious lesions. A major concern with the use of SDF in deep carious lesions is that SDF components may irritate the pulp while leaving necrotic tissue that may compromise the cariostatic effects of SDF. Hence , this study was conducted to study the effect of silver diamine fluoride as indirect pulp capping agent in permanent dentition.

In this present study, a total of 20 teeth (SDF-10 ; Dycal-10 teeth) was to be followed up at the end of 1 month and 6 months.There were no treatment failures in any case at 1 week followup. 2 patients reported with pain in mandibular first molar at 1 month which was treated with Dycal as an IPC material. The clinical and radiographic evaluation was done and success rate at 1 month was found to be 100% in permanent dentition with 38% SDF and 80% in teeth with calcium hydroxide. A study byManuschai J et al studied extracted permanent teeth with caries extending to the inner third of the dentin were used (N = 18). The periphery of the carious lesion was completely removed to the dentinoenamel junction (DEJ). In group A (n = 9), no further removal of carious tissue was performed, leaving necrotic dentin inner to the DEJ, whereas in group B (n = 9) superficial necrotic dentin was completely removed until leathery, slightly moist, reasonably soft dentin remained. SDF was applied for 3 minutes in both

groups. The micro-CT analysis showed that the PD/LD ratios of group B (1.07–2.29) were marginally greater than those of group A (1.00–1.31). However, a statistically significant difference was not observed (pvalue = 0.5078). When stratified by remaining dentin thickness (RDT), the PD/LD ratios of group B were still greater than those of group A only when RDT was >500 µm. The FESEM-EDS analysis indicated that silver particles precipitated throughout the entire thickness of the carious lesions. Applying SDF on a deep carious lesion and leaving the necrotic dentin pulpally did not affect silver penetration. However, the extent to which silver penetrates the remaining dentin beneath the lesions is dependent on the amount and characteristics of that dentin.[15]

In the present study, reparative dentine formation in both the groups was analysed. The mean thickness of reparative dentine after 1 month follow up in group I was 0.122 and in group II was 0.002. The mean reparative dentine thickness after 6months in group I was 0.168 and in group II was 0.009. The amount of reparative dentin formed was highest in the Dycal group followed by SDF group.In another study by of LeyeBenoist et al., showed 0.085 mm of increase in dentin thickness over a period of 6 months.[16] Another studyKorwar A et al studied deep Class V cavities were made on four first premolars indicated for extraction for orthodontic reasons. SDF, Type VII GIC, and calcium hydroxide base are given in three premolars, and one is kept control. No inflammatory changes were observed in any of the groups. Significantly more number of specimens in SDF and Type VII GIC groups showed tertiary dentin deposition (TDD) when compared to control group. No significant difference was seen in TDD when intergroup comparison was made. Odontoblasts were seen as short cuboidal cells with dense basophilic nucleus in SDF and Type VII GIC group. They demonstrated TDD inducing ability of SDF and Type VII GIC and also established the biocompatibility when used as IPT materials.[17]

CONCLUSION

SDF can be used as potential substitute to Calcium hydroxide for Indirect pulp capping.

REFERENCES

1. Banerjee A., Frencken J. E., Schwendicke F., Innes N. P. T. Contemporary operative caries management: consensus recommendations on minimally invasive caries removal. British Dental Journal . 2017;223(3):215–222. doi: 10.1038/sj.bdj.2017.672.
2. Innes N. P., Frencken J. E., Bjorndal L., et al. Managing carious lesions: consensus recommendations on terminology. Advances in Dental Research . 2016;28(2):49–57. doi: 10.1177/0022034516639276.
3. Farges J. C., Alliot-Licht B., Renard E., et al. Dental pulp defence and repair mechanisms in dental caries. Mediators of Inflammation . 2015;2015:230251–16. doi: 10.1155/2015/230251
4. Fusayama T. Two layers of carious dentin: Diagnosis and treatment. Oper Dent. 1979;4:63–70.
5. Miyauchi H, IW aku M, Fusayama T. Physiological recalcification of carious dentin. Bnl Tokyo Med Dent Univ. 1978;25:169–79.
6. Wilson AD, Kent BE. A Newtransluscent cement for dentistry. The glass ionomer cement. Br Dent J. 1972:132–3.
7. Ingle JI, Bakland LK. Endodontics. 5th ed. London: Elsiver Pub; 2002. p. 868.
8. Estrela C, Sydney GB, Bammann LL, Junior OF. Mechanism of action of Calcium and Hydroxyl ions of Calcium hydroxide on tissues and bacteria. Braz Dent J. 1995;6:85–90.
9. Burke FM, Ray NJ, McConnell RJ. Fluoride-Containing Restorative Materials. Int Den J. 2006;56:33–43.
10. Yamaga R, Yoshita S, Yokomizo I. Diamine silver fluoride and its clinical application. J Osaka Univ Dent Sch. 1972;12:1–20.
11. Mei M. L., Chu C. H., Low K. H., Che C. M., Lo E. C. Caries arresting effect of silver diamine fluoride on dentine carious lesion with S. Mutans and L. Acidophilus dual-species cariogenic biofilm. Medicina Oral Patología Oral y CirugiaBucal . 2013;18(6):824–831. doi: 10.4317/medoral.18831.
12. Mei M. L., Li Q. L., Chu C. H., Lo E. C., Samaranayake L. P. Antibacterial effects of silver diamine fluoride on multi-species cariogenic biofilm on caries. Annals of Clinical Microbiology and Antimicrobials . 2013;12:1–4. doi: 10.1186/1476-0711-12-4.
13. Knight G. M., McIntyre J. M., Craig G. G., Mulyani, Zilm P. S., Gully N. J. Differences between normal and demineralized dentine pretreated with silver fluoride and potassium iodide after an in vitro challenge by Streptococcus mutans. Australian Dental Journal . 2007;52(1):16–21. doi: 10.1111/j.1834-7819.2007.tb00460.x.
14. Hamama H. H., Yiu C. K., Burrow M. F. Effect of silver diamine fluoride and potassium iodide on residual bacteria in dentinal tubules. Australian Dental Journal . 2015;60(1):80–87. doi: 10.1111/adj.12276
15. Manuschai J, Talungchit S, Naorungroj S. Penetration of Silver Diamine Fluoride in Deep Carious Lesions of Human Permanent Teeth: An In Vitro Study. Int J Dent. 2021 Dec 22;2021:3059129.
16. LeyeBenoist F, Gaye Ndiaye F, Kane AW, Benoist HM, Farge P. Evaluation of mineral trioxide aggregate (MTA) versus calcium hydroxide cement (Dycal(®)) in the formation of a dentine bridge: a randomised controlled trial. Int Dent J 2012;62(1):33-9.
17. Korwar A, Sharma S, Logani A, Shah N. Pulp response to high fluoride releasing glass ionomer, silver diamine fluoride, and calcium hydroxide used for indirect pulp treatment: An in-vivo comparative study. ContempClin Dent. 2015 Jul-Sep;6(3):288-92