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SDF and KI, A modern sandwich technique– Review article

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Abstract
Silver diamine fluoride (SDF) is used in minimally invasive dentistry for arresting dental caries. However, discoloration of teeth is a significant side effect that has limited the use of SDF. Hence, the application of potassium iodide (KI) following SDF has been proposed to ameliorate the staining. Although antimicrobial activity is one of the major mechanisms of the caries-arresting effect of SDF, the antimicrobial potency of SDF/KI combination is unclear. Thus, the primary objective of this systematic review was to appraise the studies on the antimicrobial efficacy of SDF/KI combination on cariogenic microbes.

Keywords: silver diamine fluoride, potassium iodide, dental caries, antimicrobial activity

Introduction
Secondary (recurrent) caries, which refers to the carious lesions affecting the margins of an existing restoration [1], is regarded as the most common reason for re-restoration of teeth in the long term [2]. It has been reported that more than 25% of restoration replacements of amalgam and resin composite were ascribed to secondary caries [3]. This fact has facilitated the development of dental materials that possess anti-cariogenic properties, such as fluoride-containing restorative materials [4]. Glass ionomer cements (GICs) can release fluoride ions to enhance remineralization, and their abilities in fluoride release and recharge are superior to other restorative materials, such as compomers and giomers [4]. However, its antimicrobial effect is limited and inadequate to prevent secondary caries development [5]. The cariogenic bacteria of secondary caries are similar to those of primary caries, and consist primarily of Streptococci, Actinomyces naeslundii and Lactobacilli [2].
Studies have shown that silver diamine fluoride (SDF) has an intense antibacterial effect on cariogenic bacteria and can inhibit the growth of multi-species cariogenic biofilms on tooth surfaces [6–8]. SDF is a topical fluoride which is often used in high concentration (38%) for preventing and arresting dental caries [9]. SDF has recently been approved for clinical use by the United States Food and Drug Administration in 2015. A review concluded SDF as an effective, efficient, equitable and safe caries-preventive agent appearing to meet the World Health Organization's Millennium Goals for 21st century medical care [10]. Clinical studies also showed the success of SDF in preventing and arresting dental caries [11, 12]. A laboratory study found that the bond strength of restorations to dentine was not adversely affected by SDF using resin-based adhesives [13]. The application of SDF under GIC restorations has been demonstrated to produce a promising pulpal response and be effective in facilitating the formation of reparative dentine [14]. It also has been reported that prior treatment with SDF can increase resistance of cavity margins around GIC restorations to secondary caries development [5].
A significant disadvantage of SDF use, however, is black staining on teeth which can cause aesthetic concern [11]. A way that has been suggested of managing this problem is to apply a saturated solution of potassium iodide (KI) immediately after SDF application. It was suggested that discolouration of the carious lesion can be avoided while the caries arresting effect of SDF is not changed [15]. The suggested explanation is that the silver ions from the SDF solution will react with the iodide ions from the KI solution to form silver iodide. It was reported that the application of SDF + KI to dentine surfaces before the placement of GIC restorations did not affect the bond strength of GIC to dentine [16], and did not adversely interfere with the fluoride uptake into the adjacent demineralised dentine [15].

Case Study 1
This patient presented seeking a second opinion to a treatment plan involving the extraction of a carious asymptomatic upper right second molar and replacing it with a dental implant.
Minimal access "tunnel" cavities, without local anaesthesia, were prepared on the mesial of the second molar and distal of the first molar. The preparations were etched for 15 seconds washed and dried. SDF was applied

immediately followed by KI until the reactant went clear. The cavities were washed and dried and proximal matrices applied and wedged. Self-cure GIC restorations were placed into each cavity.
Figure 1 shows a radiograph of several large asymptomatic carious lesions prior to treatment.
Figure 2 shows a radiograph immediately after placement of Riva Star and self-cure glass ionomer cement, Riva SC (SDI, Australia). The increase in radiopacity was caused by the precipitation of tooth mineral within the carious lesion due to the initial high pH of Riva Star.
Six weeks later the patient returned to have the remaining cavities restored. Photograph of the restorations (Fig. 3) shows no sign of staining and a radiograph (Fig. 4) shows a further increase in radiopacity beneath the restoration.

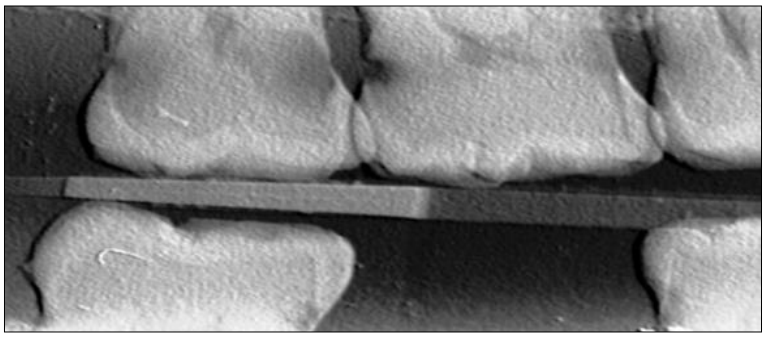

Fig 1: Large asymptomatic lesions especially mesial of the upper second molar

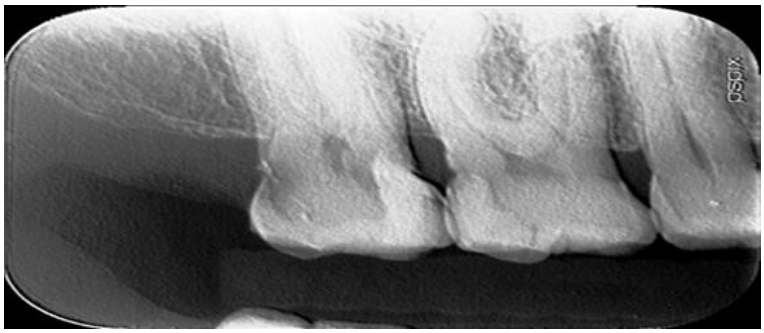

Fig 2: Radiograph immediately after Riva Star and tunnel restoration placement with self-cure GIC (Riva SC). High pH precipitates out tooth mineral dissolved in carious dentin.

Fig 3: The restorations after 6 weeks. Observe no staining on either the teeth or the restorations

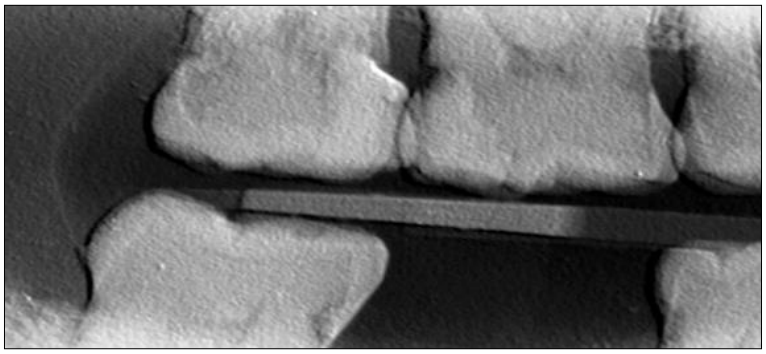

Fig 4: Six weeks later, following restoration of remaining cavities, further increases in radiopacity can be observed around tunnel restorations

Case Study 2

Shows a large asymptomatic carious lesion beneath a failed composite resin restoration (Fig. 5).The restoration was removed, and following minimal caries excavation, the lesion was etched for 15 seconds followed by Riva Star placement as prescribed and a GIC/ composite resin sandwich (co-cured) restoration placed. An immediate post placement radiograph (Fig. 6) shows a substantial improvement in radiopacity of the remaining caries. A four-week follow up shows no staining of the surrounding tooth structure or restoration (Fig. 7) and a radiograph demonstrates a further increase of radiopacity of the carious dentin (Fig. 8).

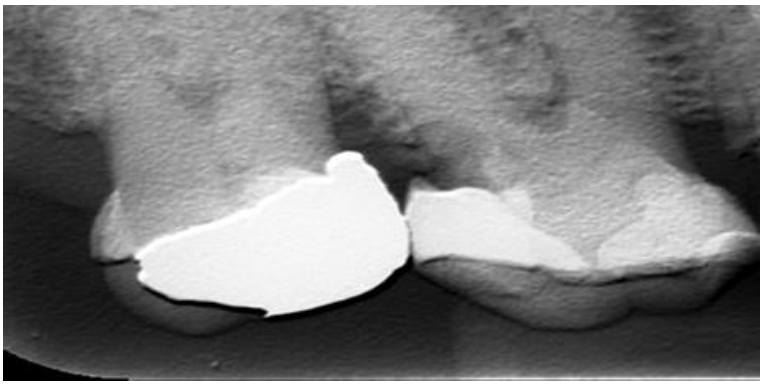

Fig 5: A large asymptomatic lesion below a failed composite resin restoration

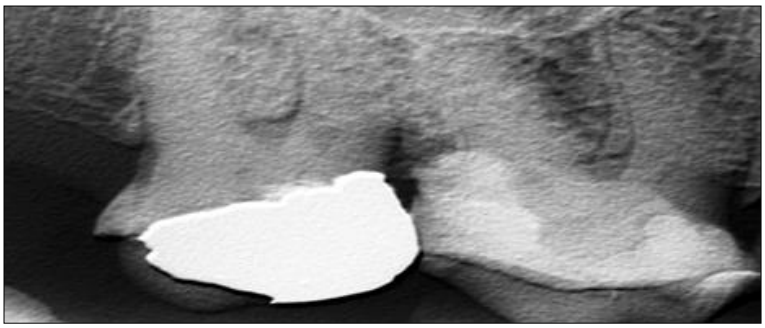

Fig 6: Immediate follow up radiograph shows a substantial increase in radiopacity of residual caries.

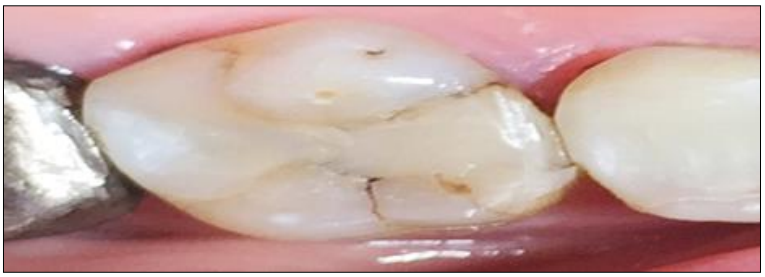

Fig 7: Four weeks after placement shows no staining of either the surrounding tooth or of the GIC, composite co-cure sandwich restoration

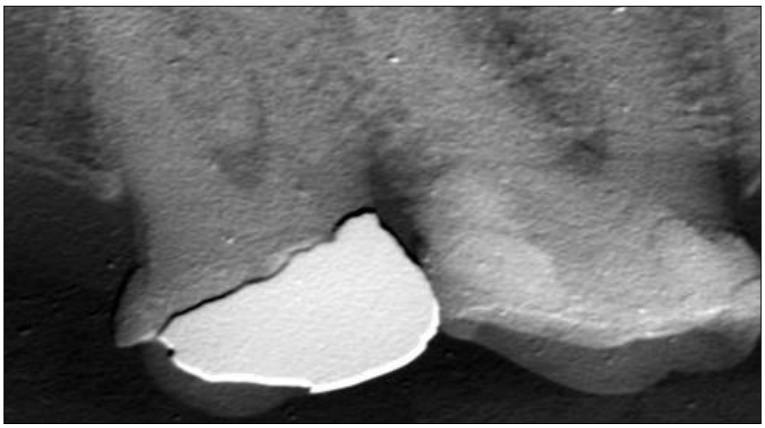

Fig 8: A radiograph demonstrates a further increase in radiopacity four weeks after initial placement of the GIC/composite restoration.

Conclusion

Silver fluoride has the potential to play an important role in minimal intervention dentistry. The use of potassium iodide to prevent the staining of enamel and dentine associated with silver fluoride will see further clinical applications and benefits of this combine use.

Clinical Rationale for Using SDF in Modern Day Practice

Early application of SDF systems can effectively control multiple and rampant caries (Clinical review, Rosenblatt *et al* 2009)

- Quick and efficient control of infection
- Non-invasive
- Ease and simplicity of use (paint on)
- Ideal for emergency care
- Caries prevention
- Cost effective intervention

Conflict of interest - NO

Source of funding - None

References

1. Montagner AF, Kuper NK, Opdam NJ, Bronkhorst EM, Cenci MS, Huysmans MCD. Wall-lesion development in gaps: The role of the adhesive bonding material. J. Dent,2015:43:1007-1012. [CrossRef] [PubMed]
2. Jokstad A. Secondary caries and microleakage. Dent. Mater,2016:32:11-25. [CrossRef] [PubMed]
3. Wilson NH, Burke F, Mjör IA. Reasons for placement and replacement of restorations of direct restorative materials by a selected group of practitioners in the United Kingdom. Quintessence Int,1997:28:245-248. [PubMed]
4. Zafar MS, Ahmed N. Therapeutic roles of fluoride released from restorative dental materials. Fluoride,2015:48:184-194.
5. Mei ML, Zhao IS, Ito L, Lo EC, Chu CH. Prevention of secondary caries by silver diamine fluoride. Int. Dent. J,2015:66:71-77. [CrossRef] [PubMed]
6. Mei ML, Li QL, Chu CH, Lo EM, Samaranayake LP. Antibacterial effects of silver diamine fluoride on multi-species cariogenic biofilm on caries. Ann. Clin. Microbiol. Antimicrob,2013:12:4. [CrossRef] [PubMed]
7. Mei ML, Chu CH, Low KH, Che CM, Lo ECM. Caries arresting effect of silver diamine fluoride on dentine carious lesion with S. mutans and L. acidophilus dual-species cariogenic biofilm. Med. Oral Patol. Oral Cir. Bucal,2013:18:824-831. [CrossRef]
8. Chu CH, Mei L, Seneviratne CJ, Lo ECM. Effects of silver diamine fluoride on dentine carious lesions induced by Streptococcus mutans and Actinomyces naeslundii biofilms. Int. J. Paediatr. Dent,2012:22:2-10. [CrossRef] [PubMed]
9. Mei ML, Lo ECM, Chu CH. Clinical Use of Silver Diamine Fluoride in Dental Treatment, Compendium of continuing education in dentistry. Compend. Contin. Educ. Dent,2016:37:93-98. [PubMed
10. Rosenblatt A, Stamford T, Niederman R. Silver diamine fluoride: A caries “silver-fluoride bullet”. J. Dent. Res,2009:88:116-125. [CrossRef] [PubMed]
11. Chu CH, Lo ECM, Lin H. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. J. Dent. Res,2002:81:767-770. [CrossRef] [PubMed]
12. Llodra J, Rodriguez A, Ferrer B, Menardia V, Ramos T, Morato M. Efficacy of silver diamine fluoride for caries reduction in primary teeth and first permanent molars of schoolchildren: 36-month clinical trial. J. Dent. Res.,2005:84:721-724. [CrossRef] [PubMed]
13. Quock R, Barros J, Yang S, Patel S. Effect of silver diamine fluoride on microtensile bond strength to dentin. Oper. Dent,2012:37:610-616. [CrossRef] [PubMed]
14. Gotjamanos T. Pulp response in primary teeth with deep residual caries treated with silver fluoride and glass ionomer cement (‘atraumatic’technique). Aust. Dent. J,1996:41:328-334. [CrossRef] [PubMed]
15. Knight G, Mclntyre J, Craig G. Ion uptake into demineralized dentine from glass ionomer cement following pretreatment with silver fluoride and potassium iodide. Aust. Dent. J,2006:51:237-241. [CrossRef] [PubMed]
16. Knight G, Mclntyre J. The effect of silver fluoride and potassium iodide on the bond strength of auto cure glass ionomer cement to dentine. Aust. Dent. J. 2006, 51, 42-45. [CrossRef] [PubMed]