

**Resin Infiltration Technique in Primary Teeth: A Review**

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**Citation of this Article:** Ramoli R. Pawar, Sandhyarani B., Anil T. Patil, Mital V. Kevadia , Devendrapratap M Singh, Aranta A Chindane, “Resin Infiltration Technique in Primary Teeth: A Review”, IJDSIR- September - 2020, Vol. – 3, Issue - 5, P. No. 372 – 377.

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**Type of Publication:** Review Article

**Conflicts of Interest:** Nil

**Abstract**

Dental caries affects oral health of the child. Managing these caries is usually done using invasive methods but in recent years, dental practice has evolved with many minimally invasive techniques, one such relatively new product is DMG Icon to treat incipient caries, white spot lesions and non cavitated proximal caries in primary teeth. The article will discuss its mechanism, use, safety and applications in deciduous teeth.

**Keywords:** DMG icon, primary teeth, resin infiltration technique.

**Introduction**

Dental caries commonly affects children in early childhood. It not only affects dental health but also reflects as negative overall health of the child thus treatment of these caries is necessary. Traditionally the caries removal methods include invasive methods in case of both cavitated as well as non cavitated caries. [1] Thus in such cases there is unnecessary tooth structure loss. However

now a days the treatment has been changed from the large invasive technique to non invasive or minimal invasive preventive techniques. Various noninvasive methods are developed to treat early lesions and non cavitated proximal caries amongst which is the resin infiltration technique is one of them.[2]

### History

Caries infiltration technique was initially developed in Charité Berlin, for management of smooth surface caries, proximal non-cavitated caries and white spot lesions, under the name of Icon (DMG America Company, Englewood, NJ).[2] In this technique methacrylic resins are used with high penetration coefficients into the porous enamel. Thus there was better penetration coefficient and removal of surface layer which is pseudo intact when the enamel is etched using 15% HCl. This product is now available in the market in the name of DMG, Hamburg, Germany.[2]

### How Does It Work ?

Icon resin infiltration is relatively new product which is effectively used in case of incipient lesions, smooth surface lesions, non cavitated proximal lesions. It is known as micro invasive method which has features of improving retention and prevention of caries progression. This technique works by penetration of resin infiltrants into incipient lesions using capillary action [2], due to this it causes blockage of the bacteria to diffuse further and stops its further development. Thus it restores the tooth without drilling or anaesthesia [3]. This feature distinguishes Icon from sealants as that it not just a mechanical barrier between tooth and oral cavity but is an exclusive method of inactivating bacteria and preventing the progression of caries. [4]

The ICON kit is available as two products; out of which one is Icon- caries infiltrate-proximal which is used for treatment of early proximal caries and the other is Icon-

caries infiltrant-smooth surface which is used for treatment of smooth surfaces lesions. The commercial available ICON® kit contains, syringes of ICON-ETCH containing hydrochloric acid used as etchant, ICON-DRY containing ethanol used for drying and ICON INFILTRANT which has infiltrate resin material.[5,6]

### Method of Application

Icon (DMG, Hamburg, Germany) kit is provided by manufacturer's instructions which gives its method of application. Icon® usage involves application of Icon®-Etch syringe which consists of 15% Hydrochloric acid and should be used for 2 minutes, followed by rinsing with water for 30 seconds and drying. Later the lesion should be desiccated using the Icon®-Dry syringe consisting of ethanol for 30 seconds followed by drying with air. Then the Icon®-Infiltrant syringe should be placed on the targeted surface and caries resin-infiltrant should be dispensed for three minutes, then later the excess infiltrant should be wiped using cotton and followed by light-curing for 40 seconds. Lastly, the infiltrant should be reapplied for one minute and light curing should be done for 40 seconds. [3,4]

### Applications of Resin Infiltration In Primary Teeth

Caries progression is as much as twice faster in primary teeth as compared to permanent teeth [7] hence once carious lesions are detected, its progression should be arrested by the use of non-operative measures like dietary control, topical fluoridation etc. Once the lesions will become cavitated, it leaves the dentist no choice but to manage them invasively.

Resin infiltration also known as Caries infiltration, which is novel micro-invasive treatment option for non cavitated lesions which serves to bridge the 'gap' between non-operative and operative options.[8]

There are various applications of DMG icon used in permanent teeth [5] however, comparatively less research

is carried out on deciduous teeth. As there exists a structural difference between primary and permanent teeth in the outermost surface of enamel via presence of aprismatic layer and degree of mineralization [9] the effects of resin infiltration may alter from primary and permanent teeth.

### **Do Resin Infiltrants Penetrate In Deciduous White Spot And Non Cavitated Proximal Lesions ?**

Various studies have been placed on the penetration depths of resin infiltrant into the deciduous teeth.

A study evaluated the effects of reduction of surface layers on deciduous teeth by using phosphoric acid and hydrochloric acid on natural lesions and concluded that hydrochloric acid shows complete removal after etching acid for 2 minutes than phosphoric acids [10] therefore this effectively removed the surface layer, so as to achieve high penetration of infiltrants and it was studied that etching and penetration in both deciduous as well as permanent teeth was unhampered by structural differences in enamel.

A study also compared the penetration of infiltrant using different infiltrant application times into natural occurring white spot lesion of deciduous molars and concluded that one minute application was sufficient but three minute application time should be recommended to infiltrate proximal lesions in deciduous molars [11]. Another invitro study evaluated the role of ethanol influence on penetration of infiltrants in proximal lesions of primary molars and concluded that the infiltrants were able to infiltrate proximal carious surface in primary molars too [12] It was also found that one minute application to gave similar penetration as five minute applications.[13]

In a study it was seen that Icon infiltrant was capable of penetration of several hundred micrometres into natural carious lesions on deciduous, when it was employed as per manufacturer's instructions making the Icon system a

valuable tool over other non invasive modalities to deal with WSL [6] Such studies have been in agreement with permanent teeth which describe the considerable variation in penetration depths. [5]

From the above studies it is concluded that three minute application yielded varying depths of penetration is seen and thus the resin-infiltration system Icon® thus provides an effective 'bridge' between non invasive and minimally invasive treatment. which is effective in deciduous teeth, along with its established use in permanent teeth.

### **Application of Resin Infiltration in Non Cavitated Proximal Caries in Primary Teeth**

Proximal caries are usually detected using bitewing or IOPA radiographs. The clinical indication of resin infiltration in primary teeth is non-cavitated proximal caries in molars. Therefore for understanding the classification of lesions as per radiographic appearance.;

E1: Enamel lesion extending upto outer half

E2: Enamel lesion extending upto inner half

D1: Dentinal lesion extending upto outer half

D2: Dentinal lesion extending upto inner half

Studies have demonstrated that E1 depth radiolucencies are rarely cavitated and require some non-invasive method of treatment while in D2 or deeper depth radiolucency are usually cavitated and requires restoration methods for treatment. [14]

Thus this infiltration method is a good modality to be used in lesions extending upto E1 and E2 which are rarely cavitated.

There are been invitro studies conducted to evaluate if the 'early carious' lesions in primary teeth behave in same manner as in permanent teeth and if these can be etched and infiltrated using the 'same' etchant and infiltrant. [15]

Another study that evaluated the penetration depth of proximal lesions after different applications times in primary molars concluded that natural non cavitated

lesions in primary molars can be deeply infiltrated with 1 minute application, however recommended 3 minute application for better results. [7,12]

In addition to this, an invitro study was conducted on proximal lesions of primary molars and permanent molars to demonstrate penetration capability which resulted in no difference in overall penetration capability in both rather little better penetration results were seen primary teeth in the lesions limited to (E2) depth. [16,17]

### **Clinical Trials**

A further literature search revealed that clinical trials were conducted with infiltration as one of the intervention for non cavitated lesions

A split-mouth study was conducted on 50 children having early lesions on primary molars and lasted for 1 year. In this study the efficacy of lesions which were covering fluoride varnish and fluoride varnish on proximal lesions only were evaluated and concluded with observation that clinical progression in the lesion (ICDAS scores) of was 31% in test group and 67% in control group. While radiographically, it was seen as 23% of test group and 62% of control group had progressed. [18]

A study included 45 children evaluated progression of proximal caries which were non cavitated in primary teeth. In this study low viscosity resins were infiltrated, with chlorhexidine varnish as well as without a chlorhexidine varnish layer having white spot lesions seen on proximal molar surfaces. After nine months, participants were recalled and observed that there were statistically significant histogram changes which were positive in group (RI + CHX varnish) thus concluded stating the benefits of an chlorhexidine varnish when layered on resin infiltration. [15]

A randomized, split month, clinical trial was conducted to evaluate if caries infiltration was effective to control the progression in proximal lesions that are non cavitated in

primary molars. The study included test group which included use of fluoridated toothpaste followed by flossing and infiltration and control group which included use of fluoridated toothpaste and flossing and concluded that caries infiltration in proximal primary molars was significantly more effective than standard method alone. [19]

The interesting thing about these trials was that the caries progression stopped by resin infiltrant, which increases the importance to use of DMG icon.

There was clinical trial conducted to evaluate radiographically if resin infiltration was effective along with the standardized preventive measures versus standardized preventive measures alone, in arresting the proximal caries progression in primary molars after 24 months of treatment and concluded that resin infiltration along with standardized preventive measures were more effective of reducing the caries progression in primary molars radiographically as compared with standardized preventive measures alone after 24 months. [20]

### **Are Resin Infiltrants Harmful In Children ?**

No relevant side effects of infiltrant technique were observed during the recall periods or even immediately after treatment. Studies did not reported side effects with children.[18,21] However further more studies are necessary to evaluate the effects of DMG icon.

### **Conclusion**

Resin infiltration is a novel method of minimal invasive dentistry which can be used for treating white spot lesions, non cavitated proximal caries, however cannot be used in deeper carious lesions. The relatively new DMG icon has good penetration ability in deciduous teeth and also is safe to used in children, however further research is necessary to evaluate strength and longevity of resin when used in deciduous teeth.

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