Resin Infiltration: An alternative to the "Wait-and-Watch" Approach

Written by Travis Nelson, DDS, MSD, MPH | June 2019

Introduction

Over half of US children aged 12-19 have experienced decay in permanent teeth.[1] In these young patients the mesial surface of the first permanent molar is the most common location for unrestored caries.[2] As the child ages these lesions are frequently restored, and by the age of 21 the occlusal, mesial, and distal surfaces of the first permanent molar account for the majority of all restored surfaces.[3] Caries in primary teeth is one of the greatest risk factors for decay in the permanent dentition. This relationship is particularly true for occlusal lesions.[4] For this reason, fissure sealants have become the standard of care for prevention of decay in high-risk permanent first molars.[5]

While fissure sealants are effective for prevention of occlusal caries, untreated smooth surfaces remain susceptible. Of all tooth surfaces at this age, the mesial surface of the first permanent molar is at highest risk for decay. This risk increases dramatically if the adjacent primary tooth is carious. When distal decay is present in the primary second molar, the risk of caries in the permanent tooth is 15 times greater than if the primary tooth is intact.[6] Once cavitated, the lesion must be restored. Initially this might involve a conservative intracoronal resin, but inevitably over the lifetime of the patient the restoration will require replacement. With each subsequent replacement the tooth becomes more compromised as the restoration grows in size. Ultimately, what started as a small lesion can lead to full coronal coverage, endodontic treatment, and even extraction.[7] (Figure 1) Therefore, limiting the progression of early caries lesions is of utmost importance.

Treatment options

Historically the main approach to managing enamel caries has been behavioral modification. This requires that the patient make changes in diet, home oral hygiene measures, and exposure to fluoride. More recently interproximal sealing and infiltration techniques have been proposed as adjuncts to behavioral modification. These interventions have been shown to dramatically reduce caries progression in non-cavitated proximal lesions when compared to hygiene and fluoride alone.[8, 9] While both sealing and infiltration effectively limit proximal caries progression, one advantage of the infiltration concept is use of standardized protocols and armamentarium. The procedure for non-invasive interproximal treatment is highly technique sensitive, and the Icon system reduces the chances for technical error by employing specifically designed delivery devices and strict treatment protocols. (Figure 2) The system allows predictable treatment of surfaces that are challenging to access. Icon also can also be used to infiltrate lesions that have penetrated into the outer layer of the dentin, thus increasing the

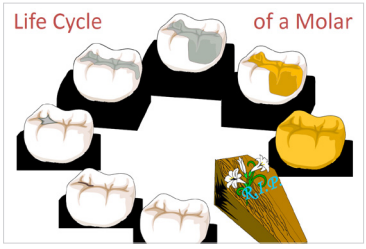

Figure 1- The molar life cycle.


Figure 2, Icon Proximal Etch and Infiltration device.

scope of minimally invasive dental treatment.

Indications for Treatment

Radiographic lesions are commonly assessed using the E0-E2, D1-D3 notation system, which denotes the degree of decay in enamel and dentin.[10, 11] The Icon system is indicated for treatment of interproximal E1, E2, and D1 lesions. Lesions that have progressed beyond D1 are not appropriate for infiltration. (Figure 3) Because there is no drilling involved in an Icon procedure, some patients may find it less stressful than a conventional dental restoration. When working with children, it is still important to note that the patient is likely to encounter some mild discomfort and must allow placement a rubber dam or similar isolation technique. For this reason, patient behavior must be assessed when considering Icon treatment. For children who are unlikely to tolerate local anesthesia or isolation procedures it may be wise to consider other treatment alternatives.

Figure 3, Icon Proximal lesion depth.

Case Report

In September 2015 an 11 year old boy presented to the clinic for routine preventive recall. He was in good health, took no regular medications, and had no allergies. The patient had an extensive dental history, including general anesthesia for comprehensive dental treatment as a young child. At that surgical visit he received stainless steel crowns (SSC) on all 8 primary molars and sealants on the first permanent molars. Clinical findings at the time of his preventive visit included generalized mild gingivitis with moderate plaque accumulation. Mild perforations of several of the SSCs was noted, but no caries was detected clinically. Bitewing radiographs were exposed, revealing an age appropriate dentition, adequate bone levels, and E2 incipient caries on the mesial surface of the maxillary and mandibular right permanent first molars. (Figure 4) A review of bitewing radiographs taken one year and two years prior revealed E1 lesions in the permanent first molars. (Figures 5.1 and 5.2)

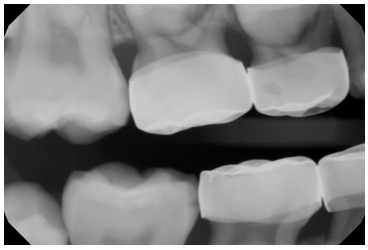
Figure 4- 9/2015 radiograph.

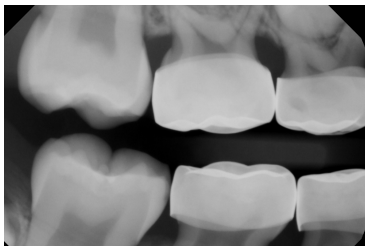
Figure 5.1- 7/2013 radiograph.

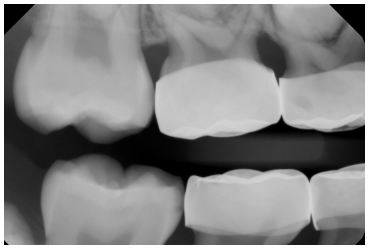
Figure 5.2- 8/2014 radiograph.

The dentist informed the patient's parent that caries on the proximal surfaces of the permanent first molars appeared to be progressing. Although the dentist had previously discussed implementing dietary changes, improving home hygiene, and 5000 PPM fluoride toothpaste the lesions were still increasing in size. After reviewing treatment options of continuing to "wait and watch" or treatment with resin infiltration, the parent elected Icon resin infiltration.

Clinical Procedure

After agreeing to the Icon procedure, large-size orthodontic separators were placed between the maxillary and mandibular 2nd primary molars and first permanent molars. Seven days later the patient returned to the clinic with the separators in place. (Figures 6.1 and 6.2) After obtaining consent to proceed, the right-side permanent first molars were anesthetized with 0.85 mL lidocaine 2% w 1/100k epi infiltration each. A non-latex rubber dam was independently applied to the mandibular and maxillary arches, and the following procedures were completed:

Step 1: The orthodontic separator was removed, revealing sufficient space for the proximal applicator. (Figures 7.1 and 7.2) The molar was then thoroughly cleaned with pumice and the contact was flossed. This cleaning step was completed with the rubber dam in place in order to avoid tissue damage and improve visualization. No cavitation of the mesial surface was visualized.

Step 2: The proximal applicator was attached to the etchant gel syringe and introduced into the interdental space. Note: the green side of the applicator faces the surface to be treated. (Figure 8) The Icon Etch gel was expressed onto the tooth surface and allowed to stand for a period of 2 minutes.

Step 3: The proximal applicator was removed, the residual etch was suctioned, and the tooth was rinsed with water for 30 seconds and dried with oil-free air.

Step 4: The lesions were then treated with Icon Dry ethanol solution for 30 seconds to remove residual moisture from the enamel. Oil-free air was used to fully desiccate the lesions.

Step 5: The proximal applicator was attached to the Icon Infiltrant syringe and introduced into the interdental area in the same fashion as the etch. The Icon Infiltrant was expressed into the lesion and allowed to infiltrate the tooth for 3 minutes. Note: the doctor's headlamp and the overhead light were directed away from the field to avoid early curing. Excess infiltrant was removed with a cotton roll, and the treated lesions were light cured for 40 seconds.

Step 6: The proximal applicator was introduced into the interdental areas

Figure 6.1, Maxillary 2nd primary molar with ortho separator.

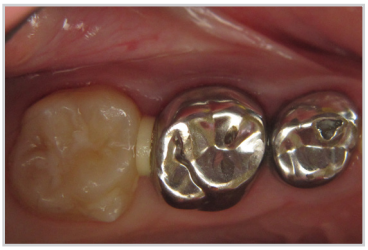

Figure 6.2, Mandibular 2nd primary molar with ortho separator.

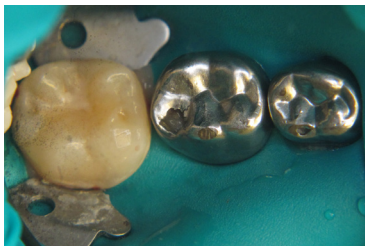

Figure 7.1, Maxillary 2nd primary molar with ortho separator removed.

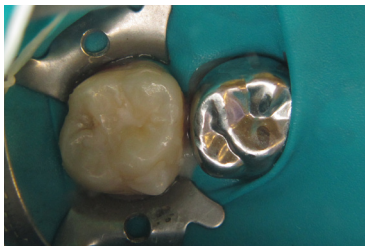

Figure 7.2, Mandibular 2nd primary molar with ortho separator removed.

Figure 8.- Icon etch gel is extruded.

again and the lesion was infiltrated for an additional 60 seconds. The treated lesions were then light cured for an additional 40 seconds.

Step 7: The interdental area was evaluated for excess material, and any excess was removed with a dental explorer and floss.

The total treatment time for both lesions was approximately 45 minutes. This included time for anesthesia administration, application of the rubber dam, and the infiltration procedure. In regions that allow expanded function hygiene and dental assistant practice it is possible to maximize efficiency by utilizing auxiliaries to perform local anesthesia and apply the rubber dam. This brings the total dentist time to under 10 minutes per lesion.

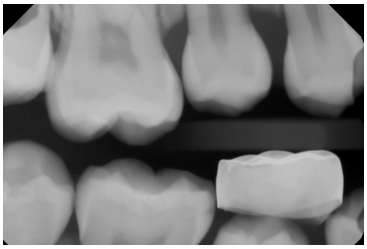

Figure 9- 10/2016 radiograph.

Follow-up

After treatment was completed the child received standard post-operative instructions regarding anesthesia of the soft tissues. A refill prescription for 5000 PPM fluoride toothpaste was also written. The patient returned for a preventive recall in April 2015 and no clinical changes were noted for either of the treated teeth. In October 2016, the patient returned for a standard preventive visit and 1 year follow-up of the Icon treatment. Radiographic examination revealed that the lesions had not changed in size. Since the last images were obtained, the maxillary 2nd primary molar had exfoliated and the mandibular 2nd primary molar was very near exfoliation. It was possible to verify visually that the maxillary lesion had not cavitated. (Figure 9)

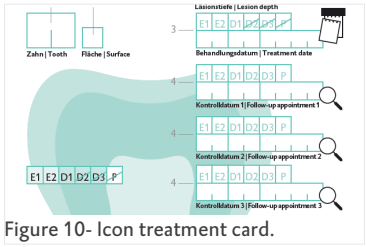

Figure 10- Icon treatment card.

Discussion

This report describes the use of resin infiltration for the treatment of interproximal lesions in a high caries risk child. Radiographic examination one year after treatment demonstrated that neither radiolucency had grown in size. While conventional restorative materials contain filler and radiopaque agents to aid in radiographic visualization, Icon does not contain filler so the treated lesion is not radiopaque. Assessment of the outcome must therefore be based upon the extension of the radiolucency in comparison with subsequent radiographs. If the lesion remains stable over time, the treatment is considered successful.

One concern that has been raised regarding resin infiltration is the fact that radiolucencies remain after infiltration. If the patient continues to receive care with the treating office, it is simple to denote which surfaces have been treated using practice management software. If the patient transfers care to another office, they can take a treatment card to indicate which lesions have been treated. (Figure 10)

Conclusion

Icon resin infiltration provides clinicians with a new alternative for managing early caries lesions. It introduces a unique treatment that falls between preventive therapy and restorative dental care. The infiltrated lesion has no margin to decay and results in no loss of structure due to tooth preparation. By intervening at this stage, we avoid the uncertainty of the "wait and watch" situation and help the patient avoid a series of increasingly invasive conventional restorations in the future.

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