

# Resin Infiltration Technique for Proximal Caries Lesions in the Permanent Dentition: A Contrarian Viewpoint

SM Hashim Nainar

Minimal intervention dentistry has been promoted as the contemporary science-based paradigm in operative dentistry.<sup>1</sup> The FDI task group reviewing minimal intervention dentistry cautioned in 2012 that one of the procedures, resin infiltration technique, while promising, needed more clinical evidence for conclusive findings.<sup>1</sup> The aim of this brief commentary is to consider the use of resin infiltration technique for proximal caries lesions in the permanent dentition.

Resin infiltration technique was first described in the 1970s for conservative management of non-cavitated smooth surface caries lesions but did not find acceptance following preliminary reports indicating dismal clinical application in proximal surfaces of premolars *in vivo*.<sup>2,3,4</sup> The resin infiltration technique has recently been reinvigorated and suggested for proximal caries “lesions extending radiographically into inner enamel or the outer third of dentin” with the intent to avoid the first restoration and its consequent retreatments.<sup>5</sup>

It has been recently remarked that resin infiltration may not be appropriate for proximal caries lesions in primary molars, the better alternative

being remineralization for enamel lesions and conventional restorations for those lesions into dentin.<sup>6</sup> In a similar vein, promotion of remineralization may be a better option than resin infiltration for proximal lesions in permanent enamel for the following reasons:

1. There is slow progression of enamel caries lesions with “an average of four years for a lesion to progress through the enamel of permanent teeth.”<sup>7</sup>
2. The resin infiltration technique may further undermine the structural underpinning of enamel caries lesions with its relatively intact surface layer and more demineralized subsurface area.<sup>8</sup> It has been shown that, compared to sound enamel, there are large reductions in elastic modulus (up to 83% lower) and hardness (up to 91% lower) in natural proximal noncavitated caries lesions in premolars, whereas the intact surface layer of enamel of the caries lesion had the least reduction (34%) in mechanical properties.<sup>9</sup> The surface layer of enamel has, however, been identified as a barrier impeding resin infiltration into the body of the caries lesion.<sup>10</sup> Resin infiltration technique therefore requires acid conditioning (15% HCl for 2 minutes) in order to remove the enamel surface layer and enhance penetration of the resin infiltrant.<sup>10</sup> This acid conditioning thus results in the removal of the residual strongest component of an already weakened tooth structure within the caries

\*SM Hashim Nainar, BDS, MDS, University of Toronto, Division of Pediatric Dentistry, Faculty of Dentistry, Toronto, ON, Canada

\*Corresponding author: 124 Edward St., Toronto, ON M5G1G6, Canada; e-mail: hashim.nainar@utoronto.ca

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lesion. The importance of the surface layer is also alluded to by a study in bovine enamel using 37% phosphoric acid for 5 seconds instead, which found that subsequent infiltration with various resins increased “both microhardness and demineralization resistance of enamel caries lesions.”<sup>11</sup>

3. Removal of the surface layer of enamel during resin infiltration technique also renders moot the potential for remineralization.<sup>12</sup> Promoting remineralization of the carious enamel without resin infiltration would result in the healed tooth structure being more resistant to acid dissolution than normal enamel.<sup>13</sup>

Definitive restorations in permanent teeth for proximal lesions that are not amenable to remineralization may be a better option than resin infiltration for the following reasons:

1. The dentino-enamel junction may be considered the Rubicon of treatment threshold for surgical intervention since a compilation of data regarding proximal caries lesions in permanent teeth “found an increasing proportion of cavitated lesions with increasing radiographic depth.”<sup>14</sup> It has been reported that in bitewing radiographs of permanent teeth, 11% of the lesions in the inner half of enamel had cavitation, with the proportion of cavitated lesions increasing on breaching of the dentino-enamel junction to 41% for lesions in the outer half of dentin and 100% for lesions in the inner half of dentin.<sup>15</sup> This concept is prudently reflected in clinical practice with ~90% of dentists in a practice-based research network reporting that regardless of caries risk, they would restore a proximal lesion involving the outer one-third of dentin in a lower premolar tooth.<sup>16</sup>
2. Subsequent to 2-minute etch treatment, resin infiltration initially increased the microhardness of caries lesions in bovine enamel; however, there was a reduction in microhardness following acid challenge, likely due to either resin shrinkage or dissolution of the remaining mineral within the body of the lesion.<sup>17</sup> Definitive restorations, though seemingly more drastic, may therefore be more pragmatic than resin infiltration since longitudinal caries data (birth to 32 years of age) have shown caries rate to be constant over the years.<sup>18</sup>

Robinson, who pioneered the resin infiltration technique in the 1970s, reported in a 2011 review that the contemporary technique lacked resolution of some methodological concerns and therefore recommended that it be restricted to “accessible and

relatively superficial lesions.”<sup>19</sup> Use of the resin infiltration technique for proximal lesions in the permanent dentition therefore warrants further research prior to its application in clinical practice.

### Conflict of Interest

The author of this manuscript certifies that he has no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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### REFERENCES

1. Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, & Eden E (2012) Minimal intervention dentistry for managing dental caries—A review: Report of a FDI task group *International Dental Journal* **62**(5) 223-243.
2. Davila JM, Buonocore MG, Greeley CB, & Provenza DV (1975) Adhesive penetration in human artificial and natural white spots *Journal of Dental Research* **54**(5) 999-1008.
3. Robinson C, Hallsworth AS, Weatherell JA, & Kunzel W (1976) Arrest and control of carious lesions: A study based on preliminary experiments with resorcinol-formaldehyde resin *Journal of Dental Research* **55**(5) 812-818.
4. Davila J, & Gwinnett AJ (1978) Sealing of approximal surfaces of teeth in vivo *Journal of Dental Research* **57**(3) Abstract #23 p 80.
5. Paris S, Hopfenmuller W, & Meyer-Lueckel H (2010) Resin infiltration of caries lesions: An efficacy randomized trial *Journal of Dental Research* **89**(8) 823-826.
6. Nainar SMH (2013) The evidence is lacking to support resin infiltration for primary molar proximal lesions (letter) *Pediatric Dentistry* In press.
7. Shwartz M, Grondahl HG, Pliskin JS, & Boffa J (1984) A longitudinal analysis from bite-wing radiographs of the rate of progression of approximal carious lesions through human dental enamel *Archives of Oral Biology* **29**(7) 529-536.
8. Silverstone LM (1977) Remineralization phenomena *Caries Research* **11**(Supplement 1) 59-84.
9. Huang TTY, He LH, Darendeliler MA, & Swain MV (2010) Nano-indentation characterisation of natural carious white spot lesions *Caries Research* **44**(2) 101-107.
10. Paris S, Meyer-Lueckel H, & Kielbassa AM (2007) Resin infiltration of natural caries lesions *Journal of Dental Research* **86**(7) 662-666.
11. Paris S, Schwendicke F, Seddig S, Muller WD, Dorfer C, & Meyer-Lueckel H (2013) Micro-hardness and mineral loss of enamel lesions after infiltration with various resins: Influence of infiltrant composition and application frequency in vitro *Journal of Dentistry* **41**(6) 543-548.
12. Peters MC (2010) Strategies for noninvasive demineralized tissue repair *Dental Clinics of North America* **54**(3) 507-525.

13. Iijima Y, & Koulourides T (1988) Mineral density and fluoride content of in vitro remineralized lesions *Journal of Dental Research* **67**(3) 577-581.
14. Ratledge DK, Kidd EAM, & Beighton D (2001) A clinical and microbiological study of approximal carious lesions. Part 1: The relationship between cavitation, radiographic lesion depth, the site-specific gingival index and the level of infection of the dentine *Caries Research* **35**(1) 3-7.
15. Pitts NB, & Rimmer PA (1992) An in vivo comparison of radiographic and directly assessed clinical caries status of posterior approximal surfaces in primary and permanent teeth *Caries Research* **26**(2) 146-152.
16. Gordan VV, Garvan CW, Heft MW, Fellows JL, Qvist V, Rindal DB, & Gilbert GH (2009) Restorative treatment thresholds for interproximal primary caries based on radiographic images: Findings from the dental PBRN *General Dentistry* **57**(6) 654.
17. Torres CRG, Rosa PCF, Ferreira NS, & Borges AB (2012) Effect of caries infiltration technique and fluoride therapy on microhardness of enamel carious lesions *Operative Dentistry* **37**(4) 363-369.
18. Broadbent JM, Thomson WM, & Poulton R (2008) Trajectory patterns of dental caries experience in the permanent dentition to the fourth decade of life *Journal of Dental Research* **87**(1) 69-72.
19. Robinson C (2011) Filling without drilling *Journal of Dental Research* **90**(11) 1261-1263.