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# The Application of Fluoride Varnish in the Prevention and Control of Dental Caries

**Abstract:** The method of applying fluoride varnish is described and the evidence of its effectiveness in the prevention and control of caries is summarized. The application of fluoride varnish should be an integral part of caries preventive programmes.

**Clinical Relevance:** This paper describes how to apply fluoride varnish and reviews its effectiveness in preventing caries.

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Fluoride varnishes were first marketed in the 1960s as an adjunct to conventional topical agents, such as fluoride toothpastes, for the prevention and control of caries. Although their use has been advocated in clinical guidelines in Europe,<sup>1</sup> America<sup>2</sup> and Australia,<sup>3</sup> they have been slow to gain widespread acceptance in general dental practice in the United Kingdom.

The effectiveness of fluoride varnishes in inhibiting caries has been clearly documented in narrative reviews,<sup>4–6</sup> meta-analyses<sup>7,8</sup> and systematic reviews.<sup>9,10</sup>

In 2007, the Department of

Health in England published *Delivering Better Oral Health – An Evidence-based Toolkit for Prevention*, which was distributed to all NHS practices in England.<sup>11</sup> The toolkit recommends the selective application of fluoride varnish for adults considered to be at high caries risk and its universal use for all children. Such an all-inclusive recommendation might, at first sight, appear to be excessive but, in truth, it is difficult for dental professionals to assess the caries risk of individuals reliably. A recent study of regularly attending young children reported that, although most children attending for the first time were caries free, 25% developed caries over the following three years.<sup>12</sup> If prevention is only provided for those who present with caries, most new cases of the disease will become established in the absence of appropriate advice and care.

Fluoride varnish can be applied by dentists and other dental care professionals who have received appropriate training.<sup>13</sup> It should be used routinely in a clinical setting and may also be provided in a community-based project.

This paper provides an opportunity for the dental team to update and renew their knowledge about the practical application of fluoride varnish.

## Composition of fluoride varnishes

The most commonly available fluoride varnish, with a product licence (POM) for caries prevention in the UK, is *Colgate Duraphat*; it contains 22,600 ppm Fluoride.

## Mode of action

Varnishes deliver fluoride to the surface of enamel and to subsurface carious lesions,<sup>14</sup> where it forms deposits of calcium fluoride and provides a reservoir of fluoride ions.<sup>15</sup>

The greatest release occurs during the first three weeks after application, with more gradual release thereafter.<sup>16</sup>

## Indications

Fluoride varnish is indicated for all children, adolescents and young adults. It is also likely to be effective in adults who give cause for concern; those with active caries, dry mouth or special needs. The application of varnish forms an essential part of a preventive package which should emphasize dietary advice and twice daily brushing with a toothpaste containing an

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Figure 1. Dispensing fluoride varnish.



Figure 2. Application of varnish.



Figure 3. Varnish applied to mixed dentition.

appropriate concentration of fluoride, as indicated by the prevention toolkit.<sup>11</sup>

#### Contra-indications

*Colgate Duraphat* varnish should not be applied to individuals with a history of allergy to any of the constituents. Its use is also contra-indicated in patients with ulcerative gingivitis, stomatitis or a history of severe bronchial asthma which has necessitated hospitalization.

#### Application

Fluoride varnishes are not intended to adhere permanently to a tooth, but should remain in contact with the surface for several hours. Toothbrushing

or wiping and drying with cotton wool rolls or cotton gauze is sufficient to clean the teeth before varnish application; a prophylaxis is not essential.<sup>17</sup>

The high concentration of fluoride in varnishes requires that only a small amount should be applied:

- Primary dentition – up to 0.25 ml
- Mixed dentition – up to 0.4 ml
- Permanent dentition – up to 0.75 ml

A quantity of varnish covering an area of 5 to 7 mm should be placed on the surface of a dispensing pad (Figure 1). After isolating the teeth in one of the lower quadrants with gauze or cotton wool rolls, the varnish is applied with a microapplicator, or a fine brush, to the sites where caries is most likely to initiate; the pits and fissures and approximal surfaces (Figure 2). The colour tint of the varnish facilitates its application and control (Figure 3). Complete the lower arch before application to teeth in the upper arch.

#### Patient instructions

Advise patients:

- To eat and drink normally before attending;
- Not to brush the teeth or chew hard food for at least 30 minutes after varnish application; only soft foods and liquids should be consumed for the first four hours after application.

#### Side-effects and risks

The Cochrane review<sup>9</sup> found no information on possible adverse events and none has been reported in recent studies.<sup>18,19</sup>

#### Frequency of application

All children, aged 3 years and over, and adolescents should receive applications of fluoride varnish twice yearly. All those giving greater concern, for example those with active caries, special needs or those wearing orthodontic appliances, should receive more frequent application (see evidence section). Adults giving cause for concern should also receive fluoride varnish two to four times a year.

## Review of the evidence

### Primary dentition

A Cochrane systematic review concluded that, on average, fluoride varnish reduced caries in the primary dentition by 33%.<sup>9</sup> A recent randomized controlled trial (RCT), of two years' duration, involving children with a mean age of 1.8 years, reported that the benefit of a combination of parental counselling plus varnish applied once, twice and three times a year reduced the mean dmfs by 53, 58 and 93%, respectively.<sup>18</sup> A nine-month study, involving children aged 3 to 5 years with active enamel caries, demonstrated that fluoride varnish applied at baseline and after 4 months inactivated 81% of lesions compared with 38% in the control group.<sup>20</sup>

### Mixed dentition

The Cochrane review<sup>9</sup> concluded that, on average, fluoride varnish reduced caries in the permanent dentition by 46%. The pit and fissure surfaces of the first and second permanent molars are particularly susceptible to caries and, although the evidence from another Cochrane review<sup>21</sup> suggests that sealants may be more effective than varnish application, further research was recommended. However, the effectiveness of fissure sealants is very technique sensitive. In contrast, fluoride varnish provides an effective preventive measure for partially erupted permanent molars, particularly in children who are insufficiently co-operative when having sealant applied.

### Permanent dentition

The twice yearly application of fluoride varnish is effective in reducing dental caries in the permanent dentition.<sup>9</sup> A recent RCT examined the impact of varnish on the incidence of approximal caries, detected radiographically, in 13-year-olds over a three-year period.<sup>22</sup> The results indicated that varnish applied monthly and twice a year reduced caries by 76 and 57%, respectively. Many adolescents may be considered to be at increased risk during the time they are wearing fixed orthodontic appliances. An RCT involving 273 children who were to be treated with fixed orthodontic appliances had either fluoride varnish or a placebo

varnish applied every sixth week during treatment. The incidence of white spot lesions during treatment was 7.4% in the varnish compared to 25.3% in the placebo group.<sup>19</sup>

#### Root caries

One study reported that the application of fluoride varnish four times a year to root surface caries lesions halved the incidence of new carious and filled root surfaces.<sup>23</sup>

### Embedding fluoride varnish in general dental practice

In the ideal situation, each contact with every child should result in the application of fluoride varnish. In many practices, the responsibility for applying the varnish can be shared between the dentist and other members of the team who have undergone appropriate training.<sup>13</sup> This would mean that the dentist could apply fluoride varnish at the initial examination appointment and the trained colleague could provide this at subsequent follow-up appointments, to the dentist's prescription.

### Summary

Fluoride varnishes are effective in preventing and controlling caries in all age groups. They are simple and quick to apply, require no sophisticated equipment, are well tolerated by patients and can be applied by appropriately trained members of the dental team, including a dental nurse with training to support this additional skill. To be effective, they require application at six monthly intervals at least. Fluoride varnish should be included in all caries preventive programmes, which should also include advice about diet and twice daily brushing with a toothpaste containing an appropriate concentration of fluoride.

#### Affiliations

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