DENTAL FLUOROSIS AS A MARKER FOR FLUORIDE-INDUCED COGNITIVE IMPAIRMENT

ABSTRACT: Analogous to the neurotoxicity markers of the Kayser-Fleischer ring in the cornea in Wilson's disease and the Burton line in the gums in chronic lead poisoning, the finding in several studies of a significant relationship between dental fluorosis and cognitive impairment indicates that dental fluorosis can be regarded as a marker for fluoride-induced cognitive impairment. As noted by Xiang et al., in the present issue of Fluoride, the prevalence of dental fluorosis can be significantly decreased by reducing the intake of fluoride and it can be anticipated that fluoride-induced neurotoxicity would be prevented by the same means.

Keywords: Burton line; Dental fluorosis; Fluoride-induced cognitive impairment; Kayser-Fleischer ring; IQ; Lead poisoning; Neurotoxicity; Prevention of fluoride-induced neurotoxicity; Wilson’s disease.

Although fluoride ion toxicity has been associated with both dental fluorosis and neurotoxicity, dental fluorosis has tended to be considered with respect to tooth appearance and function rather than as a marker for neurotoxicity. In the executive summary of the 2014 New Zealand report, Health effects of water fluoridation: a review of the scientific evidence, it is noted, with respect to dental fluorosis, that “In the common, mild forms it is of minor or no cosmetic significance, but severe forms result in pitted and discoloured teeth that are prone to fracture and wear” and “We conclude that on the available evidence there is no appreciable effect on cognition arising from CWF” (CWF=community water fluoridation).

However, several studies have found a significant relationship between the presence of dental fluorosis and impaired cognition in children. Sudhir et al. in a 2009 study of 1000, 13–15-year-old, children, found dental fluorosis, measured with Dean’s Fluorosis Index, was significantly associated with a reduced IQ, measured with Raven’s Standard Progressive Matrices (p<0.001). Shivaprakash et al. in a 2011 study of 160, 7–11-year-old, children found a significantly lower mean IQ, measured with the Coloured Progressive Matrices component of Raven’s educational test, in children with dental fluorosis, measured with Dean’s Fluorosis Index, compared to those without dental fluorosis (p<0.05) and that children with mild dental fluorosis had a lower IQ than those without dental fluorosis (p<0.05). Choi et al. in a 2014 pilot study of 51, 6–8-year-old, children found a significant association (p<0.05) between the presence of moderate or severe dental fluorosis, using Dean’s Fluorosis Index, and cognitive impairment using the WISC-IV digit span subtext. Khan et al. in a 2015 study on 429, 6–12-year-old, children found a significantly lower mean IQ, measured with Raven’s Coloured Progressive Matrices, in children with dental fluorosis, measured with Dean’s Fluorosis Index, compared to those without dental fluorosis (p<0.001).

These studies indicate that mild, moderate, and severe dental fluorosis have all been associated with cognitive impairment. Mild and moderate dental fluorosis occur in New Zealand despite the level of fluoride used in CWF being in the range of 0.7–1.0 mg/L as other fluoride sources are available including food, fluoridated toothpaste, fluoride supplements, and professionally applied fluoride varnishes. The 2009 New Zealand Oral Health Survey reported that, using Dean’s Index of Fluorosis, 44.5% of 8–30-year-olds had some degree of dental fluorosis...
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(questionable: 22.7%; very mild: 10.2%; mild: 5.1%; moderate: 2.0%, severe: 0.0%).

Mackay and Thomson in a 2005 study of 436, 9–10-year-old, children in Southland, New Zealand, found that 24.1% had diffuse opacities, consistent with dental fluorosis, with these being more frequent in those with continuous residence in a fluoridated area up to the age of 4 years (32.1%) compared to those with no or non-continuous residence in a fluoridated area (19.0%, p<0.05).

Just as the presence of neurotoxicity may be signalled by the presence of a Kayser-Fleischer ring involving brown pigmentation from copper deposited in the cornea (Descemet’s membrane) in Wilson’s disease (hepatolenticular degeneration) and presence of a Burton line involving a very thin black-blue line along the margins of the gums at the base of the teeth in chronic lead poisoning, so too the presence of dental fluorosis can be regarded as a marker for fluoride-induced cognitive impairment.

As noted by Xiang et al., in the present issue of Fluoride, the prevalence of dental fluorosis can be significantly decreased by reducing the intake of fluoride and it can be anticipated that fluoride-induced neurotoxicity would prevented by the same means.

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REFERENCES


