Association between developmental defects of enamel and dental caries

Abstracted from

Vargas-Ferreira F, Salas MM, *et al.*

Association between developmental defects of enamel and dental caries: A systematic review and meta-analysis. *J Dent* 2015; **43:** 619–628.

Address for correspondence: Dr FF Demarco. Federal University of Pelotas (UFPEL), School of Dentistry, 457 Gonçalves Chaves Street, 96015-560 Pelotas, RS, Brazil. E-mail: ffdemarco@gmail.com

Question: What is the association between developmental defects on enamel and dental caries experience in the permanent dentition?

Data sources PubMed, Web of Science, Science Direct and Embase.
Study selection Studies were included having met the following inclusion criteria: epidemiologic studies, without any restriction of design, with assessment of the likely association between developmental defects of enamel (DDE) and dental caries; determine the presence of DDE in the permanent dentition; include participants 8-19 years old; and use a population-based sample rather than a clinical convenience sample. The following exclusion criteria were applied: where dental caries was not the outcome; articles without the evaluation of enamel defects; studies evaluating the deciduous dentition; studies evaluating the mixed dentition without the separate information about the permanent dentition; case reports; literature reviews; manuscripts evaluating specific sub-populations; guidelines; and papers not using the FDI criteria to assess enamel defects.
Data extraction and synthesis Data were extracted by two researchers independently, and were analysed for the presence of controlling for confounding factors, such as socio-economic status, in each study. Crude and adjusted odds ratios with respective 95% confidence intervals were collected. Odds ratios and 95% confidence intervals were calculated for two papers based on data present.
Results Nine papers were included in the systematic review with seven contributing to meta-analysis. A positive association between developmental defects of enamel and permanent dentition caries experience was identified in six studies. The pooled effect obtained with the random model was 2.21 (95% CI 1.39; 3.54).
Conclusions The results demonstrate a positive association between caries experience and enamel defects, which could be considered a potential predictor for dental caries. However, the only study design type included was cross-sectional, so there is a need to carry out further investigations into the association and the directionality of the relationship. Due to DDE and caries sharing risk factors, a common risk approach is advised instead of focussing on one specific condition.

Commentary

Developmental defects of enamel (DDE) occur when there is disruption to the normal process of enamel formation; they can manifest either as defects in the quantity or quality of enamel.[1] Enamel hypoplasia, or a defect in the thickness of enamel, commonly manifests as pits, grooves or missing areas of enamel.[2] Opacities in enamel are often due to hypomineralisation, or problems with the quality of enamel.[2] It is thought the prevalence of DDE, in any form, in high income countries such as the United Kingdom could be anywhere between 25-50%[1, 3] with a specific form of DDE, molar incisor hypomineralisation, thought to affect around 15% of children in the UK regardless of water fluoridation exposure.[4] Enamel defects have commonly been attributed to ill health in the first years of life or poor maternal health in the later stages of pregnancy,[3] but are also shown to correlate with socio-economic status and increased caries risk, as well as an increased need for dental treatment.[1, 3, 4] The paper reviewed here attempted to analyse the evidence relating DDE to dental caries.[5]

The aim of the paper was clear, the authors endeavoured to evaluate the association between developmental defects of enamel and dental caries experience in the permanent dentition through a systematic review and meta-analysis. The search strategy used to identify papers was provided and encompassed a number of different sources, had reasonable language and date limits and utilised citation searching to obtain as wide a variety of papers as possible. Concerns could possibly be raised regarding the decision not to limit study designs accepted in the systematic review, as it is common practice to limit this to a single design, however all studies included in the final meta-analysis were of a cross-sectional design. In the PRISMA flow diagram[6] indicating the number of studies included and excluded, it was noted that some studies were excluded as they provided 'assessment of other type of enamel defect (MIH)', it is accepted however that MIH is a form of developmental defect of enamel and therefore this exclusion criterion is contradictory to the research question posed by the researchers. The quality of the studies included was assessed but then not reported clearly, though the meta-analysis was stratified for study quality at a later stage.

The meta-analysis combined the results of seven studies, with sample sizes ranging from 245 to 3538 participants, reported between the years 1994 and 2014, and using a number of different examination techniques. The resulting odds ratio indicated a 2.21 increase in odds of developing caries for participants with DDE compared to those without the condition (95% CI 1.39-3.54). There was significant heterogeneity between the studies which was

explained primarily by the quality of the studies (55% of variance explained) and adjustment for socio-economic factors within the studies (30.3% of variance explained) suggesting it may not have been entirely appropriate to combine all studies in this way. When the results were stratified by study type the heterogeneity reduced significantly, showing a more concise result when more similar studies were combined.

In conclusion despite the significant odds ratio presented in the overall meta-analysis (OR 2.21 CI 1.39-3.54) it is unlikely this paper will be of any immediate utility in routine dental practice within the UK. All except one of the studies was conducted in low or middle income countries, which have higher prevalence rates of both dental caries and DDE than most high income countries. Additionally it has been highlighted that DDE and caries share many similar risk factors such as low socio-economic status, and therefore the relationship observed may simply be due to these common risk factors and there is no specific causal relationship between the two conditions.

The authors make no attempt to explain the possible biological sequence which would lead to the proposed association or indeed assert that the caries observed was attributed to teeth displaying enamel defects. Finally, as we are unable to effectively predict the development of DDE in individuals, or prevent these defects, the importance of establishing this link is unclear. The authors themselves suggest that 'a common risk approach should be more rational' which is aligned with most caries preventive advice currently available.

Jacqueline Burns and Kate Hollands

Department of Public Health, NHS Fife, Leven, Scotland, UK

1. Robles MJ, Ruiz M, Bravo-Perez M, González E, Peñalver MA. Prevalence of enamel defects in primary and permanent teeth in a group of schoolchildren from Grenada (Spain). *Med Oral Patol Oral Cir Bucal* 2013; **18:** e187-193. doi:10.4317/medoral.18580.
2. Seow WK. Clinical diagnosis of enamel defects: pitfalls and practical guidelines. *Int Dent J* 1997; **47:** 173-182.
3. Arrow P. Risk factors in the occurrence of enamel defects of the first permanent molars among school children in Western Australia. *Community Dent Oral Epidemiol* 2009; **37:** 405-415. doi: 10.1111/j.1600-0528.2009.00480.x
4. Balmer R, Toumba J, Godson J, Duggal M. The prevalence of molar incisor hypomineralisation in Northern England and its relationship to socioeconomic status and water fluoridation. *Int J Paediatr Dent* 2012; **22:** 250–257. doi:10.1111/j.1365.263X.2011.01189.x
5. Vargas-Ferreira F, Salas M.M.S, Nascimento GG, *et al.* Association between developmental defects of enamel and dental caries: A systematic review and meta-analysis. *J Dent* 2015; **43:** 619-628. doi:10.1016/j.jdent.2015.03.011.
6. Moher D, Liberati A, Tetzlaff J, Altman DG: The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009; **6:** e1000097. doi:10.1371/journal.pmed1000097.

Evidence-Based Dentistry (2015) **16**, 72-73. doi:10.1038/sj.ebd.6401111