

Anomalies of Enamel

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Aim

- Describe anomalies affecting enamel
 - Difference between hypoplasia and hypomineralisation
 - How to diagnose inherited vs acquired conditions
 - Different management approaches for hypoplastic vs. hypomineralised enamel

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Enamel development

3 stages:

- Formation stage
 - Deposition of organic matrix
- Calcification stage
 - Matrix mineralisation
- Maturation stage
 - Crystals enlarge and mature

Stage 1: Formation

- Matrix deposition
 - Determines shape and size
 - Starts at incisal and cusp tips (MB to DP/DL)
- Hypoplasia = deficient enamel matrix
 - *Quantity* defect

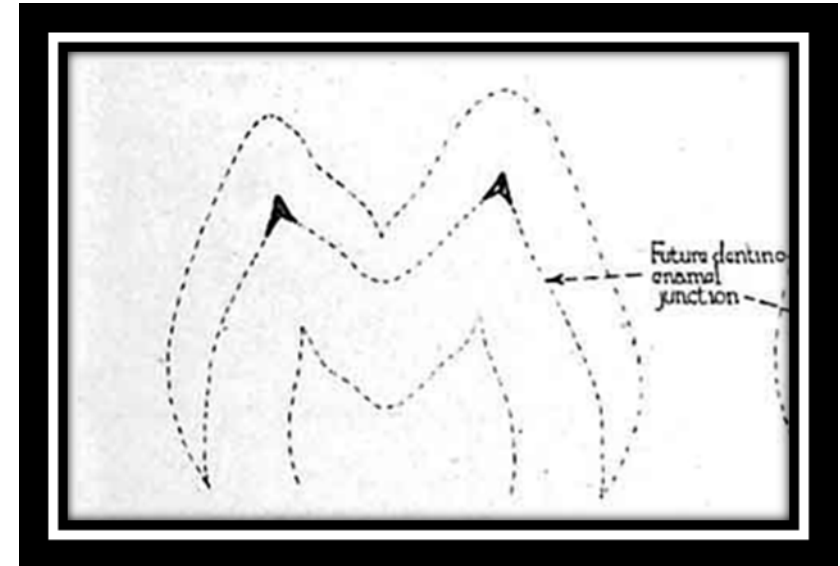


Image courtesy of UConn

Hypoplastic enamel

- Enamel NOT formed to normal thickness, so teeth can be small or abnormally shaped
- Common cause of chronological hypoplasia is vitamin D deficiency rickets



Enamel development

3 stages:

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Stage 2: Calcification

Mineralisation

- Determines colour and hardness
- *Quality* defect
- In calcification, early stages of enamel mineralisation affected:
 - Tooth is normal size and shape, but enamel can be very soft and easily chip away
 - Teeth are yellow-brown on eruption
 - Stain to brown-black with time
 - Accumulate calculus (sensitivity)

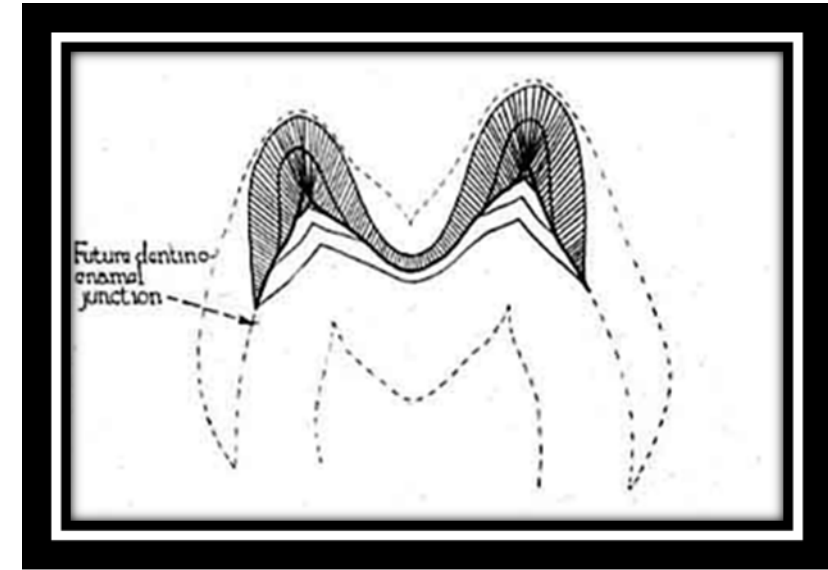


Image courtesy of UConn



Stage 3: Maturation

- Later stages of enamel mineralisation affected:
 - Teeth normal shape and size
 - But discoloured (range from white/creamy – yellow brown)
- Enamel can be weaker and flake off (post eruptive breakdown, PEB)
- Most common cause is Molar Incisor Hypomineralisation (MIH)



How can I tell if it's hypoplasia or PEB?

- Look for clues:
- Colour defects on other teeth
- Atypical pattern of tooth surface loss
- Edges of hypoplastic lesions are smooth and rounded



Enamel defects - summary

- Hypoplasia = deficient enamel matrix
- Hypomineralization = poor mineralization of matrix
 - Hypocalcified
 - Hypomature
- Combination of hypoplastic and hypomineralised
- Can be caused by local or general factors, so you need accurate diagnosis



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Diagnosis – key questions

1. Does anyone else in the family have anything like this?
2. Are all of the teeth affected in a similar manner?
3. Is there a chronological distribution to the appearance seen?
4. Any significant childhood illnesses during first 3 years?
5. What is the fluoride history?



Image from Depositphotos.com

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Amelogenesis Imperfecta (AI)

- Defined as “Hereditary conditions affecting the quality and quantity of enamel” (Wright et al 2011)
- Prevalence: 1 in 700 (Sweden) - 1 in 14 000 (US)
- Varied clinical appearance (phenotype)
- Can vary from tooth to tooth
- Primary teeth may not appear clinically affected
- 50% have skeletal anterior open bite
- Taurodontism (AIT)
- Can be associated with syndromes

Amelogenesis Imperfecta (AI) – genetics summary

Types:

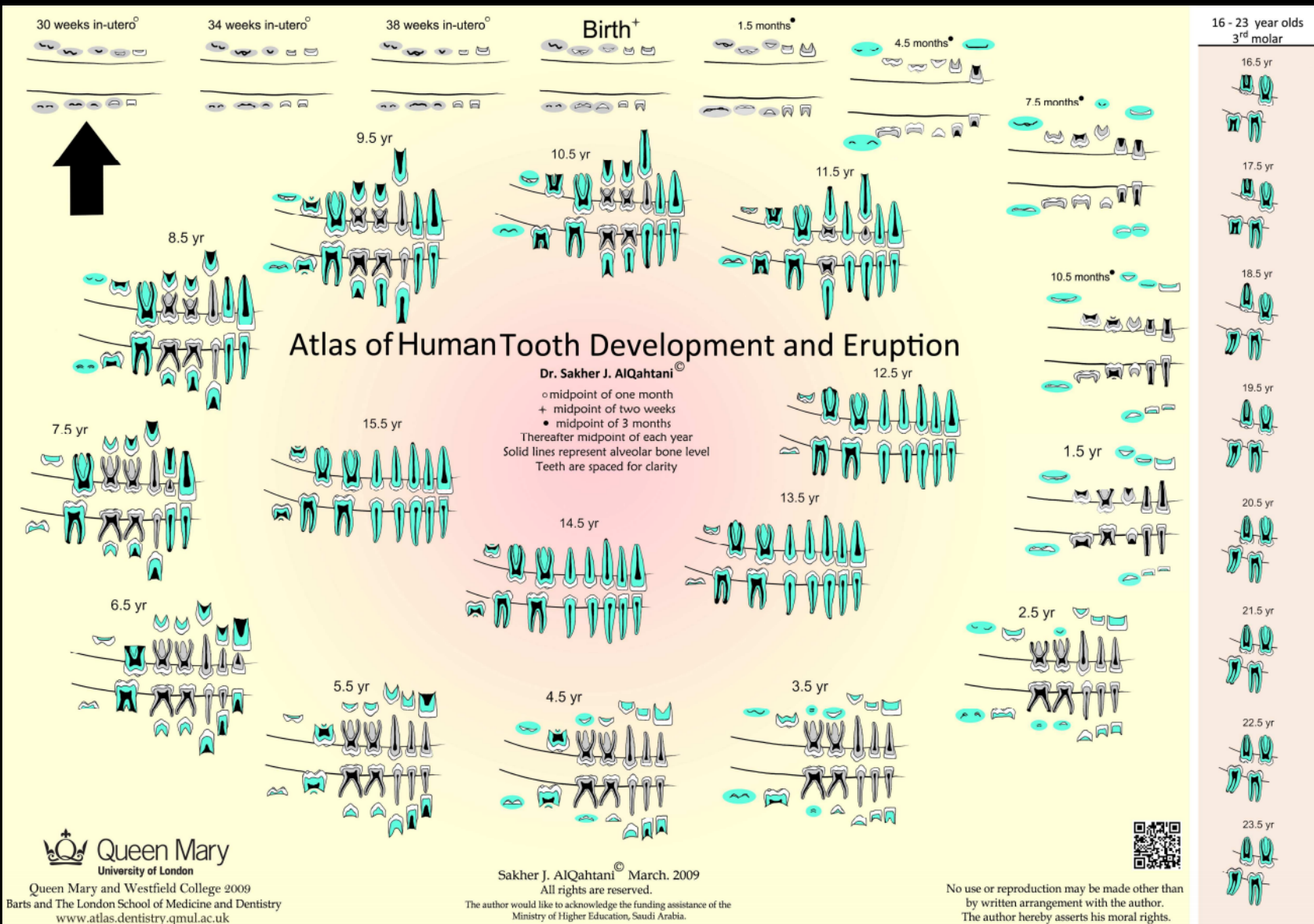
- I - Hypoplastic (AD, AR, x-linked)
- II - Hypomature (AR)
- III - Hypocalcified (AD)
- IV - Mixed (AD)

7 main genes associated with AI:

1. AMELX
2. ENAM
3. MMP20
4. KLK4
5. FAM83H (Hypocalcified, AD)
6. WDR72 (Hypomaturate)
7. FAM20A (Hypoplasia, gingival hyperplasia, unerupted teeth)

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-
- Must know your dental development dates!



What is Rickets?

- Historically known as the 'English disease'
 - Caused by lack of sunlight
- Affects bone development in children:
 - Causes bone pain & soft, weak bones
 - Can lead to bone deformities
 - Delayed walking
 - Enamel hypoplasia
- NHS recommends 10µg vitamin D supplements daily for children > 1 year
- Bone /enamel returns back to normal when vit D levels corrected



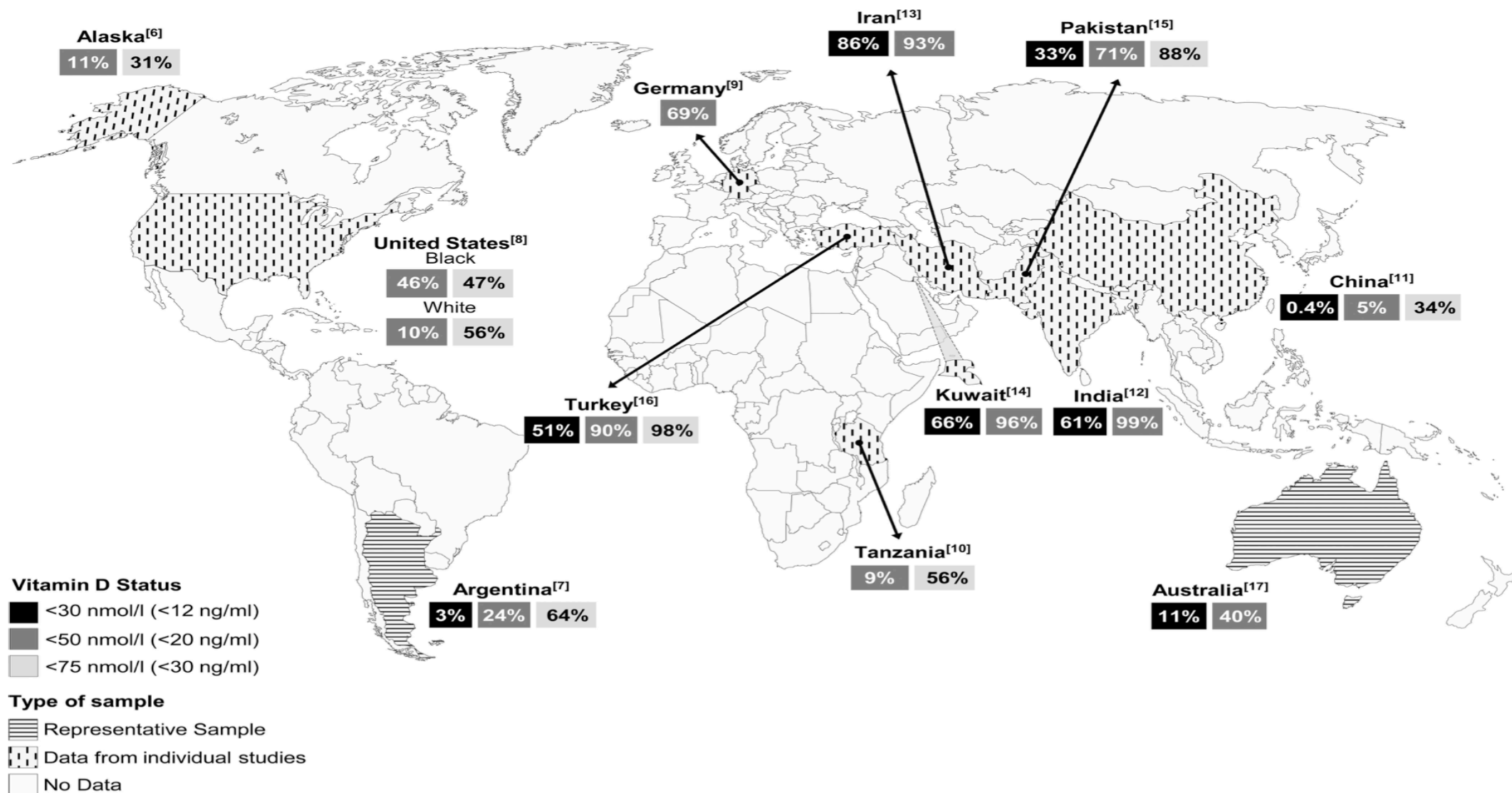


Figure 1.
Prevalence of low vitamin D status in infants worldwide.

Molar Incisor Hypomineralisation (MIH)

- “Hypomineralisation of systemic origin, presenting as ***demarcated, qualitative*** defects of enamel of one to four first permanent molars (FPMs) frequently associated with affected incisors” (Weerheijm et al 2001)
- Estimates vary (3-40% worldwide)



Dental, Oral and Craniofacial Research



Review Article

ISSN: 2058-5314

Definition and scoring system of molar incisor hypomineralization: A review

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Results: More than half of the publications used the EAPD definition and fewer than half of the prevalence reports have either used the EAPD criteria or the developmental defects of enamel (DDE) index as their classification system. Others have either incorporated modifications or created their own scoring criteria. The lack of standardized definition and heterogeneity of scoring systems used might explain the considerable variability in prevalence figures.

Conclusion: In order to better define the diagnostic criteria and the treatment needs for those patients, a globally accepted standardized protocol for scoring system is required.

Fluorosis

- Mineralisation defect of enamel due to excess fluoride exposure
- Clinically can present from white, chalky opacity to brown pitted surface
- Histologically presents as subsurface porosity below well mineralised surface zone
- Can be difficult to distinguish from AI if generalised



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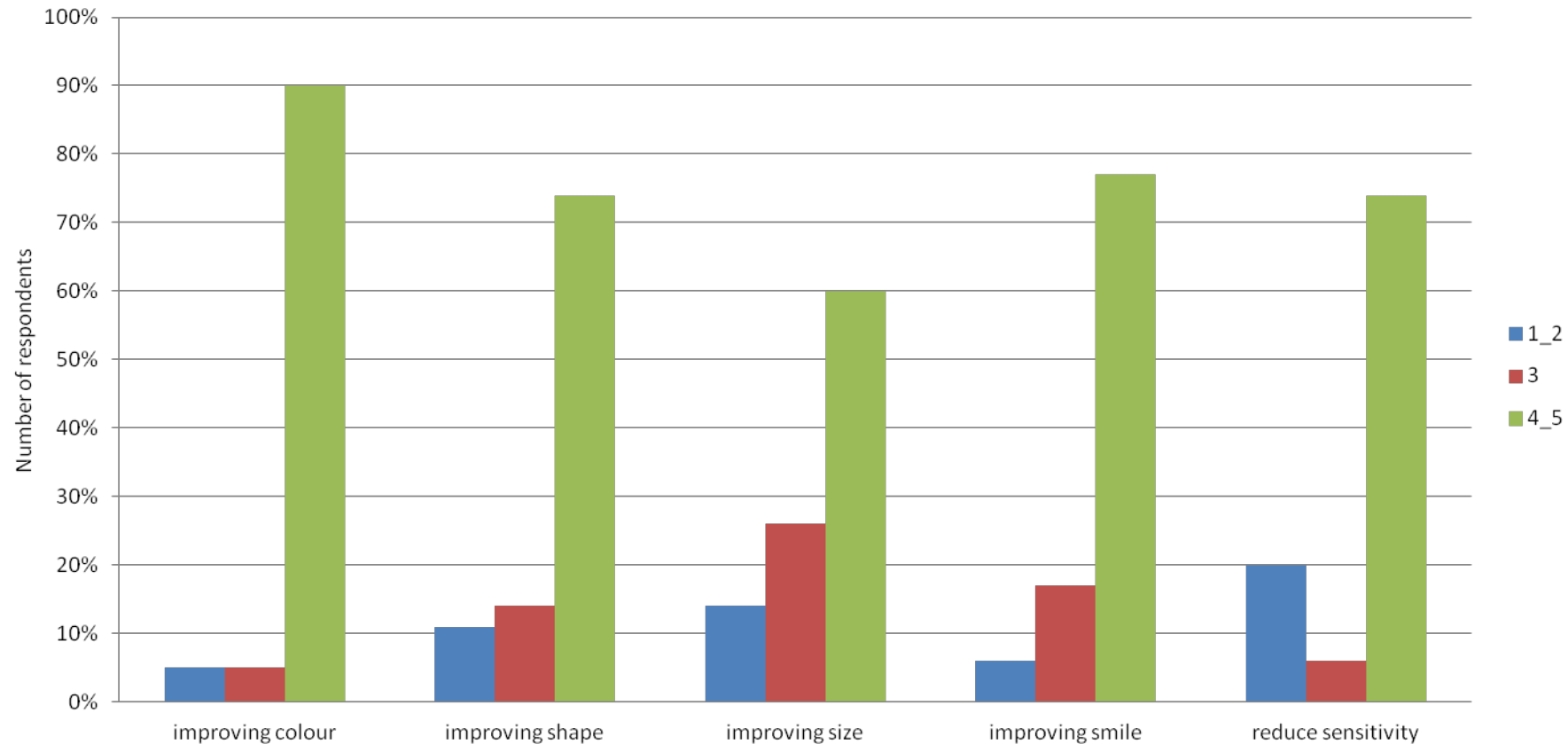
Management aims

- Address patient concerns
 - Aesthetics
 - Sensitivity
 - Function
- Prepare patients for potentially long-term treatment
 - To maintain existing tooth structure
 - Don't exhaust them too early!
- Treatment depends on defect type

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Importance of treatment aims for children with AI on a scale from 1- 5 (1 = not important at all, and 5 = very important)



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Hypoplastic enamel

- Reduced enamel quantity
- **Tooth smaller / thinner**
- Remaining enamel is mineralized:
 - Less likely to undergo post eruptive breakdown (PEB)
 - Can bond to it
 - Can use adhesive restorations without prepping the tooth (but likely to need LA)



Hypomineralised enamel

- Reduced enamel quality
- **Tooth normal size**
- Enamel less mineralised:
 - **Can undergo PEB**
 - Bonding may be compromised
 - PMC may be more suitable for molars
 - Cannot use adhesive restorations without prepping the tooth, so consider other options for anteriors:
 - Microabrasion
 - Vital bleaching
 - Resin infiltration

Posterior permanent dentition

- Maintain vertical dimension and occlusal stability:
 - Restoration
 - PMC
 - Onlays
 - Crown
- Don't need to worry about occlusal derangement (Dahl principle)
- Planned extractions – especially MIH
- Endodontics

Summary

- Enamel defects can be acquired or inherited, localized or generalised
- Careful history required to determine cause
- Need to understand the difference between hypoplastic and hypomineralised enamel to manage care appropriately
- Dedicated UK Special Interest Group for AI & DI set up in 2019

Websites

- Genetics home reference

<https://ghr.nlm.nih.gov>

- OMIM

<https://www.omim.org>

- Orphanet

<https://www.orpha.net/consor/cgi-bin/index.php>

MIH website

(<http://thed3group.org>)



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