Genetic Susceptibility to Dental Caries By Inherited Biological Variation Affecting Tooth Enamel

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Introduction

- Dental caries affect billions of people worldwide
- Common risk factors:
  - High sugar intake
  - Poor oral hygiene
  - Limited fluoride exposure
  - Limited dental care
- These factors by themselves cannot explain why individuals with similar lifestyles develop different rates of tooth decay
- Recent genetic research suggests inherited biological variation contributes to caries/cavity susceptibility

Methods

- Literature Review Paper
- Reviewed primary research articles
- Topics focused on:
  - Enamel formation genes
  - Taste receptor genes
  - Immune response genes
  - Oral microbiome studies
- Compared these findings to determine how inherited biological variation influences dental caries while also evaluating the circumstances of environmental influences

FUN FACTS

- Cavity risk is not controlled by one "cavity gene"
- Your taste genes could affect your oral health
- Fluoride can help overcome genetic inherited risks

Results

Enamel Formation Genes

- Genetic variation directly influences enamel resistance, preventative measures are still effective
  - PKD2 and SIBLING gene variants increase caries/cavity susceptibility
  - Enamel formation genes influence enamel structure
  - Tooth surface type affects inherited risks
  - Fluoride reduces genetic inherited susceptibility

Taste Genes and Dietary Behavior

- Inherited genetics could increase exposure to cariogenic foods, influenced from dietary behaviors
  - Taste receptor genes influence sugar preferences
  - AMY1 gene variation affects carbohydrate metabolism
  - Genetics indirectly alters caries/cavity risk due to diet

Oral Microbiome and Immune Function

- Host's genetics shape the oral microbiome that contributes to development in dental caries/cavities
  - Oral microbiome differs between individuals determined by health
  - Immune related genes are regulators of bacterial colonization
  - Host's genetics influence the response to oral bacteria

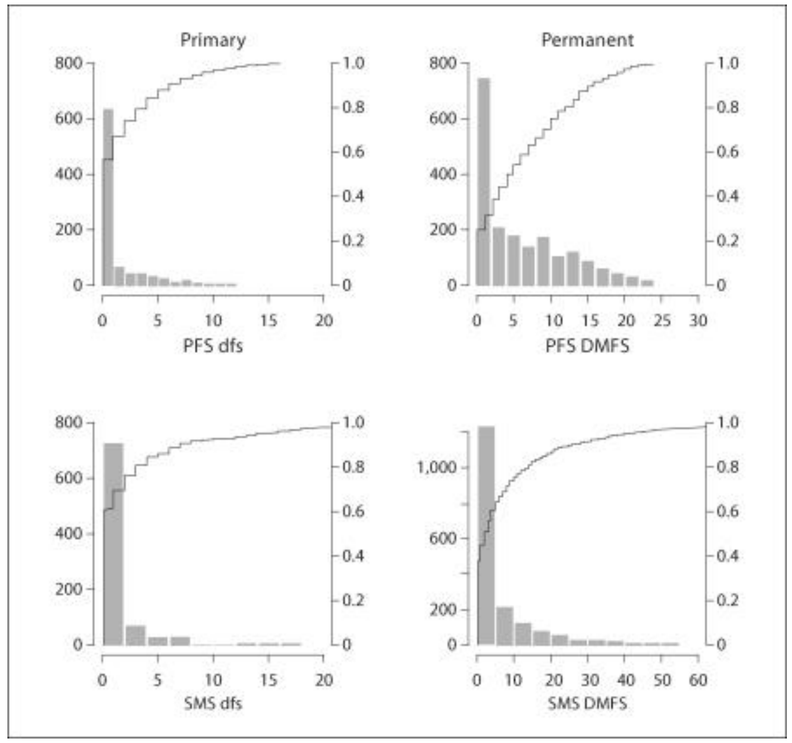

Fig. 1 Genetic Susceptibility by Tooth Surface (Shaffer et al. 2012)
Distribution of dental caries scores for pit-and–fissure surfaces (PFS) vs. smooth surfaces (SMS) in primary and permanent teeth. This study included more than 2,600 individuals, from 740 different families, finding measurable heritability for both types of surfaces.

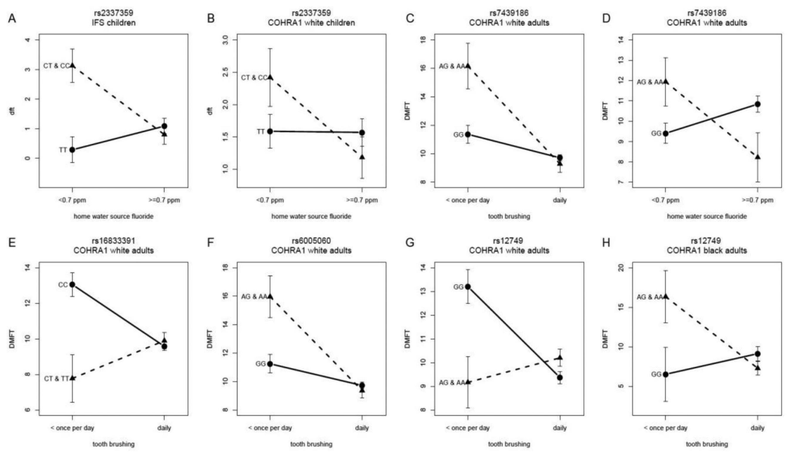

Fig. 2 Gene and Fluoride Interaction (Shaffer et al. 2014)
Interactions between enamel-related genetic variants and fluoride exposure. Specifically, participants with certain genotypes that would have larger dental caries when they were not exposed to fluoride.

Discussion/Conclusion

Overall findings

- The literature explains consistently that dental caries are considered a multifactorial disease
- Environmental factors that modify inherited risks:
  - Fluoride exposure
  - Oral hygiene
  - Dietary habits
  - Accessible dental care
- Genetic Influences:
  - Enamel mineralization
  - Taste preferences
  - Oral microbiome composition
  - Immune regulation

Conclusion

- The effects of inherited genetic variation contributes a significant part in susceptibility to dental caries but does not independently cause the development of the dental disease

Future Directions

- Larger research and more diverse populations
- Identifying a direct causal genetic mechanism
- Further research into gene and microbiome interactions
- Determine if genetic screenings can be useful in early intervention

References