Caries: Risk Assessment and A New Approach to Prevention

Caries in Australia:

- Most Common Chronic Disease in Children, affecting 41% of children in the primary dentition
- Over 50% of teenagers have tooth decay
- Incidence of decay increases with age
- Almost 40% of adults have an oral health impact (self-reported)
- 25% of adults (15 years+) have untreated decay
- DMFT of 65+ years is 23.7

Source of Caries Problem

- Cariogenic bacteria such as *S. mutans* metabolise sugar to make organic acids and extracellular polysaccharide
- Organic acids cause pH drop
- Extracellular polysaccharide allows for:
  - increased adhesion of bacteria
  - nutrient reserves
  - increased porosity of matrix so fermentable substrates can diffuse to inner part of biofilm and be converted to acid at tooth surface resulting in demineralisation of enamel

What is pH?

- pH is a measure of how acidic or basic the environment is
- Bacteria metabolism changes plaque pH
  - Acid Producing Bacteria = Lower pH = Harmful
  - Base Producing Bacteria = Higher pH = Protective
- pH determines if teeth are safe or in danger of demineralisation
- pH of plaque and saliva is neutral for healthy individuals
- Tooth mineral does not dissolve at neutral or basic pH

Role of Saliva

- Contains bicarbonate
  - Excellent buffer
- Washes away carbohydrate substrates and helps dilute acids
- Is supersaturated with Ca^{2+} and PO_4^{3-} providing minerals for remineralisation

Modern clinical caries management: Medical vs. traditional surgical approach

- Focuses on prevention of disease
- Requires
  - Early detection
  - Understanding of the disease process
  - Successful risk assessment
  - Management strategies with a good prognosis
  - Ability to monitor outcomes

Methods for Detection, Assessment and Monitoring

- Radiographs
- DiagnoDent
- Fibre Optic Transillumination (FOTI)
- Enhanced visual method: Quantitative Light-induced Fluorescence (QLF)

Risk Assessment

- Medical management of dental caries is possible and it provides better treatment outcomes than surgical intervention alone.
- Dental caries is a multifactorial, transmissible bacterial infection that can be “prevented” and treated using a multifactorial, enamel health and antimicrobial approach

CAMBRA

CAries Management By Risk Assessment

ICDAS

International Caries Detection and Assessment System (ICDAS) is based on the current strategy to standardise diagnosis and facilitate prognosis and management of dental caries.

Modern Treatment Principles

- Assess caries risk
- Assess lesion activity
- Classify lesion severity
- Assess cavitation status
- Remineralise enamel lesions
- Restore cavitated lesions

Colgate®

Prevention of Caries

Make tooth stronger (Traditional Approach)
Make biofilm healthier (A New Approach)

Plaque Biofilm

- Changes in the environment trigger a shift from "healthy" plaque biofilm to a "cariogenic" plaque biofilm
- Factors that drive a "healthy" plaque biofilm include:
  - fluoride
  - pH
  - arginine

Fluoride in plaque biofilm

- Low pH in the plaque biofilm solubilises calcium and phosphate at the tooth-biofilm interface
- Calcium and phosphate move out of tooth enamel into the local environment resulting in demineralisation
- When fluoride is present at the tooth-biofilm interface the critical pH for solubilisation of calcium and phosphate is lowered
- Lower plaque pH can be tolerated before calcium and phosphate is lost from enamel

Arginine in plaque biofilm

- Arginolytic bacteria in the plaque biofilm break down arginine to form ammonia via the Arginine Deiminase pathway
- Ammonia raises the pH and allows the bacteria to survive in the biofilm
- When arginolytic bacteria are favoured a "healthy" plaque biofilm results
- This process contributes to the balance between acid production and base production that results in the resting plaque pH

PRO-ARGIN™ Technology The Anti-cavity Benefits:

- Arginine is utilised by some plaque bacteria to form ammonia which increases the plaque pH
- Calcium is the first mineral lost from the tooth during acid attack - it helps in promoting remineralisation
- Pro-Argin™Technology complements fluoride by reducing demineralisation and increasing remineralisation beyond the benefit of fluoride alone
- Helps to arrest and reverse the early caries process

Arginine and Fluoride

- Arginine and fluoride act independently providing a two-arm approach to caries protection
- Fluoride's primary mode of action is on the tooth
- Arginine's main effect is on plaque biofilm
- Arginine's added anti-caries effect is the same regardless of fluoride level
- Arginine does not kill bacteria - it creates an environment that favours a non-cariogenic state due to beneficial plaque metabolism

Clinical Studies Summary

- QLF has been validated in peer-reviewed publications as an effective measure to assess early enamel caries
- Results from QLF are predictive of the progression of early lesions to cavitation
- Five 6-month clinical studies confirm the efficacy of 1.5% arginine, insoluble calcium compound and 1450ppm fluoride toothpaste in preventing and arresting early carious lesions vs a 1450ppm fluoride toothpaste
- A 2 year clinical study confirmed 20% reduction in incremental DMFT / DMFS for the 1.5% arginine, insoluble calcium compound and 1450ppm fluoride toothpaste vs a 1450ppm fluoride toothpaste

References

1. Child Dental Health Survey Australia 2007: 30-year trends in child oral health. Mejia GC *et al*. 2012. http://www.aihw.gov.au/publication-detail/?id=10737421875.
2. Dental decay among Australian children. AIHW dental statistics and research unit. Research report 53. July 2011. http://www.adelaide.edu.au/arcpoh/downloads/publications/reports/research/2011/report-51.pdf.
3. Australia's dental generations: the National Survey of Adult Oral Health 2004-06. AIHW dental statistics and research unit. http://www.aihw.gov.au/publication-detail/?id=6442467953.
4. Pitts. J Dent Res. 2004: 83(Spec Iss C):C43-C47.
5. Pretty. J Dent. 2006: 34: 727-739.
6. Powell. Comm Dent oral Epidemiol. 1998: 26: 361-71.
7. Kitamura and Kiyak. Comm Dent oral Epidemiol. 1986: 14: 34-8
8. Evans *et al*. Aust Dent J. 2008: 53: 83-92.
9. Cantore *et al*. J Clin Dent. 2013: 24(Sp Iss A): A32-A44.
10. Wolff *et al*. J Clin Dent 2013: 24(Sp Iss A): A45-54.
11. Yin *et al*. J Dent 2013: 41S: S22-S28.
12. Yin *et al*. J Clin Dent 2013: 24 (Spec Iss A): A15-A22
13. Srisilapanan *et al*. J Dent 2013: 41S: S29-S34.
14. Souza *et al*. J Dent 2013: 41S: S35-S41.
15. Hu *et al*. J Clin Dent 2013: 24 (Spec Iss A): A23-A31
16. Kraivaphan *et al*. Caries Res 2013: 47:582-590.

Head to www.colgateprofessional.com.au/students for more information on products, references, resources, competitions and prizes