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# Is caries in young children an infectious disease?

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# Abstract:

Dental caries is one of the most common infectious diseases, with a significant high prevalence among all group ages of population. Mutans Streptococci are strongly implicated in production of carious lesions, being the major etiologic agents. This evidence based study analyses the transmissibility of dental decay in young children, using both a direct and indirect approach. Direct approach is through research papers that assess the causation of this disease and the indirect approach is by evaluating prevention studies. A thorough search of electronic databases yielded 917 initial studies, further reviewed at title, abstract and full text stage. The number of studies included after the critical appraisal of full text was 10, divided between causation (4 studies) and reversibility (6 studies). Each study was assessed by either “Causation checklist” or “Prevention checklist” according to its content and also by the quality of evidence and grades of recommendation from Canadian Task Force on preventive care. Reversibility studies achieved the best scores and were also assigned the highest design strength and level of evidence. Causation studies had lower scores and fair/poor level of evidence. Only preventive studies had strong support to suggest that prevention or treatment in mothers leads to lower caries and lower bacterial counts in children. Clinical evidence and review results suggest the need for further research to establish the direct correlation in bacterial numbers and dental caries experience between mothers and children, to demonstrate the infectious character of the disease.

# Introduction:

Dental Caries is one of the most important problems not only in dentistry but also in medicine as a contributing factor to overall human health. Dental Caries is an oral disease, which when untreated, destroys the teeth and their functionality.

An estimated 90% of schoolchildren worldwide and most adults have experienced Caries, with the disease being most prevalent in Asian and Latin American countries and least prevalent in African countries. In the United States, Dental Caries is the most common chronic childhood disease, being at least five times more common than asthma. It is also the primary pathological cause of tooth loss in children. A similarly skewed distribution of the disease is found throughout the world with some children having none or very few Caries and others having a high number. Some countries such as Australia, Nepal and Sweden have few cases of Dental Caries among children, whereas, cases are more numerous in Costa Rika and Slovakia .

The dramatic decline in Dental Caries among children in many industrial countries has been demonstrated since the early 1980s. However, there is mounting international evidence that this decline is ending. Furthermore, in Ontario, Canada, Caries experience may be increasing, at least in the primary dentition of the youngest elementary schoolchildren.

| 1997/98 survey in Toronto 4, 5 year olds | | |
|---|---|---|
| Those born: | deft | % with caries |
| in Canada | 0.93 | 24.5 |
| outside Canada | 2.13 | 42.9 |

Canadian dental care costs in 1989 were estimated $ 3.1 billion higher than any medical condition representing a tripling of dental care cost since 1979. As a result, besides the biological effects of this disease, diagnosing, preventing, treating and retreating Dental Caries is also a great financial burden.

According to evidence based on researches done on animals, Caries is the result of interaction between the teeth, cariogenic microorganisms (mostly Mutan Streptococci - MS) and fermentable carbohydrates. Among these, it is assumed that MS is the first factor in Caries production. In addition, there is evidence than infants whose mothers have high levels of MS are at great risk of acquiring these organisms. It is also believed that the incidence of mother-child transmission depends on exposure of the children with the bacteria from the mother’s saliva.

Now, the important question is if Dental Caries is really a transmissible disease, and if yes, what can be done to prevent this transmission.

# Search strategy and Inclusion/Exclusion criteria:

The literature search for relevant articles was performed using:- Ovid Medline® (mesz), Ovid Medline ® in process & other non indexed citations(prem), AMED, CINAHL(nursing), CDSR(coch), ACP journal club(acp), DARE, CCTR, EMBASE(emez), HAPI, Journals Ovid(ovft), HEALTHSTAR(hstr).

Initial search strategy was accomplished using two sets of keywords, which were combined to form a more thorough compilation of articles. The following table illustrates the strategy:

| # | **Search history** | **Results** |
|---|---|---|
| 1 | (Tooth decay or dental decay or enamel decay or dentin$ decay or tooth cavit$ or enamel cavit$ or dentin$ cavit$ or dental cavit$ or tooth demineralization or enamel demineralization or dentin$ demineralization or dental demineralization or dental caries or enamel caries or dentin$ caries or teeth decay or teeth caries or teeth cavit$ or white spot lesion$) | 79595 |

| | | |
|---|---|---|
| 2 | (Infectious or contagious or transmis$ or communic$ or transfer$) | 2470040 |
| 3 | 1+2 | 2928 |
| 4 | Remove duplicates from3 | 2268 |
| 5 | Limit 4 to English | 2146 |
| 6 | Limit 5 to English language | 2146 |
| 7 | Limit 6 to human | 2016 |
| 8 | Limit 7 to humans | 2016 |
| 9 | Limit 8 to local holding | 1238 |
| 10 | Limit 9 to (all infant (birth to 23 months) or all infant or infant (1 to 23 months) or infant <1 to 23 months> or preschool child(2 to 5years) or preschool child <2 to 5years> | 956 |
| 11 | Limit 10 to (infant or preschool child <1 to 6years> | 917 |

The initial search yielded 917 studies for further review and evaluation.

The studies were further reviewed at the title stage, abstract stage and finally at the full text stage where individual studies were selected and sorted on the basis of the" checklist for assessing causation" and "checklist to assess evidence of efficacy of therapy or prevention " developed by Leake and adapted from Fletcher, Fletcher and Wagner. (Clinical epidemiology- the essentials. 3rd ed. 1996).

The studies were thus subdivided into 2 aspects

1-With relevance to causation.

2-With demonstration of reversibility (prevention/efficacy studies).

The studies were also classified and graded according to the Canadian Task force on preventive health care: Quality of evidence and grades of recommendation.

The exclusion criteria's were based on a combined agreement on the final grading and quality of studies (RCT's for prevention studies and cohort for causation studies were chosen for having the best design strength respectively , thus allowing for the strongest level of evidence). Other criteria's used were lack of sample size, no good controls and reviews.

## Method of review analysis:

At each review stage the studies were divided randomly and distributed among the group and were then cross checked by each other to establish consensus at the end but not during the study so as to keep each other blinded about scores marked.

## Results

## Causation:

None of the four studies included for assessing causation (the transmissibility of Mutans Streptococci form mothers to their children were randomized control trials. Three of them were cohort studies without controls and one was a cross sectional study.

In the study by Li et al., conducted in 156 mother-infant pairs and followed up for 4 years, the maternal variables including mode of delivery were shown to have significant effects on the time of acquisition of M.S in Cesarean section born babies (cases)compared to vaginal delivery born babies(non cases). The former acquired M.S 11.7 months earlier. The percentage of children who had detectable M.S levels was almost the same in cases and non cases. (31% vs. 36.7%).

The second cross sectional study by Smith et al. compared the maternal risk indicators for children caries in two groups of children, one having high caries rates and restored teeth and the other caries free. A strong association was found between maternal high M.S levels, active decay and sugar consumption, and children caries rates. (OR~11.6, 3.9 and 4 respectively)

The third study on the causation was a cohort study without controls in which the fidelity of the acquisition of the M.S between 34 mothers and their children was studied. The majority of children had the same genotypes as their mothers at the end of the 3 year study period (71%) and this transmission was shown to have a gender specificity(females acquired with more fidelity(88% vs. 55% of males).

In the last study in the causation series, which was a cohort study conducted on 12 mother-child pairs with a 7 year follow up, levels of two species of streptococci (M.S and S.S) were measured in different times and compared between mothers and children. They reported that the majority of children had only the same M.S genotypes as their mothers,

although their mothers had both M.S and S.S. 9 out of 26 genotypes were the same between mothers and children. 8 children developed no caries at the end of study.

## Prevention /Reversibility:

All of the studies included for this approach were RCTs and they were given level I/A. The purpose of including them in this evidence based study was proving the reversibility of transmission of the M.S from mothers to children as a result of preventive dental care interventions for the mothers.

The first study was conducted by Söderling et al. They assigned 120 mothers to test group and 32 and 36 mothers to control group. The effects of chewing Xylitol gum in test mothers and use of Chlorhexidine mouth rinse and Fluoride varnish in controls on the colonization of M.S in their children was studied. It showed a significant reduction in the test children.

Another study by Brambilla et al. showed that comprehensive oral hygiene measures and preventive care in mothers could significantly reduce the salivary M.S levels of children and the permanent infection with these bacteria as compared to simple preventive care.(48% vs. 83%, tests vs. controls) Also the mean age of colonization was higher than control group. They concluded that a detailed preventive and operative program for mothers delays the time of colonization in their children.

In the study by Sülgergil, conducted in a rural area where the mothers had no access to care outside the study, the mothers were assigned to two groups based on the type of interventions. The test group was provided with detailed preventive and operative program while the control group got only simple oral hygiene instructions and Atraumatized restorative treatments. At the end of this 2 year study, it was shown that M.S and L.B levels were reduced in test children and the occurrence of caries was lower in this children (dfs in tests vs. controls 0.2 vs. 3.17)

The fourth study basically compared the effects of chewing different sugar free gums containing artificial sweeteners such as Xylitol and Sorbitol and also Fluoride and Chlorhexidine by mothers on the M.S levels and caries development in their children. 173 mothers were assigned to groups A, B, C (Tests) based on difference of chewing gums and 232 were assigned to controls who had low M.S counts although there was no mention of their M.S levels. The findings suggested that high Xylitol chewing gums caused more reduction in both salivary M.S levels and caries rates in children comparing other gums. A correlation was also shown to exist between early establishment of M.S and caries development in children. (OR~12)

# Discussion:

Upon review of the literature 2 main approaches o the infectious nature and transmissible nature of caries were made.

Firstly, the causation aspect was considered and to find out the main cause of dental caries transmission from mother to child. Upon going through various studies on cause of dental caries and after grading and scoring them, it was concluded that there is only fair/ poor evidence available to prove these causes.

Various factors were considered like levels of mutans streptococci, high sugar consumption or active carious lesions in the mother etc. that could lead to caries transmission to the child.

Various reasons for limitations in the level of incidence were, lack of sufficient sample size, loss of follow up, inconsistency in the observations in different times and places.

No controlling factors for caries were considered and not the strongest designs were used. Further studies with strong designs need to be done to prove the role of above-mentioned factors in transmission of caries from mother to child.

The second aspect of these studies was the reversibility or prevention factor. The main reason was to prove the reversibility of the transmission process, which indirectly would prove that caries is infectious disease.

Various studies were looked into ad discussed regarding the reduction or delay in carious process or acquisition of mutans streptococci in children. When these mothers were put onto various preventive regimens like xylitol chewing gums, chlorhexidine rinses, and oral hygiene instructions etc., it was observed that there is a reduction in mutans streptococci colonization and count plus a significant decrease in caries incidence.

According to a study conducted by Y.Li Caufield et al 1995, on 218 pregnant mothers to find out the relation between the mode of delivery and the mutans streptococci acquisition and counts. It was reported that the percentage of infants with detectable mutans streptococci was almost similar between the 2 groups i.e. 31% for c-section v/s 36.7%for vaginal.

There was another study conducted by the same group on 34 mother infant pairs to correlate maternal mutans streptococci with the child and the outcome was that 71% of children had identical mutans streptococci to their mothers. Also that 88% female infant v/s 55% male infants had the same genotype as the mothers.

A study by E. Lindquit,C G. Emilson2003 on 12 mothers and 15 children also showed similar results, that 10/15 children acquired mutans streptococci from their mother and 4 had mutans streptococci and streptococcus sobrinus. 9/26 genotypes were identical to their mothers

A study by E Soderling st al in 2000 on 169 mother child pairs where the mothers were put on preventive regimens like xylitol chewing gums for mothers in test groups, chlorhexidine mouthrinses and fluoride varnishes in control groups.

The tests being conducted at 2,3and 6 years showed that acquisition of mutans streptococci in children was the lowest in the xylitol group followed by the chlorhexidine group and then the fluoride group.

Two different studies conducted by E. Brambilla et al. 1998 and Turkel Sulgergil et al.2004 where the mothers in test group were put on various preventive regimens like diet counseling, oral hygiene instructions, scaling, mouth rinses, restorations showed that

- Permanent infection in children in test group was 48% as against 83% for control
- Mean age of colonization in children in test was 22.5v/s 18.20 months for control group
- There was a decreased caries in children in dfs test group 0.13(12 months) 0.2(24 months) v/s dfs control group 1.67(12 months) 3.17(24months).

# CONCLUSION AND EVIDENCE BASED RECOMMONDATIONS:

There is insufficient evidence to conclude that childhood caries is caused by transmission of bacteria i.e Strep Mutans from mother to their children .Various maternal caries risk factors influence caries acquisition in their children but there remains no clear evidence(level-11-3) in the literature to support this topic.

On the other hand, there is fairly good evidence (1-A) reinforcing the fact that different interventions done in mothers to decease sterp mutans count proves beneficial in children by deceasing MS count ,delaying MS colonization and reducing caries .Use of xylitol chewing gum, fluoride and CHX varnish show promising results .

# RECOMMENDATIONS FOR FUTURE RESEARCH:

- Additional studies with stronger design (RCT, Cohort) need to be conducted on these topics.
- We require longitudinal studies with adequate sample size to establish relationship between MS level in children and their caregivers verifying caries as a transmissible disease.
- We also need studies focusing on different groups of caregivers other than mothers and on various other preventive interventions.
- Studies taking into to account other controlling factors for caries should be considered.

# Acknowledgements:

We extend our special thanks to Dr. Azarpazhouh A., Dr.Leake J. for their support and guidance, without which the project wouldn’t have been possible. We would also like to thank the library staff for their assistance.

# Appendix:

## Checklist to Assess Causation

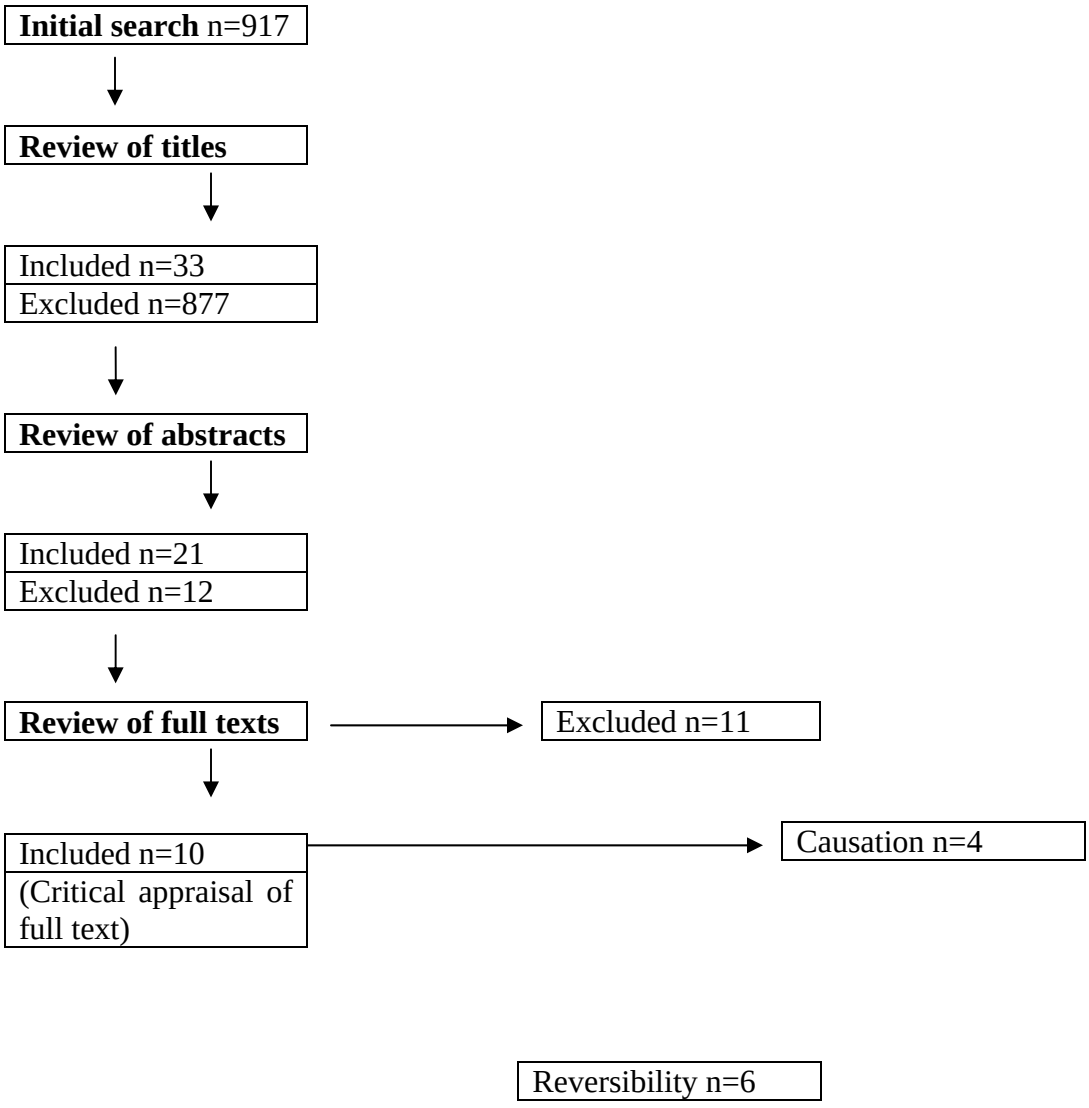
- Ethical?
- Strong design to assess causation or risk?
- Cases defined validly and reliably measured?
- Risks validly and reliably measured?
- Risks assessed controlling for other factors, model's prediction power strong?
- "Cause" preceded the effect?
- Estimated risk beyond chance and large?
- Dose-response relationship?
- Reversibility demonstrated?
- "Cause" consistently observed in different times, places?
- "Cause" biologically plausible?
- "Cause" specific to disease?
- "Cause" analoguous to another established disease/exposure?

Leake, JL, Department of Biological and Diagnostic Sciences, Faculty of Dentistry, University of Toronto. Unpublished document. Course notes DENT IDAPP 2007. Checklist adapted from Fletcher RH, Fletcher SW, Wagner EH. Clinical Epidemiology. The essentials, 3rd ed. Baltimore: Williams and Wilkins, 1996; and Sackett DL, Richardson WS, Rosenberg W, Haynes RB. Evidence-based medicine: how to practice and teach. EBM. 2nd ed. New York: Churchill Livingstone, 1997.

# Checklist to assess Evidence of Efficacy of Prevention

- Ethical?
- Strong design to assess efficacy?
- Outcomes validly and reliably measured?
- Interventions validly and reliably measured?
- Treatment effect large enough to be clinically important?
- Estimated treatment effect beyond chance and precise?
- Power 80% or better if “no difference” in findings?
- Assignment of patients to treatments randomised?
- Loss to follow-up less than 20% and balanced?
- Patients analysed in groups where randomised?
- Sufficient duration of study?
- Patients, health workers, study personnel “blind” to treatment?
- Groups similar at start of trial?
- Groups treated equally aside from intervention?
- Care received outside study?
- All clinically important outcomes considered?
- Likely benefits of treatment worth potential harms and costs?

Leake, JL, Department of Biological and Diagnostic Sciences, Faculty of Dentistry, University of Toronto. Unpublished document. Course notes IDAPP 2007. Checklist adapted from Fletcher RH, Fletcher SW, Wagner EH. Clinical Epidemiology. The essentials, 3rd ed. Baltimore: Williams and Wilkins, 1996; and Sackett DL, Richardson WS, Rosenberg W, Haynes RB. Evidence-based medicine: how to practice and teach. EBM. 2nd ed. New York: Churchill Livingstone, 1997.




Flow chart of article selection through the review

| | CITATION | REASON FOR REJECTION |
|---|---|---|
| 1 | Berkowitz RJ. Mutans streptococci: acquisition and transmission. [Journal Article] Pediatric Dentistry. 28(2):106-9; discussion 192-8, 2006 Mar-Apr. | Informal review |
| 2 | Caufield PW. Dental caries--a transmissible and infectious disease revisited: a position paper. [Review] [39 refs] [Journal Article. Review] Pediatric Dentistry. 19(8):491-8, 1997 Nov-Dec. | Informal review |
| 3 | Caufield PW. Dental caries: an infectious and transmissible disease where have we been and where are we going?. [Journal Article] New York State Dental Journal. 71(2):23-7, 2005 Mar. | Informal review |
| 4 | Dasanayake AP. Caufield PW. Cutter GR. Stiles HM. Transmission of mutans streptococci to infants following short term application of an iodine-NaF solution to mothers' dentition. [Clinical Trial. Journal Article. Randomized Controlled Trial. Research Support, U.S. Gov't, P.H.S.] Community Dentistry & Oral Epidemiology. 21(3):136-42, 1993 Jun. | Inconclusive study |
| 5 | Dasanayake AP. Wiener HW. Li Y. Vermund SV. Caufield PW. Lack of effect of chlorhexidine varnish on Streptococcus mutans transmission and caries in mothers and children. [Clinical Trial. Journal Article. Randomized Controlled Trial. Research Support, Non-U.S. Gov't] Caries Research. 36(4):288-93, 2002 Jul-Aug. | Inconclusive study |
| 6 | Florio FM. Klein MI. Pereira AC. Goncalves BR. Time of initial acquisition of mutans streptococci by human infants. [Journal Article. Research Support, Non-U.S. Gov't] Journal of Clinical Pediatric Dentistry. 28(4):303-8, 2004. | Only time frame considered |
| 7 | Kohler, B. Bratthall, D. TitleIntrafamilial levels of Streptococcus mutans and some aspects of the bacterial transmission. SourceScandinavian Journal of Dental Research. 86(1):35-42, 1978 Jan. | Study level and grading: poor |
| 8 | Milgrom P. Riedy CA. Weinstein P. Tanner AC. Manibusan L. Bruss J. Dental caries and its relationship to bacterial infection, hypoplasia, diet, and oral hygiene in 6- to 36-month-old children. [Journal Article. Research Support, U.S. Gov't, P.H.S.] Community Dentistry & Oral Epidemiology. 28(4):295-306, 2000 Aug. | Cross-sectional study. |

| | | |
|---|---|---|
| 9 | Ramalingam, Lochana. Messer, Louise Brearley. InstitutionDepartment of Restorative Dentistry, National Dental Centre, Singapore. TitleEarly childhood caries: an update. [Review] [70 refs] SourceSingapore Dental Journal. 26(1):21-9, 2004 Dec. | Informal Review |
| 10 | Segovia-villaneuva A. Estrella-Rodriguez, Ramon. Medina-Solis, Carlo Eduardo. Maupome, Gerardo; Dental caries experience and factors among preschoolers in south-eastern Mexico: a brief communication. Journal of public health dentistry. 66(2):88-91, 2006 | Cross-sectional study |
| 11 | Tanner AC. Milgrom PM. Kent R Jr. Mokeem SA. Page RC. Liao SI. Riedy CA. Bruss JB. Similarity of the oral microbiota of pre-school children with that of their caregivers in a population-based study.[erratum appears in Oral Microbiol Immunol. 2003 Oct;18(5):338]. [Journal Article. Research Support, Non-U.S. Gov't. Research Support, U.S. Gov't, P.H.S.] Oral Microbiology & Immunology. 17(6):379-87, 2002 Dec. | Study level and grading: below cut off limits of inclusion criterias. |

# Causation

| Author, Date | Cases | Non cases | Outcome | C/A comments | Level of Evidence |
|---|---|---|---|---|---|
| **Y. Li. Caufield et al. 1995** | 29 pairs<br>• Caesarian section | 127 pairs<br>• Vaginal delivery | • M.S was detected in 55 / 156 children(35.3%), with the average acquisition median age of 20.3 mos<br><br>• The percentage of children with detectable M.S was similar between the two groups, c-section vs. vaginal: 31.0% vs.36.7% | • 62 pairs loss to follow up in the first 2 months | II-2, 11/13 |
| **R. E. Smith et al. 2002** | 29 pairs<br><br>• Children with active or restored caries | 31 pairs<br><br>• Caries free children | • Logistical regression:<br><br>• Strong association between caries in children (Cases ) and high MS levels in their mothers as compared to non-Cases (OR ~12 )<br><br>• Strong association between caries in children (Cases) and increased sugar consumption in mothers comparing Non Cases(OR~ 4 )<br><br>• Strong association of high caries rate in mothers and caries in children ( Case) compared to Non-Case: (OR~4) | • Cross sectional study, no follow up in time<br><br>• Cause not consistently observed in different times, places | II-3, 10/13 |
| **Y. Li Caufield et al. 1994** | 34 mother- infant pairs | N/A | • 71% of children had identical M.S to their mothers<br><br>• Acquisition of same genotypes of M.S in children: 88% females vs. 55% males : (p~0.02)<br><br>• More likelihood of getting caries in male vs. female children (OR~13, p=0.07)<br><br>• Earlier emergence of teeth in infants who acquired M.S vs. others (6.6 vs. 7.9 mo; p=0.01) | • Small sample size<br><br>• No other controlling factors for caries considered<br><br>• Reversibility was not demonstrated<br><br>• Not a strong design to assess causation<br><br>• No control group | II-3, 10/13 |
| **E. Lindquit,C. G.Emilson. 2003** | 12 mother-child pairs | N/A | • 10/15 children acquired M.S, only 4 had both M.S and S.S (mothers had both)<br><br>• 9/26 children had genotypes identical to mothers<br><br>• Low caries experience in children, 8 caries free<br><br>• at 5-7 years of age, greater tendency for developing caries in children with both species | • Small sample size<br><br>• No control group<br><br>• Mothers had the opportunity for asking and getting information about caries risk factors<br><br>• No p-values or OR | II-3, 9/13 |

# Prevention

| Author, Date | Intervention or test treatment | Control treatment | Outcome | C/A comments | Level of evidence |
|---|---|---|---|---|---|
| **E. Söderling et al. 2000** | 120 mothers<br><br>• Xylitol chewing gum (3 times a day) from 3-24 months after delivery<br><br>• Regular dental care and OHI | 32 mothers<br><br>• CHX mouth rinse<br><br>36<br>• Fluoride varnish used at 6, 12, 18 months after delivery | Acquisition of M.S in test children vs. F and CHX<br><br><u>2 year</u>: 10% vs. 29% & 49%<br><br><u>3 year:</u> 28% vs. 65% & 37%<br><br><u>6 year:</u> 52% vs. 84% & 86%<br><br>• Difference in M.S levels of mothers not statistically significant | • 2 year: the clinicians were not blinded<br><br>• No power calculation<br><br>• Did not mention about care outside the study | I-A, 16/17 |
| **E. Brambilla et al. 1998** | 31 mothers<br>• Dietary counseling<br>• OHI<br>• Scaling<br>• CHX an d Fluoride mouth rinse<br>• Systemic Fluoride | 32 mothers<br>• Diet counseling<br><br>• OHI and systemic F | • Reduction of salivary M.S levels in children<br><br>• Permanent infection in test vs. control children: 48% vs. 83%<br><br>• Mean age of colonization in children, test vs. control: 22.5 vs. 18.20 mos | • Comparisons could have been done between high M.S levels and low M.S levels<br><br>• Blinding not mentioned | I/A, 16/17 |
| **Türksel Sülgergil et al. 2004** | 15 mothers<br><br>• Detailed preventive, operative program<br>• OHI, Triclosan<br>• ART<br>• Flossing<br>• Fluoride varnish<br>• GIC sealants<br>• CHX mouth rinse | 12 mothers<br><br>• Simple care and advice program<br><br>•OHI<br><br>•ART | • Significant reduction MS& LB in test children ( $p<0.001$)<br>-Test vs. control- M.S score: 5/15 vs. 0/12<br>• Significant lower caries in test children ($p<0.001$)<br>- dfs test group:<br>0.13 (12mos)<br>0.2 (24 mos)<br>- dfs control group:<br>1.67 (12 mos)<br>3.1 7(24 mos)<br>• Caries-free children test vs. control: 87% vs. 8% ($p<0.001$) | • No power calculation<br><br>• Small sample size | I/A, 15/17 |
| **I. Thorild Et al. 2004** | 173 mothers with high salivary M.S<br>• <u>A:</u> 61<br>XYL<br>• <u>B:</u> 55<br>CHX<br>XYL<br>SORB<br>• <u>C:</u> 57<br>Fluoride<br>SORB<br>XYL<br>• <u>E</u>: drop outs from A, B, C | 232 mothers<br><br>•Lower M.S counts<br><br>• No Intervention<br><br>• <u>D</u>: control | • Group A,B,C vs. D:<br>No Significant difference in caries or MS count in children<br><br>• Significant correlation between early establishment of M.S and caries development in the children of three intervention groups. (OR~12)<br><br>• Significant reduction in MS counts and less caries prevalence in the children in high Xylitol gum (A,B) vs. low Xylitol gum (C and E) | • No control group caries or M.S count<br><br>• No other controlling factors for caries considered<br><br>• The efficacy of this type of intervention in low caries community may be evaluated | I/B, 15/17 |

# References:


1. Brambilla E. Felloni A. Gagliani M. Malerba A. Garcia-Godoy F. Strohmenger L. Caries prevention during pregnancy: results of a 30-month study [Clinical Trial. Journal Article. Randomized Controlled Trial] Journal of the American Dental Association. 129(7):871-7, 1998 Jul.

2. Canadian task force on preventive health care. Canadian task force methodlogy, levels of evidence-research design rating. Available at :http:/www.ctfphc.org.

3. Fletcher RW, Fletcher SW. Clinical epidemiology: The essentials, 4th ed. Philadelphia: Lippincott Williams & Wilkins 2005.

4. Isokangas P. Soderling E. Pienihakkinen K. Alanen P. Occurrence of dental decay in children after maternal consumption of xylitol chewing gum, a follow-up from 0 to 5 years of age.[see comment]. [Clinical Trial. Comparative Study. Journal Article. Randomized Controlled Trial. Research Support, Non-U.S. Gov't] Journal of Dental Research. 79(11):1885-9, 2000 Nov.

5. Leake JL checklists for appraising evidence in health care. In: faculty of dentistry, university of Toronto clinical epidemiology course package (DEN1040H) Toronto On./University of Toronto Health sciences writing centre Producing an evidence based practice report. Available at:http://www.hswriting.ca/handouts/producingevidence.asp

6. Li Y. Caufield PW. The fidelity of initial acquisition of mutans streptococci by infants from their mothers. [Journal Article. Research Support, Non-U.S. Gov't. Research Support, U.S. Gov't, P.H.S.] Journal of Dental Research. 74(2):681-5, 1995 Feb.

7. Li Y. Caufield PW. Dasanayake AP. Wiener HW. Vermund SH. Mode of delivery and other maternal factors influence the acquisition of Streptococcus mutans in infants. [Journal Article. Research Support, N.I.H., Extramural. Research Support, U.S. Gov't, P.H.S.] Journal of Dental Research. 84(9):806-11, 2005 Sep.

8. Lindquist B. Emilson CG. Colonization of Streptococcus mutans and Streptococcus sobrinus genotypes and caries development in children to mothers harboring both species. [Journal Article] Caries Research. 38(2):95-103, 2004 Mar-Apr.

9. Soderling E. Isokangas P. Pienihakkinen K. Tenovuo J. Influence of maternal xylitol consumption on acquisition of mutans streptococci by infants.[see comment]. [Clinical Trial. Journal Article. Randomized Controlled Trial. Research Support, Non-U.S. Gov't] Journal of Dental Research. 79(3):882-7, 2000 Mar.

10. Soderling E. Isokangas P. Pienihakkinen K. Tenovuo J. Alanen P. Influence of maternal xylitol consumption on mother-child transmission of mutans streptococci: 6-year follow-up. [Clinical Trial. Journal Article. Randomized Controlled Trial. Research Support, Non-U.S. Gov't] Caries Research. 35(3):173-7, 2001 May-Jun.

11. Smith RE. Badner VM. Morse DE. Freeman K. Maternal risk indicators for childhood caries in an inner city population. [Journal Article] Community Dentistry & Oral Epidemiology. 30(3):176-81, 2002 Jun.

12. Turksel Dulgergil C. Satici O. Yildirim I. Yavuz I. Prevention of caries in children by preventive and operative dental care for mothers in rural Anatolia, Turkey. [Clinical Trial. Controlled Clinical Trial. Journal Article] Acta Odontologica Scandinavica. 62(5):251-7, 2004 Oct.

13. Thorild I. Lindau B. Twetman S. Salivary mutans streptococci and dental caries in three-year-old children after maternal exposure to chewing gums containing combinations of xylitol, sorbitol, chlorhexidine, and fluoride. [Journal: Article] Acta Odontologica Scandinavica. Vol. 62(5)(pp 245-250), 2004