A retrospective study on the follow-up effect on implemented dental prevention program among children and adolescents

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Abstract

**Introduction:** Prophylaxis programs are frequent and are powerful tools for the prevention of caries. This study aims to evaluate the possibility on implementing a prevention program in rural areas by involving all dental staff and follow-up on the outcome of the implementation.

**Methods and Material:** 143 patients in mixed dentition in ages of 7-9 and 11-13 were examined and categorizing in risk and non-risk caries patients using CAMBRA.

**Results:** 92 patients were assessed as high-risk and where then called at three months interval for hygiene control, instruction and motivational talk as well as fluoride varnish. The prevention program was evaluated after nine months based attendance among patients. The implementation went successfully with a rate of approximately 80% attendance at each follow-up session, and approximately 68% for the same individual at all appointments.

**Discussion:** In rural areas with great need of dental care due to high caries level among children and adolescent the implementation of prevention program could help arrest initial caries as well and prevent new decays. This study shows that prevention programs can be implemented and that the whole dental staff, especially hygienist and dental nurses, can be an important part in its implementation and follow-up.

**Keywords:** Dental Caries; Prevention; Prophylaxis; Risk Assessment; Implementation; Follow-up; Children; Rural population; Fluorides
En retrospektiv studie om uppföljning av effekten av ett implementerat preventionsprogram hos barn och ungdomar

Sammanfattning

**Introduktion:** Profylaxprogram är ett viktigt vertyg som kan användas vid prevention av karies. Denna studie går ut på att utvärdera möjligheten av att implementera ett preventionsprogram i glesbebygda områden genom att involvera hela kliniken och följa upp effekten av detta implementering.

**Material och Metoder:** 143 patienter under tandväxling i åldrarna 7-9 år och 11-13 år undersöktes och riskbedömdes i låg- alternativ hög-risk för karies med hjälp av CAMBRA.

**Resultat:** Av ovanstående patienter bedömdes 92 patienter som hög-risk och kallades in med tre månaders intervaller för hygien kontroll, instruktion och motivationssamtal samt pensling med Fluor lack. Implementeringen av preventionsprogramet visade god lyckandefrekvens på ca 80% närvaro vid varje uppföljningstillfälle, samt ca 68% för samma individ vid samtliga tillfällen. **Diskussion:** I områden med stort behov av tandvård orsakad av hög karies nivå kan implementering av ett preventionsprogram bland barn och ungdomar vara till god hjälp i kampen mot karies. Denna studie visar att preventionsprogram kan bli implementerad och att hela kliniken, speciellt hygienister och sköterskor, kan vara en viktig roll för dess genomförande och uppföljning.
Introduction

In most Scandinavian countries the welfare system has institutionalized systemic dental care free of charge for children and adolescents. Preventive programs have been offered and in recent years individualized dental care based on risk assessment has become more frequent (Wang et al. 1999).

In rural areas the lack of dentist creates an imbalance of dental care that leads to greater need of dental treatment for children and adolescents where the levels of caries are higher. With public dental care being free for this group of people the rest of the population in the area finds themselves in a disadvantaged position concerning adequate dental care. This creates a viscous circle for all parties involved. (Allisson et al. 2007; Gorbatova et al. 1999).

The term cariology falls under a broad context where the etiology of the disease being one part, and risk factors, assessment and prevention having an equal part in managing the diseases as a whole (Zafar et al. 2009).

"How to prevent Caries” (SBU, 2002) is a report evaluating health care technologies initiated by the Swedish Council on Health Technology Assessment. The idea behind was to bring forth a document to cover knowledge gaps in the subject of caries and prevention with scientific evidence and recommendations on the subject scrutinizing the effectiveness of different prevention methods.

Dental caries is the most chronic child disease in the world, also known as Early Childhood Caries, ECC (Ramos-Gomez et al 2010; Marshall et al. 2003).

ECC has been a big challenge within Odontology to overcome by good oral health and absence of pain and tooth decay. Pain caused from untreated caries can affect many aspects of a child’s
life, from school attendance, eating and speaking as well as growth and development (Marshall et al. 2003). Even so, dental caries is a preventable disease that can be arrested by overlooking the risk factors such as diet and oral hygiene and by so minimizing the risk of further development (Featherstone et al. 2007). This can be reached through changes in attitude and understanding the cause of the disease in which the patients dietary habits and intake as well as their oral hygiene plays a major role (Featherstone et al. 2007).

The etiological background of caries lies in the interaction between bacteria’s in the mouth and the nutrition we supply them, causing loss of tooth minerals by acid production (Ramos-Gomez et al 2010, Sarmadi et al. 2011). Caries is a multifactor disease starting with microbiological shifts within the biofilm on the tooth surface, and is affected by salivary flow and composition, exposure to fluoride, consumption of dietary sugars and by preventive behaviors such as teeth cleaning. The mechanism of the caries process is endogenous bacteria in the biofilm (plaque) produce weak organic acids as a by-product of metabolism of fermentable carbohydrates. A fall below a critical value in the pH results in demineralization of the tooth hard tissue. This leads to cavity if the diffusion of calcium, phosphate and carbonate continues to lead to an ecological imbalance in the physiological equilibrium between tooth minerals and oral microbial biofilms (Selwitz et al 2007). The caries “imbalance” (Fig.1) shows the balance amongst disease indicators, risk factors and protective factors determine whether dental caries progresses, halts, or reverses (Featherstone et al. 2007).
Fig 1. Illustration of the caries “Imbalance” (Featherstone et al. 2007)

Demineralization can then be reversed through uptake of calcium, phosphate and fluoride. Fluoride acts as a catalyst for the diffusion of calcium and phosphate into the tooth remineralizing the crystalline structures in the lesion (García-Godoy et al. 2008).

The extent of tooth decay caused by bacteria falls under classification on the severity of enamel loss originally developed by WHO and later on modified by Pitts and Ismail. The classifications are D1 = initial caries, D2 = caries of enamel, D3 = caries of dentine, D4 = caries of probable pulpal involvement. (Banting et al. 2011, Wienstien et al. 2009, Jazrawi KH. 2009).

Surgical treatment such as removing caries and replacing it restorative material are carried out in the D3 stage of bacterial penetration of the dentin.

Caries can be arrested and potentially reversed in its early stages, but it is not self-limiting with lack of proper care it can progress until the tooth is destroyed with its burden lasting a lifetime (Selwitz et al. 2007).
Caries is related to the lifestyle of patients. Behavioral factors are implicated, such as poor oral hygiene, poor dietary habits, and use of medications containing sugar. Poverty, level of education, previous caries experience and low socioeconomic status are other factors that can afflict the disease (Selwitz et al. 2007).

A child has neither the knowledge nor the understanding for what is dangerous and hazardous to its health where pain and discomfort are of inevitable matter.

As ECC affect children the real task is how to engage parents. Having a clear line of communication towards parents and younger adolescents’ dental staff can help them to take control of their own oral health and stop upcoming or ongoing diseases (Kagihara et al. 2009).

With modern knowledge of dental caries, the trend in caries management has moved away from conventional drilling and filling method towards a preventive approach. The challenge for dentist is to detect lesions at an early stage. Furthermore the dentists must choose from various preventive treatment programs to control the caries process and prevent disease progression to advanced stage disease that needs restorations (Selwitz et al. 2007).

A number of prevention programs have been designed to guide dental staff in assessing their patient’s in different caries risk groups (Featherstone et al. 2007). To be useful in practice a good model for risk assessment should be easy, inexpensive and most importantly be a useful aid in decision-making. Risk assessment is partly used to plan the patient’s treatment as well as helping to set intervals for upcoming examinations (SBU 2007).

The CMS, Caries Management System is a 10-step non-invasive strategy that is implemented on patients’ with caries in early stage. It is designed to impact the individual health behaviors and professional dental care and focus on the diagnosis of cavitated lesions (Evans et al. 2009).
The ICDAS (International Caries Detection and Assessment System) provides a scoring system with codes in caries detection and diagnosis to provide adequate information, prognosis and clinical management of the disease. The system has been found effective in determining baseline calibration in examiners reliability in caries diagnosis (Nelson et al. 2011).

The Caries Risk Assessment (CRA) measures the caries balance of a patient at a point in time, and information that is gathered drives the decision-making process in clinical treatment. Treatment is evidence-based where patients are treated individually according to their oral status rather than treating all patients in the same way. Treatment involves strategies that put the patient into a healthy balance (Young et al. 2007, Young et al. 2009).

CAMBRA, Caries Risk Management by Risk Assessment, is a guideline by California Dental Association. It is designed to assess patients at risk and endorse prevention of caries. The guideline has been tested on high-risk caries patients receiving interventions such as fluoride and chlorhexidine based on their CRA. The control group involved in the CAMBRA investigations received conventional restorative care without endorsement of prevention. Comparison of the two groups resulted in that the CAMBRA group reduced caries incidence in the high-risk group while conventional teeth restoring did not (Featherstone et al 2012). CAMBRA has an easy format (Fig.2) covering disease indicators, risk and protective factors, clinical findings and management of self-goals. Self-goals helps to facilitate oral health education as well as increases the understanding of how individual behavior can affect the development and progression of the disease (Ramos-Gomez et al. 2011).

Through its concept of risk assessment early interventions and through establishment of dental home, clinicians are able to reduce the patient’s caries risk and improve their oral and general health (Ramos-Gomez et al. 2011).
Many of the guidelines or risk assessment similar to CAMBRA has not been demonstrated with a follow-up and the effect it has by implementing treatments needed on patients with risk. In
order to know if a prevention program can have effect and be successful there is a need to investigate if implementation has potential.

In Ørnes kommune there are approximately 760 children between the ages 3-18 years old with high level of dental caries with the number of inhabitants being approximately 3400.

The study was done retrospectively. The aim of the study was to evaluate if implementation of caries prevention program could be successful or show positive results. The hypothesis was that the implementation of such a program is possible including the necessary follow-ups. To make it achievable the dental staff was to work in teams, delegating the work amongst them.

In order to have success in prevention programs it is important to have a good treatment plan created individually for the patient. Frequent follow-ups are crucial as well as patient’s cooperation, motivation and attendance.

A prevention program is particularly useful for dental staff in areas with high decay frequency. If the study shows success in implementation of the caries prevention program it indicates that such a program can be put into force with meaningful outcomes in areas with high decay frequency.
Materials and Methods

Study Design

The study was done retrospectively with dental examination and caries registration as baseline. Additional two follow-ups were done with three months interval after baseline, with a total time elapse of six months. The results registered throughout the prevention program are presented with descriptive methodology of the program.

Ethical consideration

Ethical consideration was taken before the material was examined, but due to the fact that this study was done retrospectively on a prevention program that had already taken place no ethical approval was applied for.

All collected material from the patients were anonymized after evaluation and stored within the clinic.

Review of literature

Thorough review of literature was undergone for the study mainly by search engine PUBMED with key words such as: Caries/etiology, Prevention programs/caries, Caries/fluoride, Risk assessment/caries, Caries/rural areas, Prevention/assessment/management/caries, Caries/evaluation, CAMBRA. Only articles in the English language were accepted based independence of age and based on its contents.
**Prevention program**

The initial idea was to implement a caries prevention program in a municipality due to the high caries rate between children and adolescents in Ørnes kommune. Through involvement of the health counselor a prevention program was planned in two steps. One where to increase awareness among parents about their children’s oral health having the dental staff visiting kindergartens, educating staff and invited parents about causes, risk and how to they could help to prevent dental caries. The second step was to assess children in risk of developing or having ongoing dental caries.

**Subjects**

**Criteria for inclusion and exclusion**

Only patients belonging to Ørnes tannklinikk who did the modified CAMBRA risk assessment (see Part I: Selection of patients by Cambra) for the prevention program could be included in the study.

The patient group was in the mixed dentition. The age group was divided in two subgroups:

1) Early dentition group (EDG) 7-9 years old
2) Late dentition group (LDG) 11-13 years

The patients included had their yearly dental examination coming up. Patients within the same age groups who had undergone dental examination earlier in the year prior to commencement of the prevention program were excluded from participation in the risk assessment of the prevention program and the study.
Patients

After risk assessment patients included in the prevention program were selected by their age with interest in their dental age, because plaque accumulation is more frequent in mixed dentition leading to caries risk due if poor oral hygiene. No considerations were taken to patients’ gender. The total number of children and adolescents between the ages of 3-18 years in Ørnes kommune was 759. The subgroups chosen to undergo risk-assessment prior to the start of the prevention program (ages 7-9 and 11-13) gave a total of 144 participants, corresponds to about 19% of the total children and adolescents population in the area (Fig. 4).

Dropouts and additions

Of the total 144 patients included in the prevention program, it was revealed at the time of the first follow-up examination that two patients no longer lived in the area and would not be able to continue the program.

One patient were later on added to the program who had undergone his dental examination earlier in the year but was enrolled with no explanation on its circumstances, but was either how accepted (Fig.3). In total 143 patients were included to participate in the risk assessment of the prevention program where 92 of them classified as high-risk patients, corresponding to 64% of all patients risk assessed (Fig. 4).
Fig 3. Overview of number of children and adolescents in Ørnes kommune and patients examined and risk assessed

Fig 4. Overview of percentage between groups
Part I: Selection and assessment

Selection of patients by CAMBRA

All the 144 patients initially called upon dental examination (baseline), underwent an annual control of dental check-up with x-rays for approximal and occlusal caries diagnostics. Standard hygiene instruction as well as motivational talk was offered to all patients, also application of fluoride varnish if necessary was performed.

An external examination protocol based on CAMBRA with modification was used to risk assess the patients for caries and classification of risk group (Featherstone et al 2007).

The initial CAMBRA protocol was changed to fit the limited access and apparatus of the clinic. In the section of risk factors measurement of Mutans Streptocci or Lacto Bacillus culturing, and also saliva flow were not included. In the protective factors section of the protocol only the use of fluoride toothpaste, application of fluoride varnish and use of fluoride rinse or pastilles were taken into consideration.

Patients were assessed as non-risk or risk patients by the use of the protocol (Appendix 1) where yes in any of the question within the disease indicators section would indicate patient as high risk, and thereby enroll them in the prevention program.

Caries was divided according to WHO classification into: D1, D2, and D3, D4 was not included. The numbers of cavities were stated and all different stages of caries could be representative in one single patient.

The patients were then called with three months interval for control of hygiene, motivational talk and application of fluoride varnish on initial cavities. Manifest cavities were restored in conventional matter by removal of bacteria and restoration.
CARIES RISK ASSESSMENT FORM

Patients Name: ____________________ Age: ______ Gender: ____________________
Recall Patient (Circle) New Patient (Circle)

<table>
<thead>
<tr>
<th>Disease Indicators (If any yes indicates &quot;High Risk&quot;)</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible cavities or radiographic penetration of the dentin</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White spots on smooth surfaces</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restorations last 3 years</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cavities on Xrays (number of lesions)</td>
<td>D1:</td>
<td>D2:</td>
<td>D3:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible Plaque</td>
<td>YES</td>
</tr>
<tr>
<td>Deep pits and fissures</td>
<td>YES</td>
</tr>
<tr>
<td>Medications</td>
<td>YES</td>
</tr>
<tr>
<td>Mouth dry due to medications</td>
<td>YES</td>
</tr>
<tr>
<td>Exposed roots</td>
<td>YES</td>
</tr>
<tr>
<td>Orthodontic Appliances</td>
<td>YES</td>
</tr>
<tr>
<td>Frequent snack (number of times)</td>
<td>=</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protective Factors</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoride toothpaste at least once daily</td>
<td>Yes</td>
</tr>
<tr>
<td>Fluoride toothpaste at least 2x daily</td>
<td>Yes</td>
</tr>
<tr>
<td>Fluoride Varnish</td>
<td>Yes</td>
</tr>
<tr>
<td>Fluoride rinse/pastilles (concentration)</td>
<td>No=0 0.05=1 0.2=2</td>
</tr>
</tbody>
</table>
Observers

Dental hygienist performed dental examinations, including the fill in of the risk assessment forms. Dentists carried out the treatments. The evaluation of the risk assessment and classification of patients into low or high-risk groups was done by one dentist.

Consent

During the dental examination patients were informed about the prevention program initiated towards improvement of oral health with inhabitation of caries. Parents were asked if the examiner could register some of the parameters from the examination and if consent were given to ask a few question related to their child’s dental health.

Children without accompanied adult were informed in the same way and asked for permission to complete needed parameters of the protocol.

The study is approved as an epidemiological quality project for oral health monitoring by the Dental Manager in Nordland County Mid, Norway.

Appointments procedure

Patients were called in for dental examination and their three months hygiene control by mail with name and profession of the clinician stated on the appointment card.

Up to three cards were send out for those who did not attend to their yearly examination, and twice for the control check-ups.
Part II: Follow-up and Collection of data

Hygiene Protocol

All patients assessed as risk patients were called in with three months intervals. There was a total of three appointments: the dental examination appointment = baseline, and two follow-up appointments three months after baseline and six months after baseline.

At the hygiene control additional appendix (Appendix 2) in regard to the control were filled in to register changes in plaque, gingivitis, and improvement in toothbrush habits. Professional cleaning was performed on patients with insufficient cleaning and application of fluoride varnish on initial cavities.

One observer performed the following two hygiene controls with 3 months apart.

FOLLOW-UP FORM ON CARIES RISK PATIENTS AT 3 MONTHS INTERVAL

<table>
<thead>
<tr>
<th>Please circle</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible Plaque</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Gingivitis</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Bleeding on Probing</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Fluoride toothpaste</td>
<td>YeS</td>
<td></td>
</tr>
<tr>
<td>Dental hygiene Instructions</td>
<td>YeS</td>
<td></td>
</tr>
<tr>
<td>Professional teeth cleaning</td>
<td>YeS</td>
<td></td>
</tr>
<tr>
<td>Orthodontic Appliances</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Fluoride rinse/pastilles</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>MIH</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
Collection of data

All data that could be collected from both appendixes in regards to how thoroughly they were filled out by the observers was transferred into a Microsoft Excel working sheet.

Statistical analysis

The data analyzed were numerically compiled and presented as charts and graphs were extracted using Microsoft Excel working sheets.
Results

Distribution between groups and gender

The patient group (Table 1) chosen to participate in the project was chosen by age and was divided into two subgroups according to their dental age: Early dentition group (7-9) and Late dentition group (11-13). Special interest was taken into plaque accumulation on teeth surfaces in the mixed dentition. Patients selected for the program were not chosen by gender, only by age and their dental age. Later on gender was taken into consideration with interest to see if difference could be seen between gender and high-risk patients. At the time of examination the distribution between the two genders were 12% higher with male participants. The representatives were lowest in the age 7 group by only 14 participants, and highest in the age 8 and 12 years group (Table 1).

Of the 92 patients categorized as high-risk patients, female and male participants (Table 2) were almost equally represented. A descriptive illustration is given in Fig.5.

Table 1. Examined patients at baseline by age and gender

<table>
<thead>
<tr>
<th>Age</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>76</td>
<td>7</td>
<td>16</td>
<td>15</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Girls</td>
<td>67</td>
<td>7</td>
<td>16</td>
<td>8</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>14</td>
<td>32</td>
<td>23</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>
Table 2. High-Risk patients by age and gender

<table>
<thead>
<tr>
<th>Age</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>47</td>
<td>2</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Girls</td>
<td>45</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>4</td>
<td>16</td>
<td>14</td>
<td>8</td>
<td>24</td>
</tr>
</tbody>
</table>

![Age and gender distribution](chart.png)

Figure 5. The chart demonstrates amount of patients by gender at time of examination (N=143) and after risk assessment (N=92) both by age and gender

Caries Prevalance

Among the patients initially examined (N=143) an equal distribution in all three stages of caries, D1-D3 could be seen, being approximately as high as 60% for each stage (Fig. 6). The same individual could have all three forms of caries spread in the dentition.
Risk factors versus caries

From an investigation it showed that the most common cause for manifest of a cariogen cavity (D3) was due to lack of tooth brushing with fluoride toothpaste twice per day. Patients brushing twice with fluoride toothpaste were less exposed to manifest caries (D3). Also frequent snacking showed correlation to high rate of dental caries, both initial and manifest, as well as correlation could be seen between medication and caries (Fig. 6)

Results showed that patients on medication, for example ADHD medication, showed higher rate of D3 caries. Patients stating mouth dry due to medication showed equal amount D1/D2/D3 caries. Patients using complementary fluoride had less manifest of D3 (Fig. 7).
**Figure 7.** Overview of risk factors versus protective factors correlation with initial (D1/D2) and manifest dental caries (D3) among high-risk patients.

**Implementation and Follow-up**

Of the total amount of patients (N=143) 68 were in the group 7-9 years (early dentition group, EDG) and 75 in the 11-13 years (late dentition group, LDG).

Of the 92 patients assessed as high-risk patients, 34 were represented in the EDG and 58 in the LDG. At the 3 months follow-up session a total number of 76 patients attended their appointment, 31 from the EDG and 45 from the LDG. Similar results were attained in the 6 months follow up with 72 attending their appointment, 24 in the EDG and 48 in the LDG. The demonstration can be seen in Fig. 8a, 8b and 8c with the number of high-risk patients
attendance at baseline, 3 months and 6 months follow-up among the two age groups participating in the program. Last column represents the same individuals attendance on all sessions.

Patients attending all their appointment, from initial examination to their 3 and 6 months follow-up reached at total of 62 patients, 23 in EDG and 39 in the LDG.

The results show a total of 67,3% attendance among patients throughout the whole prevention program, even higher at each of the separate follow-up sessions, 82,6% at 3 months respectively 78,2% at 6 months (Fig 8d).

Figure 8a. A general overview of patients’ attendance frequency at each follow-up occasion separately and as whole throughout the prevention period.
Figure 8b. Patients’ attendance frequency in the 7-9 year old group at each follow-up occasion separately and as whole throughout the prevention period.

Figure 8c. Patients’ attendance frequency in the 11-13 year old group at each follow-up occasion separately and as whole throughout the prevention period.
**Figure 8d.** High-risk patients’ (n=92) attendance frequency at each follow-up occasion separately and as whole throughout the prevention period given in percentage.
Discussion

The purpose of the study was to see the potential of implementing a caries preventive program including follow-ups among children in northern Norway.

The program showed to be successful in patients with need of prevention due to their high-risk caries status. There was a high attendance level at each follow-up session demonstrating that patients informed and knowledge about their caries situation understand the importance of good dental health, and are motivated to improve. Through motivational talks and feedback patients get an insight of the improvements or lack of improvements and can be further guided. The significance of this study is of great value for areas in shortage of dentists. The shortage might be partially solved by employing dental hygienists and dental nurses to help to keep the severity of the caries progress down. When the protocols are established the dental hygienist and nurses can provide reinforcement and continue with the assessment of the process and report its progress to patients (Gutkowski et al. 2007).

As stated before due to CAMBRA’s simplicity, clear definition of disease factors, easy to teach to a dental staff. In the same way it is easy to modify it to match the resources of the dental clinic. All in all it was found to be a useful guideline for the prevention program initiated.

Selection

The motivation behind this selection was due to their early and late mixed dentition where thorough oral hygiene is important to remove plaque as well as provide the new permanent teeth with adequate fluoride exposure from the toothpaste being used.

Most caries prevention studies are clinical or community trails with child populations selected by age or school age, and are conducted on particular study populations because they reflect on
one or more high risk caries indicators, such as low socioeconomic status, but seldom based on individual caries risk indicators with individual participant selection (Bader et al. 2001). In this study individual risk has been considered with prevention follow-up as treatment help, while most preventive protocols have been tested in general populations with few investigations limiting their samples to individuals with elevated caries experience or with known risk for caries as well as little focus has been put in previous studies on primary teeth (JD Bader et al.)

When appointment cards were send out for the follow-up examinations the name of the examiner was displayed. In cases where hygienist where the examiners a greater loss was discovered. Most patients attended their appointment when the examiner was a dentist. In cases of non-attendance patients was recalled to dentist and in most occasions they would attend on the second trial. Unfortunately this can indicate that patients don’t take their appointments serious enough when the attendance involves meeting up with a hygienist. This is unfortunate since hygienist appointment involves milder treatments, such as dental cleaning or check-up, while dentist appointments can involve treatment that can be painful and more invasive.

**Registration**

On the case of validity regarding the registration on finds it is difficult to determine if the procedure was executed similar for all patients based on the fact of multiple examiners performing the registration at the examination time.

The two hygienist performed the majority of registrations of the protocols at the dental examination with patient screening as their main task. A dentist mainly performed the follow-up sessions after discovering lack of attendance by patients based on the title of examiner on their attendance card. This was a change of tactic to improve the follow-up statistic when
discovers the error of loss in attendance. At that point of time the primary focus were on patients and their need of preventive treatment. The results that are presented in this study might not have been as positive if no tactical changes were done upon the follow-up sessions, and should be taken into consideration.

To increase the effect and validity of the study registration, calibration for repeatability is recommended among the dental team performing the investigation. Examiner reliability and subjective assessment of internal validity is a frequent problem in terms of analytical design (JD Bader et al.) The aim of the study was to effectively use dental staff and their knowledge in rural areas where lack of dentist. Hygienist and nurses can be useful on prevention care to reduce or slow down the rate of caries among children. In order to provide equal treatment care to individuals under risk assessment solid calibration validity needs to be synchronized among clinicians. This was unfortunately a shortcoming in this study and is something that needs to be discussed among dental staff and taught out.

**Registration results**

The effect of a prevention program lies in the arrest of dental caries or development of new cavities. If caries arrested and new cavities were not developed it would help patients into a healthier dental circle and less time needed for surgical restorations for dentist.

The majority of prevention program where the use of fluoride is included in any shape has shown caries reduction between 30-70 percent, with higher fluoride concentration the better. Also application of fluoride varnish minimum twice per year on permanent teeth has shown preventive effect upon caries with simultaneous use of fluoride toothpaste (SBU rapport “Att förebygga karies”). From the results it was shown that patients tooth brushing once per day
with fluoride toothpaste had more manifest caries than patients brushing twice per day. This indicates promoting tooth brushing twice per day as well as applying fluoride varnish on initial caries prevention program would be effective in arrest of further disease development. The effect of fluoride toothpaste has shown to be of effect in previous prevention programs (Selwitz et al.2007).

**Future studies and improvements**

A prevention program has equal importance and effect, if not more, in rural areas where lack of dentist is inevitability. The high level of caries among children and adolescents has to be addressed and the only way to step away from surgical approach is to put focus on methods to arrest caries, through prevention and behavioral changes.

By educating dental staff such as hygienist and nurses in calibration and preventive care patients submitted to high risk can receive individual care assessed from their personal need.

For future studies, its recommended to choose a preventive model and assessment that is easy applicable in regards to the area of the dental clinics existence and equipment, as done in this study. However, preventive care needs dental awareness among parents and teaching them how to brush and supervise their children while brushing (Al-Jundi et al 2006). This parental education can parallel with the care being put in at the clinics, which was in this project performed with the help of the health counselor pushing on a dental awareness campaign in the municipality by increasing awareness in parents and their children’s oral health. Dental staff visiting kindergartens informing staff and invited parents about causes, risk and how to prevent dental caries was one step and preventive care at the clinics the second. Preventive care needs to start at an early age; the more knowledge parents have about caries as a disease and the
reasons for its development the better they can motivate themselves and their children for their well-being and good oral health.

The main causality for the high prevalence of caries among children and the adolescents in the area, including patients within the prevention program, were due to the poor oral hygiene among patients as well as poor food habits. An assessment of the outcome effect on caries arrest through initiation of the prevention program could not be evaluated as the program only lasted for 6 months, with too short time elapsing to follow-up with radiographs.

In conclusion the hypothesis in this study is accepted. That implementation of a preventive program can be successful including follow-up. For future improvements it is recommended for dental staff to be calibrated in their role to perform adequate risk assessment. The prevention program should be applicable to the clinics resources and easy in its handling for all parties involved. Clear goals need to be set up for patients to follow as well for dental team to work towards. Patients should be illustrated about their current dental status, with overview of their caries situation. Knowledge about the etiology of caries along with dietary advice should also be offered to patients helping them fulfill their goals. Parents also need to be involved emphasizing their cooperation in order to help their children to maintain a healthy oral and general health. Patients need to be evaluated at each follow-up session, where improvement leads to longer time elapsing till next upcoming session. If all above mentioned aspects are put in action the outcome of a prevention program could be successful not only in its implementation but also in arresting caries with allowing sufficient time for the program to give result.
Acknowledgements

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Appendix 1

CARIES RISK ASSESSMENT FORM

<table>
<thead>
<tr>
<th>Patients Name:</th>
<th>Age:</th>
<th>Gender:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall Patient (Circle)</td>
<td>New Patient (Circle)</td>
<td></td>
</tr>
</tbody>
</table>

**Disease Indicators (If yes indicates "High Risk")**
- Visible cavities or radiographic penetration of the dentin
- White spots on smooth surfaces
- Restorations last 3 years
- Cavities on X-rays (number of lesions)

**Risk Factors**
- Visible Plaque
- Deep pits and fissures
- Medications
- Mouth dry due to medications
- Exposed roots
- Orthodontic Appliances
- Frequent snack (number of times)

**Protective Factors**
- Fluoride toothpaste at least once daily
- Fluoride toothpaste at least 2x daily
- Fluoride Varnish
- Fluoride rinse/pastilles (concentration)

**Appendix 2**

FOLLOW-UP FORM ON CARIES RISK PATIENTS AT 3 MONTHS INTERVAL

<table>
<thead>
<tr>
<th>Patients name:</th>
<th>Age:</th>
<th>Gender:</th>
</tr>
</thead>
</table>

**Please circle**
- Visible Plaque
- Gingivitis
- Bleeding on Probing
- Fluoride toothpaste
- Dental hygiene Instructions
- Professional teeth cleaning
- Orthodontic Appliances
- Fluoride rinse/pastilles
- MIH