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– a health technology assessment

Summary

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Summary

In recent years, there has been an observed fall in the incidence of dental caries in permanent teeth. This has not been the case in children's primary teeth, where the incidence of caries has remained at a relatively stable level. Because dental caries can result in unpleasant treatment for children, as well as create risk for prolonged dental anxiety, an attempt has been made to establish a procedure which diagnoses caries earlier and better, and treats the diagnosed caries preventatively, so that the primary teeth remain symptom free and functioning until their natural exfoliation. Caries in the primary teeth are frequently proximal caries, which are found on the smooth surfaces between the teeth. These caries can be difficult to diagnose without a valid diagnostic procedure, but the earlier the process of decay is detected and stopped, the simpler the treatment. An existing health technology assessment deals with a treatment method for containment of proximal caries in children's primary teeth.

The treatment procedure involves the implementation of X-ray scanning of close set molars in the primary teeth for children aged five to six, as well as a subsequent chemical-mechanical treatment, consisting of professional cleaning with dental floss, combined with chlorhexidine, every third month against the initial caries formation. Previous practice has been that the X-ray scanning is only utilized to give indication of the supposed development of caries, meaning that initial decay is most likely under diagnosed and is not treated to a sufficient extent. Initial decay is normally treated with dental sealants.

This health technology assessment's aim is to assess: 1) to what degree proximal caries in primary teeth are under diagnosed with current diagnostic methods; 2) whether it is possible to achieve a reduction in the development of caries with new treatment that involves early diagnosis and chemical-mechanical treatment; 3) to what extent the previous diagnostics and treatment cause a change in the use of resources; 4) whether benefits in dental health can bear comparison with the use of resources by implementing treatment; as well as 5) which organizational conditions must be present in order to implement the new treatment.

As a part of the health technology assessment a three year prospective partially blind, quasi-experimental pre-test/post-test investigation with intervention group and control group was completed. Some of the clinics from The Municipal Dental Service in Odense offered the new treatment, while other clinics operated with the customary practice. Students from seven different schools participated in the investigation; three schools made up the intervention group while four schools constituted the control group. The schools were selected based on their representativity with regards to prevalence of caries within the Odense average. The study consisted of two parts: a partial study of the improved diagnostics with X-ray scanning and a partial study of the gains in dental health from combining X-ray scanning and chemical-mechanical treatment. 224 children from the original intervention group were involved in the first study of the improved diagnostics. This was followed by the involvement of 182 children from the interventions group and 154 children from the control group in the subsequent prospective study of benefits in dental health. The children's dental health was measured on a baseline period from January 2000 up to and including June 2001 and once again in the follow-up period from January 2003 up to and including December 2003. All of the children were thus involved in the study for at least 1.5 year and some for longer. Start and finish time was calculated in relation to the individual children's participation in the study (exposure time), so that the progression of caries could be

adjusted for this fact, since children in the intervention group on average were involved in the study for a longer period of time.

Technology and Patient

The results of the diagnostic investigation indicated that a significantly higher number of incidences of dental decay were found in the bitewing examinations than in the normal clinical examinations. In particular, the difference between the initial dental decay was large, but the bitewings also revealed clinical misdiagnoses of the manifest dental decay. With examination, 75 % of proximal caries found by radiographic investigation were not found clinically. Among the clinically caries-free children, 42 % were found by radiographic investigation to have proximal caries, of which 11 % had caries in the dentine. The average diagnostic benefit for bitewing scanning for six year olds was overall calculated to 1.9 surfaces per child. Comparison with earlier studies indicated that there was agreement between the results in existing studies and previous studies. The need to supplement clinical examinations with bitewing scanning corresponds therefore to the need that is expressed in corresponding studies.

The desire to find a diagnostic method that is better than a clinical examination at detecting dental decay early was fulfilled in this study. Ethical considerations of the risks of radiation damage by X-ray scanning must be related to the advantages of radiographic diagnosis. The results of the study speak clearly in favour of extending indication for bitewing examinations, since they are assessed to surpass the small risk associated with exposure to intraoral radiographic recording.

For the study of benefits in dental health by treatment procedure, the relevant measurement was development of teeth's disease condition defs (decayed, extracted, and filled surfaces), which expresses the total number of surfaces per child that has initial caries, manifest caries, fillings, root canal treatment, or are extracted. Growth in the average defs-score was used as a collective end-point for the development of dental disease. Clinical diagnostics was used to compare the intervention group and the control group, as bitewing scanning of all surfaces was only carried out in the intervention group, which meant that clinical diagnostics gave the most comparable measure for the two groups.

The results showed that there was no difference in the growth of defs from the baseline to the follow-up in the two groups, as the growth was estimated to an average of 1.43 for the intervention group and 1.44 for the control group. It was however not taken into account in the calculations that the measurements took places at different times. A regression analysis, which adjusted for differences in exposure time, indicated that the growth in defs in the intervention group was about 22 % less than in the control group. This growth is statistically significant.

Analyses of the separate proximal surfaces indicated that there were relatively more initial and manifest cases of dental decay in the finish time measurement in the control group than in the intervention group. This is connected with the fact that dental decay is diagnosed and treated earlier in the intervention group, where clinical examination is supplemented with bitewing radiographs. There was relatively more secondary dental decay and the highest number of fillings in the follow-up measurements in the intervention group. Proximal secondary caries are best detected with the bitewing radiographs, which can provide part of the explanation. The higher number of fillings can

be a cause of more instances of dental decay being diagnosed from the bitewing radiographs in the intervention group than in the control group.

Furthermore, a difference was observed in the relative increase of unpleasant treatments (root canal and extraction) in the two groups. The relative increase for root canal was largest in the intervention group and the relative increase for extraction was largest in the control group. An important element of the intervention was specifically to avoid unpleasant treatments for children, so that they, the first time around, would be protected from bad experiences and in the long run would have a decreased tendency to develop dental anxiety. The study unfortunately also revealed that, in the intervention group, it was not possible to catch many cases of dental decay until they were so large that the teeth needed root canal treatment. Collectively, fewer children in the intervention group than in the control group were encumbered with major treatments that would cause dental anxiety. It can also be noted, through other experiences from the study, that children were easy to treat and did not bemoan the chlorhexidine's bad taste or the necessary surgical treatment. Furthermore, the attitude amongst the parents was positive; they displayed an interest in intervention and supported careful dental care in the home. A part of this cooperation could possibly be attributed to the research institution.

Organization and Economics

The intervention will require individual organizational changes in the makeup of personnel and working procedures. These changes are in line with the National Board of Health's recommendations for the municipal dental care structure and organization. Surgical cavity treatment can be performed by dentists, while preventative cavity treatment can be performed by dental assistants and dental hygienists, according to a treatment plan established by dentists and dental hygienists. With early diagnosis of dental decay, the recommended treatment will increasingly be preventative rather than surgical, and a larger portion of dental care will thereby be handled by dental hygienists and dental assistants.

Data regarding the use of resources was gathered simultaneous with the gathering of clinical data for the study. The economical aspects were presented afterwards, with estimates of The Municipal Dental Service in Odense's costs for the intervention group and control group, together with a cost-effectiveness analysis, where the health benefits were placed in relation to the costs for the intervention.

The results of the analysis indicated that there were higher costs connected to the treatment trial consisting of early diagnostics with bitewing radiographs and chemical-mechanical treatment of initial caries than with the previous practice of bitewing radiographs and medicament treatment of indication from clinical consideration. The average costs per child were estimated at DKK 1,397 and DKK 792 for the intervention group and the control group, respectively. This corresponds to the intervention causing an increase of costs of 80 % in relation to the previous practice. In a regression model, where adjustments were made for the different exposure times in the study, it appeared that even with control for time in the study, intervention costs were more than 50 % higher than expenditures in the control group. This is primarily due to the extra use of resources in the form of personnel, which was used in the treatment trial, because there must be systematic taking of the bitewings and performance of the chemical-mechanical treatment. Among these, a part of the explanation is also that the early diagnostic has given rise to more children being treated, which in turn has given rise to an increased use of resources for dental care.

Two cost-effectiveness ratios were estimated in the economic analysis: one ratio for costs per averted defs and one ratio for costs per averted unpleasant treatment (root canal treatment or extraction). Both ratios were estimated at approximately DKK 1,000, which is to say that it costs approximately DKK 1,000 to avert one defs or one unpleasant treatment.

Conclusion

Despite the diagnostic benefit of early and improved diagnostics, together with the benefits in dental health of the subsequent chemical-mechanical treatment, immediate implementation of the collective intervention, in the form which was used in the study, can not be recommended. The intervention is assessed to be resource demanding in relation to the benefits in dental health. The obvious largest cost item is the increased spending on personnel.

If there is particular importance attached to the desire to protect children from damaging treatments, which in the first round protects children but in the long run reduces the risk of dental anxiety, the intervention can potentially be implemented in a modified form, so that the benefits are retained, but where the use of resources is reduced substantially. Costs can be reduced by, for example, caries free six year olds first having bitewing radiographs taken again when they are eight or nine, and by those who have most dental decay being treated chemically-mechanically, concurrently with another treatment. Furthermore, the design of calling in can be made more efficient by calling in groups, and time consumption by the prophylactic treatment ought to be reduced in relation to the procedure that is used in the report. Moreover, all prophylactic treatment could be performed by dental assistants, which reduces the use of dentist and dental hygienists.

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