First tooth, first visit, zero cavities: a review of the evidence as it applies to Ireland

Précis
Appropriate preventive dental advice and care should commence early in life. In this narrative review, an infant oral health visit is recommended and the reasons for this advice are discussed.

Abstract
Statement of the problem: There is increasing evidence that the first oral health visit should occur before 12 months of age. Anecdotally, most children in Ireland are not seen at an optimal age.
Purpose of the study: To review the benefits, on both an individual and population basis, of children receiving oral healthcare before 12 months of age, and to apply the appropriate available evidence to the current oral health landscape in Ireland.
Results: From an individual perspective, there is published evidence of the benefits of infants attending a dentist before the age of 12 months. These benefits include the opportunity to risk assess the child, provide tailored oral health education and institute preventive care. From an oral health promotion perspective, there are additional benefits of providing population level programmes for children at an early age.
Conclusions: Introduction of the first dental visit by 12 months of age should be firmly on the health agenda here in Ireland.

Introduction
In recent years several studies have demonstrated that dental caries is already well established by the time a child reaches three years of age. In Scotland, for example, three-year-old children had a caries prevalence of 25%, with a higher rate of 32% in children living in deprived areas, when examined in 2007/2008. In England in 2013, 12% of three-year-old children had experienced dental decay and those children with dental disease had approximately three teeth that were decayed, missing or filled. Gussy et al. recently followed 467 Australian mother/child pairs at one, six, 12, 18 and 36 months of age and demonstrated that the prevalence of caries increased from 8% of children at 18 months of age to 23% of children at 36 months of age. Gussy’s paper highlighted that the optimal time period for screening and prevention of oral disease should be early, ideally before 12 months. Most children in Ireland (anecdotally) visit their dentist at a much later age. Within Ireland, the Health Service Executive (HSE) has a statutory requirement to provide dental services free of charge both to preschool children and school children attending State primary schools referred from child health service and school health service examinations. The salaried HSE public dental service...
It is possible that children who attend national school and do not present with a dental emergency do not receive dental care until they are screened by the HSE at six to eight years of age, with the possibility of even later attendance for some. In some areas, it is possible that this screening is delayed due to resourcing issues.

In the UK, dental caries has been reported as the most common reason for children between five and nine years of age to be admitted to hospital for treatment under general anaesthesia (GA), equating to 31% of all GAs administered to children in that age group.7 This dental treatment under GA is concerning due to the GA-associated morbidity and risk of mortality. The financial burden is considerable: in England it has an estimated cost of £30 million (2012).8,9

There may be some underestimation in the numbers of children reported to have had dental treatment provided under GA in the UK.10 Within Ireland, the lack of reliable data is also apparent with recent national discussions having highlighted this uncertainty.11 Within the Irish Healthcare Pricing Office’s report for the year ended December 2014, it is noted there were 8,406 procedures carried out in acute hospitals for dental-related morbidity for children under 15 years, with 4,320 patient discharges relating to dental care in under 15s.13 It is likely that the majority of these patients’ discharges were related to GA. There is, however, some debate about the number of GAs undertaken for children for dental care, which has been reported in October 2015 by the HSE as being 3,600 per year in Ireland.12

It is certain that dental caries is problematic. Not only does the disease significantly impact on child well-being, but societally it is an expensive and time-consuming problem to treat, both for the State, and for parents of children who elect to be seen privately. Internationally, early childhood caries (ECC), defined as the presence of decay in one or more primary teeth in a child younger than six years of age, is reported to affect 28-82% of children.15 ECC is also a strong predictor of caries in future life.16 From a public health perspective it is important, therefore, to do as much as possible to reduce the occurrence of ECC. Primary prevention (before dental decay develops) is key.

This paper reviews the recent evidence for the benefits of infants aged 12 months or less of attending a dentist. It reviews the types of oral health interventions that can be delivered either on an individual basis or in a population programme to the infant, and applies that evidence to addressing the issues in the context of the Irish health system.

## Methods

A review was undertaken of all papers which addressed the following question: what are the benefits to infants aged 12 months or less of attending a dentist, specifically: pathology/soft tissue, early dental prevention; caries prevention; fluoride varnish; tooth brushing; nutrition; education of parents/behavioural change of parents; and, health visitor referral (Ireland: public health nurse visits after birth and at six weeks)?

For the purpose of this review only randomised controlled trials (RCTs) and systematic reviews published in the English language within the last 10 years were searched, using the databases Web of Science, Embase, CINAHL and PubMed. The review was not intended to be systematic, but was undertaken to find relevant evidence to answer the question, and produce a narrative review on the topic of interest. This was not a systematic review; therefore, tools were not used to assess quality and bias. Two individual authors (B.D. and K.F.) assessed each paper for its relevance to the research question and to the Irish landscape. Both individual interventions and population approaches were considered.

### Results from the review

From an individual perspective there is significant evidence of the benefits of infants attending a dentist before the age of 12 months. The interventions that can influence the oral health of a child can be seen in Table 1, and each is discussed in more detail below. The interventions are then discussed in the Irish context and with reference to cost-effectiveness.

### Performing a risk assessment

To prevent caries in children, high-risk individuals should be identified at an early age before problems occur. Babu and Doddamani state that risk factors should be assessed in mothers during prenatal care and strategies should be adopted, including anticipatory guidance, behaviour modifications (oral hygiene and feeding practices) and establishment of a dental home by one year of age for children deemed at risk.17 Seeing children at an early age enables a clinician to carry out a formal caries risk assessment that analyses both risk factors/indicators and protective factors, and then to design an appropriate intervention tailored to a child’s individualised risk. An example of a caries risk assessment tool is given in the UCC guidance.18

The strategy of risk assessment for caries is used within the Scottish Childsmile programme – a targeted preventive programme that has been successful in reducing the prevalence of caries in children in Scotland.19 Children who are considered to be at high risk within Scotland are given appropriate support by a dedicated team of dental health support workers, including support for behavioural modification (oral hygiene and feeding practices).19

In addition to the risk factors/indicators and protective factors as described in the UCC guidance,19 there are additional risk factors identified in the literature, which contribute to the development of dental caries in children. There have been a number of reviews demonstrating both the evidence of a vertical transmission of Streptococcus mutans from mother to child, and the increased risk this can cause to a child’s oral health.20-22 Hooley demonstrated high caries rates within single-parent families, large family sizes, low education, minority ethnicity, immigrants, and poor living conditions.23 The Scottish Intercollegiate Guidelines Network (SIGN) 138 document lists dietary habits, oral hygiene, microbiological risk factors, socio-demographic markers and previous caries experience as risk factors for dental caries in children.24

| Table 1: Summary of interventions that can influence the oral health of a child. |

<table>
<thead>
<tr>
<th><strong>Perform risk assessment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provide oral health education using a motivational interviewing approach</strong></td>
</tr>
<tr>
<td><strong>Prevention:</strong> fluoridated water; fluoride gels; varnishes; and, mouthwashes</td>
</tr>
<tr>
<td><strong>Oral health promotion</strong></td>
</tr>
<tr>
<td><strong>Others with possible benefit:</strong> CPP; and, xylitol</td>
</tr>
</tbody>
</table>

---

1. The resources, priorities and service interventions vary considerably within and between regions. The HSE also operates a school dental programme where nationally, school children and children with special needs are screened in selected classes. The majority of these patients’ discharges were related to GA. There is, however, some debate about the number of GAs undertaken for children for dental care, which has been reported in October 2015 by the HSE as being 3,600 per year in Ireland.12
2. Babu and Doddamani state that risk factors should be assessed in mothers during prenatal care and strategies should be adopted, including anticipatory guidance, behaviour modifications (oral hygiene and feeding practices) and establishment of a dental home by one year of age for children deemed at risk.17
3. Babu and Doddamani state that risk factors should be assessed in mothers during prenatal care and strategies should be adopted, including anticipatory guidance, behaviour modifications (oral hygiene and feeding practices) and establishment of a dental home by one year of age for children deemed at risk.17
4. Hooley demonstrated high caries rates within single-parent families, large family sizes, low education, minority ethnicity, immigrants, and poor living conditions.23
5. The Scottish Intercollegiate Guidelines Network (SIGN) 138 document lists dietary habits, oral hygiene, microbiological risk factors, socio-demographic markers and previous caries experience as risk factors for dental caries in children.24

---
systematic review of parent-related factors on dental caries in the permanent dentition of six- to 12-year-old children, children with highly-educated, professional and high-income parents were at lower risk. The relationship between higher caries rate and deprivation is well documented and apparent in recent epidemiological surveys. Leong et al. outlined a number of risk factors that can increase a child’s risk of dental caries.

Oral health education
An oral health education programme should include a common risk approach and advice on common risks in oral and general health, including advice on diet, adequate intake of fresh fruit and vegetables, reduced sugar intake, smoking cessation, etc.

Due to the relationship between diet and caries, influencing diet is an important part of any oral health prevention programme. The diet that children are exposed to in their early formative years influences the development of their taste and food preferences, highlighting the need to intervene early. Dental and dental caries are significantly associated with the consumption of foods high in sugar and are more pronounced in those of lower socioeconomic status. Soft drink consumption provides a significant source of added sugar to the diet and contributes around 5% to average total energy intake in men aged 19-24 years. Obesity is one of the primary challenges to public health, so the need for immediate preventive action is warranted. Hooley suggests that the level of health knowledge and skills possessed by parents will influence children’s diet choice, as well as the level of physical activity within their lives, which in turn influences their weight. Dentists can play an important role in supporting healthy feeding practices and improving long-term health in these children.

The type of health education that takes place in dental practices traditionally involves giving oral hygiene and diet advice rather than using the newer motivational interviewing (MI) approach. There are a number of reviews that have investigated the effectiveness of traditional oral health education on reducing caries risk. Kay and Locker looked at the effectiveness of health education. The majority of evidence suggests therefore that a simple oral health improvement programme consisting of education only is unlikely to be effective in reducing oral disease. MI is an approach that is based on psychology and defined by Miller and Rollnick as a technique based on evidence, centred on the individual and individually tailored. MI involves setting goals and providing client-centred counselling in an attempt to elicit behavioural change.

For more information on this please refer to Curtin’s useful paper. Yevlahova (2009) performed a review of 32 studies and demonstrated that MI interventions were the most effective method for altering health behaviours in a clinical setting. Ismail (2011) evaluated the effectiveness of a tailored educational intervention on oral health behaviours and new untreated carious lesions. One group received both MI and a DVD, with booster calls six months after the intervention, while the other group received just the DVD. After six months of follow-up, the parents who received MI and DVD were more likely to have changed oral health behaviour. There was, however, no change in new untreated carious lesions. Six months is also a short time period to assess the development of untreated lesions. In contrast, Harrison performed a cluster randomised pragmatic effectiveness trial testing MI in Canadian indigenous children. When the children were examined at 30 months of age there was a substantial preventive effect for dental decay.

Leong suggests that oral health promotion leaders need to identify, as part of the oral health promotion programme development, why some health behaviour programmes are adopted and others are not. Strategies often do not sufficiently consider the socio-cultural content or behavioural determinants that influence individual behaviour. Factors identified in his review that may add further complexity include the broader social determinants of health such as identified by Marmot. These five key areas (determinants) are also defined by healthy people to include economic stability, education, social and community context, health and healthcare, and neighbourhood and built environment.

Preventive care
The relationship between fluoride and caries reduction was first demonstrated by Dean in 1944. Topical fluoride reduces dental disease by reducing demineralisation and encouraging remineralisation of the tooth surface. Spieth has also demonstrated the considerable cost benefits of using fluoride in reducing the cost of operative dentistry over the life course. Fluoride can be delivered through water fluoridation, toothpaste, gel, varnish and mouthwash. From the studies reviewed it is clear that there is consistent and strong evidence that the use of fluoride can significantly reduce dental caries. The best available evidence suggests that fluoridation of drinking water supplies reduces caries prevalence, both as measured by the proportion of children who are caries free and by the mean decayed, missing or filled teeth (DMFT) score. The fluoridation of Irish water has had significant impact on the reduction of dental caries, with the most recent studies confirming lower caries rates in children living in fluoridated areas compared to children living in non-fluoridated areas. In 2014, €3.9 million was spent on water fluoridation with an estimated cost of €1 per person per year.

In Ireland, fluoride toothpaste is readily available. The Cochrane review on fluoride toothpastes provides considerable evidence as to the effectiveness of toothpaste in caries reduction with a child who brushes with fluoride toothpaste having 23% less caries than a child who does not. The review, however, only found a reduction in caries for fluoride concentrations of 1,000ppm and above. It is, therefore, important that fluoride toothpaste is used appropriately. Widespread use of fluoride toothpaste is considered responsible for much of the significant decline in caries since the 1970s. There are a number of studies that demonstrate the efficacy of school toothbrushing programmes. A study by Jackson et al. (2005) demonstrated an overall caries rate reduction of 10.9% compared to controls and a study by Pine et al. (2007) showed a reduction in the proportion of children with dental decay with a preventive fraction of 0.44 in school-based toothbrushing programmes.

Ellwood demonstrated that access to toothpaste and toothbrushes was also a factor in reducing caries prevalence. When toothpaste containing fluoride at levels of 440ppm or 1,450ppm was posted at three-month intervals to children from the age of one to five years, the children who received the toothpaste had significantly less caries.
Marinho et al. (2015) recently updated their review on the effectiveness of fluoride gels and showed a 28% reduction in dental caries in permanent teeth, with fluoride gel used once a year to several times a year. There was only low-quality evidence to show a reduction in caries of 20% in the primary dentition. A Cochrane review on fluoride varnish demonstrated a reduction in dental caries of 37% in primary teeth and 43% in permanent teeth compared to controls. These studies included children from as young as 12 months of age. The evidence is so strong that HSE guidance recommends fluoride varnish applications for children at high caries risk.

There are other preventive agents that could be used at an infant oral health visit for high-risk children; however, the evidence for their effectiveness is not strong. A recent Cochrane review, for example, could not demonstrate that chlorhexidine varnish or gel reduces tooth decay or reduces the bacteria that encourage tooth decay. There is some early work looking at the efficacy of probiotics at reducing dental disease, but the evidence is conflicting and more research is needed before probiotics could be considered as clinically relevant. Similarly, casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) is also used as a caries-preventive agent, but a recent review by Raphael and Blinkhorn could not find evidence of its efficacy.

There have been a number of clinical studies looking at the effect of xylitol on dental caries. These can be grouped into direct effects (where the xylitol is consumed directly by the person, and its effect on their oral health) and maternal consumption studies (the theory is that by consuming xylitol at a specific point in the child’s life, just before the teeth erupt, that mothers can influence the type of bacteria they pass onto their child). Looking at the evidence for a direct effect of xylitol, Riley et al. showed that fluoride toothpaste containing xylitol provided additional benefit, but could not find any conclusive evidence to demonstrate that any other xylitol-containing products could prevent caries. Looking at the maternal consumption of xylitol, Lin recently reviewed the evidence and showed a significant reduction in mutans streptococci (MS) transmission in mothers who consumed xylitol. However, the evidence is of low to moderate quality. A recent paper by Duane reported no statistical difference in MS transmission between children whose mothers consumed xylitol and children whose mothers did not. However, it is possible that this was because the control group consisted of children who were enrolled in the Childsmile programme.

Effective oral health promotion

An effective oral health promotion programme for the younger child according to the Ottawa Charter would build healthy public policy, create supportive environments, strengthen community actions, develop personal skills of individuals and reorient health services. An oral health promotion programme should be embedded across all health areas including child health teams, community programmes, and dental services. Sir Michael Marmot would argue that an oral health promotion programme is not only about education, but would also ensure that every child would have the ability to maximise their capability and have control over their lives.

In England, parents are encouraged to take their child to the dentist when “their first milk teeth appear.” English dental teams are encouraged to follow a preventive programme known as ‘Delivering better oral health’. The American Academy of Pediatric Dentistry gives similar advice, with parents being encouraged to bring their child to a dentist no later than after their first birthday.

In Scotland, an oral health improvement programme, Childsmile, in line with the Marmot Review, has adopted a population/proportionate universalism approach to improve the oral health of its population. The programme works both within community dental services targeting schools and nurseries, and all NHS dental practices. This programme ensures every child has access from six months of age to Childsmile, with different support offered to targeted groups of children along the life course. Within the community all children receive free toothbrushes at various stages before school, with all three and four year olds attending nursery school receiving toothbrushing as part of the nursery programme. In areas of higher risk of dental disease, children receive both fluoride varnish programmes and toothbrushing programmes in the first few years of primary school. As part of Childsmile, all parents are encouraged to register their baby with a dentist as soon as possible after birth, or by the time they are six months of age. Health visitors encourage parents to bring their child to a dentist, and also provide toothbrushes and toothpaste at an early age. In a Childsmile practice the dental team all supports the oral health of a child, with specially trained extended duties dental nurses allowed from the General Dental Council to apply fluoride varnish, and provide oral health resources and oral health education to high-risk children. The government provides additional payments to Childsmile practices, including a payment for fluoride varnish to high-risk children. The Scottish oral health programme has reduced caries prevalence by half since its inception in 2007, enabling children to start to have comparable oral health status with their English peers.

In Ireland, no nationwide early oral health programme has been established, and the guidelines developed in collaboration with the HSE and UCC have not been fully implemented.

Screening

Screening, including dental screening, is an integral part of Government-funded health services in Ireland. The school-based dental screening service in Ireland enables some children to receive dental care for defects identified. It also enables eligible children to gain access to the orthodontic pathway. Within the UK, population screening in school-aged children from six to nine years of age was carried out until 2006. At that time, the UK national screening committee suggested there was no evidence that this was effective and the recommendation was that screening should stop. The US Preventive Services Task Force (USPSTF) believes that the current evidence is insufficient to assess the potential benefits and harms of routine screening examinations for dental caries performed by primary care clinicians in children from birth to five years of age.

Dental home, and the need for a team approach

According to the American Academy of Pediatric Dentistry, the dental home is the “ongoing relationship between the dentist and the patient, inclusive of all aspects of oral healthcare delivered in a comprehensive, continuously accessible, co-ordinated, and family-centred way.” The dental home should be established at no later than 12 months of age and includes referral to dental specialists when appropriate. Using the medical model the dental home concept could be used to improve families’ access to dental care. The Dental Council in Ireland states that: “A dentist is best placed within the dental team to provide leadership, develop a vision of patient care, promote integrity, openness and fairness within the dental team and ensure a holistic approach to the patient’s care.” Internationally, in recent decades there has...
been a growing use of the team approach, which can be advantageous in the delivery of oral healthcare. The General Dental Council in the UK, for example, has mandatory registration of dental nurses, dental technicians, dental therapists, dental hygienists, orthodontic therapists and clinical dental technicians. Within Ireland, it is this team approach that could be very helpful to provide cost-effective dental care for infants. Within the UK, for example, dental nurses with extended approved training can provide fluoride varnish as part of an oral health promotion programme.

In other countries there is an even wider approach to delivering oral health promotion. In Ohio, USA, nurse practitioner teams were utilised to increase dental workforce capacity. The team trained registered dieticians and nursing students to provide oral health assessments and place fluoride varnish, with a resultant expansion of access to oral health and reduced dental caries. Within Scotland, in Childsmile, an important part of the health visitor’s role is to identify children at risk and support their entry into a child oral health pathway.

The team approach is limited within Ireland due to the Dental Act, which restricts the scope of practice more narrowly than its UK equivalent. However, a guidance document “Strategies to prevent caries” has recommended the need for public health nurses, practice nurses, GPs and other primary care workers who have regular contact with young children to have training in the identification of high caries risk preschool children and in completing an oral assessment as part of their child health record. This has yet to be implemented nationally.

Cost-effectiveness

Savage undertook an analysis of the effects of early preventive dental visits on subsequent utilisation and costs of dental services among preschool-aged children. The investigation studied a longitudinal cohort of children in North Carolina, coding their care as either preventive or restorative. The age of the first visit had a significantly positive effect on dental-related expenditures, with the average dental-related costs being less for children who received earlier preventive care. Results need to be interpreted carefully as there are significant biases in their selection. Parents who provide an optimal oral health environment in their homes may also, for example, be more likely to access earlier dental care. Within this study, children from racial minority groups had significantly more difficulty in finding access to dental care as did those in counties with fewer dentists per population. Lee demonstrated the cost-effectiveness of early dental visits (Figure 1).

It was demonstrated that an average total cost of care over five years for a child in US dollars ($) rises from around $250 if a child is seen for prevention before age one, to around $550 if the child is not seen for prevention until aged four to five years.

Anopa recently calculated the costs of the Childsmile nursery toothbrushing programme in Scotland to be £1.8 million per year. The estimated costs of dental treatment in 2001/2002 were £8.8 million per year, which decreased to £4.7 million by 2009/2010. The authors noted that these cost reductions were more than two and a half times the cost of the Childsmile nursery preventive programme implementation.

Discussion

From the papers reviewed there are distinct advantages in seeing children in the dental setting from a very young age. There is a high-quality body of evidence that children should have early oral health visits, not just for economic reasons but for optimal oral and systemic health. This review has demonstrated the evidence for the need to perform a risk assessment, the need for better tailored oral health education (using an MI type approach), with preventive care offered as an integrated oral health promotion plan, either on an individual or population basis.

In Ireland, the advice that is given in a preventive care booklet for babies and young children encourages parents to take their baby to the dentist when their first teeth start to appear. However, in the HSE, such a service is at present limited to children with special healthcare needs.

From an Irish perspective, there would need to be changes made to a number of services to optimise oral healthcare for children. A primary care strategy would need development to allow a higher number of children to access care. For those children who are not accessing care, and this appears to be most preschool children, systems need to be developed to identify children at high risk of caries, with system changes to enable public health nurses, practice nurses, GPs and other primary care workers who have regular contact with young children to have both training in the identification of high caries risk preschool children and in completing an oral assessment as part of their child health record.

In addition to a national system of identifying children at risk of caries, pathways need to be developed and funded so that children can receive high-quality education and prevention to improve their oral health. Publicly-funded, high-quality, evidence-based dental treatments should be available to children for whom preventive care is not entirely successful.

Conclusion

This review presents conclusive evidence that investing early in oral health yields lasting dividends. It is certainly possible, with appropriate early intervention, to maintain the oral health of the one-year-old child. And it is eminently possible to avoid the development of dental caries in the young child and the need for dental treatment under GA or otherwise. Introduction of the first dental visit by 12 months of age should be firmly on the health agenda here in Ireland.

References


Journal of the Irish Dental Association | April/May 2017 : Vol 63 (2) 111