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One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour (Review)

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[Intervention Review]

One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour

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ABSTRACT

Background

The dental care setting is an appropriate place to deliver dietary assessment and advice as part of patient management. However, we do not know whether this is effective in changing dietary behaviour.

Objectives

To assess the effectiveness of one-to-one dietary interventions for all ages carried out in a dental care setting in changing dietary behaviour. The effectiveness of these interventions in the subsequent changing of oral and general health is also assessed.

Search methods

The following electronic databases were searched: the Cochrane Oral Health Group Trials Register (to 24 January 2012), the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2012, Issue 1), MEDLINE via OVID (1950 to 24 January 2012), EMBASE via OVID (1980 to 24 January 2012), CINAHL via EBSCO (1982 to 24 January 2012), PsycINFO via OVID (1967 to 24 January 2012), and Web of Science (1945 to 12 April 2011). We also undertook an electronic search of key conference proceedings (IADR and ORCA between 2000 and 13 July 2011). Reference lists of relevant articles, thesis publications (Dissertations Abstracts Online 1861 to 2011) were searched. The authors of eligible trials were contacted to identify any unpublished work.

Selection criteria

Randomised controlled trials assessing the effectiveness of one-to-one dietary interventions delivered in a dental care setting.

Data collection and analysis

Abstract screening, eligibility screening and data extraction decisions were all carried out independently and in duplicate by two review authors. Consensus between the two opinions was achieved by discussion, or involvement of a third review author.

Main results

Five studies met the criteria for inclusion in the review. Two of these were multi-intervention studies where the dietary intervention was one component of a wider programme of prevention, but where data on dietary behaviour change were reported. One of the single intervention studies was concerned with dental caries prevention. The other two concerned general health outcomes. There were no studies concerned with dietary change aimed at preventing tooth erosion. In four out of the five included studies a significant change in dietary behaviour was found for at least one of the primary outcome variables.

Authors' conclusions

There is some evidence that one-to-one dietary interventions in the dental setting can change behaviour, although the evidence is greater for interventions aiming to change fruit/vegetable and alcohol consumption than for those aiming to change dietary sugar consumption. There is a need for more studies, particularly in the dental practice setting, as well as greater methodological rigour in the design, statistical analysis and reporting of such studies.

PLAIN LANGUAGE SUMMARY

Interventions to change diet in a dental care environment

Unhealthy sugar consumption habits are known to be associated with high rates of dental decay, and fizzy drink consumption habits associated with tooth enamel being dissolved (dental erosion). Members of the dental team routinely assess patients' diets, highlighting areas where this could be improved to reduce disease. This advice might extend to dietary issues affecting general as well as oral health. Although we know that certain dietary habits contribute to disease, whether patients take note of advice given to them and change their diet as a result, is less certain. The aim of this review was to determine whether efforts by dentists and other dental staff members are successful in changing patients' diets. We limited the review to looking at studies where diet advice was given in a dental surgery or similar place, and where the advice was given by one member of staff to an individual patient.

We identified five studies. Two of these were concerned with diet advice given concerning general health (one was about alcohol and one was about fruit and vegetable consumption). In both these studies there was a change to healthier behaviour following the advice.

We also identified three studies which attempted to change sugar consumption habits in order to reduce dental decay. However, in two out of these three studies there were also other types and forms of advice given at the same time, for example about toothbrushing. It was therefore impossible to say whether changes in diet came about because of the diet advice given or because they were subtly influenced by the other messages. For example: advice on toothbrushing might make patients more aware of their oral health resulting in changes to their diet. Most of the studies concerning sugar consumption are of relatively weak quality. The evidence for dietary advice aiming to change sugar consumption is poor. Further studies in this area should be considered.

BACKGROUND

Diet is defined as the selection of food and drink consumed by a person and generally refers to food and drinks consumed regularly or habitually, whereas nutrition is a term used in conjunction with the intake and absorption of nutrients from food and drinks. Although nutrition is recognised as being associated with some oral diseases, notably periodontal diseases (Touger-Decker 2003), these indirect effects are mediated through various systems in the body. Diet on the other hand, has a direct, local effect on oral health, on the integrity of the teeth, and on the pH and composition of saliva and plaque. It plays a major aetiological role in dental caries and enamel erosion. This review is limited to interventions concerned with the direct effects of diet on oral health and is not concerned with indirect effects which are the result of nutritional factors.

Dental caries

Despite marked declines in dental caries in the past 30 years, it remains a major dental public health problem in most countries. Caries risk is also something that is not just confined to childhood,

since adults have been found to have caries incidence rates similar to children (Holst 2000). Sugars, particularly sucrose, are the most important dietary aetiological cause of dental caries. The evidence establishing sugars as an aetiological factor in dental caries is overwhelming. The foundation of this lies in the multiplicity of studies rather than in the power of one (Arens 1999). There is no evidence that sugars naturally incorporated in to the cellular structure of foods (intrinsic sugars) or lactose in milk or milk products (milk sugars) have adverse effects on health (DoH 1991). Foods rich in starch, without the addition of sugars, play a small role in coronal dental caries (Moynihan 2004). Non-milk extrinsic sugars (NMES) are "sugars found in confectionery, soft drinks, table sugar, biscuits, cake, fruit juices, honey and sugars added to recipes" (DoH 1989). The intake of NMES beyond four times a day leads to an increased risk of dental caries (Moynihan 2004). The current dose-response relationship between caries and extrinsic sugars suggests that sugar levels above 60 g per person per day for teenagers and adults increases the rate of caries. For preschool and young children, the intakes should be proportional to those for teenagers: about 30 g per person per day for preschool children (Sheiham 2001). Controlling the intake of sugars is therefore important for caries prevention (Moynihan 2005).

Recent studies on diet and caries have been confounded by the widespread use of fluoride toothpastes, and some have argued that with greater exposure to fluoride, the sugar consumption/caries relationship may be weaker in the modern age than previously, with fluoride raising the threshold of sugar intake at which caries progresses to cavitation (Burt 2001). However, a review by Marthaler 1990 concludes that within modern societies a significant relationship between sugars and caries persists despite the regular widespread use of fluoride toothpaste. He also concludes that sugars "continue to be the main threat for dental health of (1) whole populations in some developed and many developing countries, (2) for the individual in both developed and developing countries and (3) in spite of the progress made in using fluorides and improved oral hygiene". Therefore, a key strategy to further reducing levels of caries in individuals as well as for populations, is by means of reducing the frequency of sugars intakes in the diet.

The use of chewing gum and other xylitol-containing products have also presented another option in caries risk reduction. Chewing sugar-free gum three or more times daily for prolonged periods is thought to reduce caries incidence (Van Loveren 2004). There has also been some recent research on the protective effects of certain foods on the teeth. Recent studies have shown that milk and cheese can reduce the effects of metabolic acids and help restore enamel lost during eating (Ahola 2002; Kashket 2002).

Dental erosion

Dental erosion is defined as the loss of dental hard tissue by a process that does not involve bacteria. Dietary acids are one of the most commonly cited causes of erosion (Moynihan 2004). The UK National Diet and Nutrition Survey (NDNS) of preschool children showed a relationship between the consumption of carbonated soft drinks and erosion, and the NDNS of young people reported the age-related increase in levels of dental erosion was greatest in children with the highest consumption of acidic food and drinks (Walker 2000). The survey also showed that soft drinks were the largest contributing source of acidic food and drink consumption. A trend towards increased soft drink consumption has given cause for concern (Shenkin 2003) and has been associated with increases in the prevalence of dental erosion (Nunn 2003). Changes in beverage consumption have also given rise to concern over wider health impacts. The increase in soft drink consumption has led to a decrease in dairy consumption among children and adolescents in America (Shenkin 2003). Replacement of milk with sugar-containing beverages affects calcium intake and overall diet quality (Marshall 2005). It has been suggested that incorporating a dietary assessment of soft drink consumption into patient management in a dental practice setting is increasingly appropriate.

Lifestyle advice given in the primary care setting

There is a growing emphasis on the role of general medical practitioners in giving lifestyle advice to their patients. The basis for general practice-based health promotion is that since particular lifestyle behaviours increase the risk of disease, interventions which are successful in assisting people to modify their behaviour could result in significant gains in terms of public health, with general practice settings deemed by patients as an appropriate place to receive such advice (Ashenden 1997). In primary care, consultations and assessments are conducted on a one-to-one basis with advice being given which is specific to the patient's circumstances and health profile. The potential public health role of general dental practitioners in providing lifestyle advice for their patients has been recognised, and it has been suggested that dental practitioners and their teams' involvement in brief general health promotion interventions might contribute to Government targets on cancer and circulatory disease (Dyer 2006). As well as smoking cessation advice, dentists are in a position to deliver dietary advice which may give health benefits beyond the prevention of oral disease. The common risk strategy (WHO 2000) recognises that risk factors such as a high sugar intake contributes not only to oral disease but also, and perhaps more significantly, to diseases such as heart disease and diabetes. It is also important that any dietary messages given within the dental setting, for example relating to reduction in sugar consumption, does not give rise to other changes such as an increase in fat intake, which might have a deleterious effect on general health. There is also the potential for the involvement of dental teams in the promotion of dietary change such as increasing fruit and vegetable consumption, which has an impact on general health, but no impact on dental caries and erosion.

Types of lifestyle change interventions

The term 'dietary interventions' used here embraces a range of approaches from the giving of dietary advice through to undertaking dietary behaviour change interventions, and it is important that these distinctions are understood. The approaches taken in delivering lifestyle advice may range from health education (educating patients in order to change their knowledge), health advice (giving health advice as well as supporting lifestyle change) (Hooper 2000), undertaking behavioural interventions (using behavioural strategies, specifying the changes to be made, relapse prevention, identifying barriers to change) (Shaw 2005), and undertaking psychological interventions (using psychological theories to elicit changes) (Renz 2007). In relation to dietary lifestyle changes, there is also the possibility of giving dietary supplements (such as chewing sugar-free gum) to elicit change.

Dietary interventions for reducing sugar and carbonated drinks and increasing fruit and vegetable consumption

A systematic review by Lingstrom 2003 which aimed at evaluating the effect of dietary changes in the prevention of dental caries found a lack of studies showing an effect of information designed to reduce sugar intake/frequency on caries increment after 2-years follow-up. It also suggested that the evidence for the use of sorbitol or xylitol in chewing gum was inconclusive. However, studies were not differentiated into types of dietary interventions, and it may be that some approaches (e.g. a behaviour change intervention) may be more effective than others. The impact of dietary changes on dental caries increment may be attenuated by confounding factors such as oral hygiene when measured across a population. Using a behavioural intervention approach, which is based on a one-to-one targeting of a high risk individual, may be more effective, and closer reflects what may happen when lifestyle advice is given in a primary care setting.

OBJECTIVES

To assess the effectiveness of one-to-one dietary interventions for all ages carried out in a dental care setting in changing dietary behaviour. The effectiveness of these interventions in the subsequent changing of oral and general health is also assessed.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised controlled trials (RCTs) that follow individuals for a minimum of 1 month were included. The follow-up period of 1 month was used because the primary outcome studied was a change in dietary behaviour. The unit of randomisation could be individual patients, clusters of individuals, or dental practices. The risk of bias of the included studies was assessed by examining sampling techniques, randomisation procedures, allocation concealment, statistical analysis and outcome evaluation.

Types of participants

Studies included participants of any age (both child and adult) receiving dietary advice as a one-to-one intervention in a dental practice setting or in dental settings where one-to-one advice is given. A dental setting was defined as a place where dental care was the main, or at least one of the services delivered in that building. Studies based on participants recruited from populations with medical problems with systemic effects were excluded. We made this distinction in order to include disorders such as cleft lip/palate which might be considered a medical problem but where medical care considerations were limited; whereas we excluded studies such as dietary interventions for cancer patients because there were significant wider medical care considerations.

Types of interventions

Studies involving a one-to-one dietary intervention with an aim to prevent dental caries or erosion or to influence general health e.g. using messages such as eat five pieces of fruit or vegetables per day, were included. Interventions included were those where dietary education or advice was given as well as interventions where there is an explicit intention to change behaviour, either by adapting habitual behaviour, removing existing behaviour or introducing new behaviours. Interventions included brief advice, skills training, provision of self help materials, counselling, lifestyle strategies, or any combination of these. Studies comparing the effects of dietary advice versus no dietary advice or dietary advice versus different dietary advice were included. Studies were included if the dietary intervention took place alongside an intervention aiming to change oral hygiene behaviour, although these multi-intervention studies were subject to subgroup analysis. Studies were excluded if they involved the giving of medication or non-dietary supplements (e.g. fluoride), unless the fluoride supplements were given as part of a multiple intervention which included attempts to change dietary behaviour. The interventions included were delivered by a dentist, dental hygienist, dental assistants or staff in any dental setting such as a dental practice, health clinic or dental hospital.

Types of outcome measures

Primary outcomes

The primary outcomes studied were related to dietary behaviour change. The outcome measure assessed related to changes in the frequency, amount or timing of food/drink consumption, and were specific to changes in relation to sugary/low sugar foods, chewing gum, drinks and other types of food. Changes in relation to consumption of non-milk extrinsic sugars (NMES) and intrinsic sugars (fruit) and other sugars, sucrose, glucose, xylitol and other intense sweeteners were recorded. The primary outcomes were based on self reported measures, or other means of recording dietary change such as diaries and methodologies using 24-hour recall.

Secondary outcomes

The secondary outcomes studied included both oral health and general health outcomes and depended on the aim of the intervention. If the intervention aimed for example to reduce frequency and amount of sugar consumption, dental caries outcomes were assessed. If the dietary intervention aimed at for example reducing carbonated drink consumption, tooth wear outcomes were assessed. General health outcomes were assessed where reported.

Dental caries outcomes included: caries experience (mean number of decayed, missing and filled permanent or primary teeth (DMFT/dmft)), caries increment (changes in the mean DMFT/dmft scores), sound teeth/surfaces number, size and severity of white spot lesions, early carious lesions arrested or reversed, and root caries (adults only, any index).

Dental erosion outcomes included: tooth wear indices.

General health outcomes included: measures of adiposity such as Body Mass Index, waist: hip measurements, cholesterol level, blood sugar, lipids, and any other general health outcomes recorded.

Search methods for identification of studies

For the identification of studies included or considered for this review, detailed search strategies were developed for each database searched. These were based on the search strategy developed for MEDLINE (OVID) but revised appropriately for each database. The search strategy used a combination of controlled vocabulary and free text terms and was linked with the Cochrane Highly Sensitive Search Strategy (CHSSS) for identifying randomised trials (RCTs) in MEDLINE: sensitivity maximising version (2009 revision) as referenced in Chapter 6.4.11.1 and detailed in box 6.4.c of the *Cochrane Handbook for Systematic Reviews of Interventions* version 5.1.0 (updated March 2011) (Higgins 2011). Details of the MEDLINE search are provided in Appendix 3. The searches of EMBASE, PsycINFO and CINAHL were linked to the Cochrane Oral Health Group filters for identifying RCTs. Searches of electronic databases were complemented by handsearches of thesis publications and conference proceedings as a means of ensuring all relevant literature was identified. Reference lists contained in articles identified as relevant to the review were also searched.

The following electronic databases were searched:

- The Cochrane Oral Health Group Trials Register (to 24 January 2012) (Appendix 1)
- Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2012, Issue 1) (Appendix 2)
- MEDLINE via OVID (1950 to 24 January 2012) (Appendix 3)
- EMBASE via OVID (1980 to 24 January 2012) (Appendix 4)
- CINAHL via EBSCO (1982 to 24 January 2012) (Appendix 5)
- PsycINFO via OVID (1967 to 24 January 2012) (Appendix 6)
- Web of Science (1945 to 12 April 2011) (Appendix 7)
- Conference proceedings (IADR and ORCA) (2000 to 13 July 2011) (Appendix 8)
- Dissertation Abstracts Online (1861 to 2011) (Appendix 9).

Unpublished literature

Some texts such as dissertations or technical reports may not have been indexed into major databases. A letter was sent to known researchers in the area and authors of each included study published in the last 20 years in order to obtain information regarding unpublished works.

Non-English language articles

There were no limits on language. Non-English papers were translated.

Data collection and analysis

Selection of studies

The titles and abstracts identified in the searches were independently screened by two review authors to select potentially relevant studies. These studies were obtained in full text and assessed by two review authors for suitability for inclusion to the review. Any discrepancies between review authors about the suitability of a study for inclusion was resolved by consulting the Cochrane Oral Health Group. Full data extraction was conducted by two review authors. Any studies which were excluded were reported in a table in the main body of the review with the reason for exclusion stated.

Data extraction and management

A data extraction form was designed and piloted prior to full use. Two review authors independently extracted data from the included studies to be presented in a table for comparison. Any disagreements between the two review authors undertaking data extraction was resolved by discussion and the involvement of a third review author. The study author was contacted where possible to clarify any unclear or inadequate characteristics before a final decision on inclusion was made. Information was extracted on the following review criteria, and forms the basis of data in the 'Characteritics of included studies' table.

- General study information - published/unpublished, author, title, year of publication, journal, year research was conducted, ethics and consent process, country of origin, language, funding source and contact address.
- Study characteristics and descriptive data - sample size, randomised controlled trial (RCT) criteria, sample size, number of participants recruited to each group, number of participants at follow-up, randomisation method, allocation concealment, blinding and study duration.
- Participants characteristics - medical factors (e.g. smoking), severity of disease (at baseline), behaviour at baseline, gender and inclusion criteria. Also, age according to the subgroups children (up to 16 years), young adults (16 to 24 years), adults (25 to 64 years) and the elderly (65 years+).
- Intervention characteristics - psychological model used for the intervention design, alternative intervention group(s) theoretical basis, follow-up period, number of sessions, length of sessions, type of intervention: information given, strategies used, financial and time costs to provider and received, additional treatments given to either group, staff group of the advice giver (dentist, dental nurse, oral health promoter, other), location of dental setting and any adverse events.
- Outcome measure characteristics - what type of measures, the results for each, baseline and follow-up results, outcome measures and reported outcome measures.

Assessment of risk of bias in included studies

For the studies included in this review assessment of risk of bias was conducted by two review authors using the Cochrane risk of bias assessment tool. Six domains were assessed for each included study: sequence generation, allocation concealment, blinding in primary outcome measurement, blinding in secondary outcome measurement, completeness of outcome data and risk of selective outcome reporting.

A description of the domains was tabulated for each included trial, along with a judgement of low, high or unclear risk of bias. For example, criteria for risk of bias judgements regarding allocation concealment are given below as described in the *Cochrane Handbook for Systematic Reviews of Interventions* version 5.1.0 (Higgins 2011).

- Low risk of bias - adequate concealment of the allocation (e.g. sequentially numbered, sealed, opaque envelopes or centralised or pharmacy-controlled randomisation).
- Unclear risk of bias - unclear about whether the allocation was adequately concealed (e.g. where the method of concealment is not described or not described in sufficient detail to allow a definite judgement).
- High risk of bias - inadequate allocation concealment (e.g. open random number lists or quasi-randomisation such as alternate days, date of birth, or case record number).

A summary assessment of the risk of bias for the primary outcome (across domains) across studies was undertaken (Higgins 2011). Within a study, a summary assessment of low risk of bias was given when there was a low risk of bias for all key domains, unclear risk of bias when there was an unclear risk of bias for one or more key domains, and high risk of bias when there was a high risk of bias for one or more key domains.

Data synthesis

The Cochrane Collaboration's statistical guidelines were followed in determining the choice of summary statistic and estimates of overall effect. For dichotomous outcomes, the estimate of effect of an intervention was expressed as risk ratios together with 95% confidence intervals. For continuous outcomes, means and standard deviations were used to summarise the data for each group. Due to high degree of heterogeneity in the included studies relating to: study design, recruitment and sampling methods, participant characteristics, type of intervention and behavioural outcome; it was not possible to conduct a meta-analysis. Consequently, the description of the studies and report of the findings was narrative. Because of the low number of studies identified, it was also not possible to conduct a sensitivity analysis to determine whether conclusions reached would be affected by different inclusion criteria.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

The search strategy identified 5725 references. When duplicates were excluded, and titles and abstracts screened for relevance, 62 studies were identified for paper screening for study eligibility. From these, 57 studies were excluded from this review because they did not meet the criteria for inclusion. Details of the exclusion of these studies are given in the Characteristics of excluded studies table. One ongoing study was identified (Ongoing studies). This

involves a motivational interviewing intervention for overweight 12 to 14 year olds attending general dental practice. There are currently no studies awaiting assessment.

Five studies met the criteria for inclusion in the review (Hoogstraten 1983; Wennerholm 1995; Smith 2003; Bradbury 2006; Hausen 2007). Only three of these were single-intervention studies, and only one was concerned with the prevention of dental caries (Wennerholm 1995); two single intervention studies were concerned with dietary change to enhance general health (Smith 2003; Bradbury 2006). The other two studies identified were multi-intervention studies where the dietary intervention was one component of a wider programme of prevention, but where data on dietary behaviour change were reported (Hoogstraten 1983; Hausen 2007). There were no studies concerned with dietary change aimed at preventing tooth erosion.

All three of the single intervention studies identified took place in dental teaching hospitals. Wennerholm 1995 selected 20 adults on the basis of both harbouring *Streptococcus mutans* and *Streptococcus sobrinus* in saliva, and eating sugar frequently. Fourteen of the participants were students at the Dental Technical School, and six were patients at the Department of Cariology in the University of Götenburg, Sweden. Subjects in the test group (n = 12) were provided with detailed information about the sugar content of various food products, and asked to refrain from sugar-containing foods between meals as well as reducing sugar in main meals. Sugar restriction continued for 6 weeks, after which participants were asked to return to their former high-sugar diet. For the control group (n = 8), no advice on sugar restriction was given. Participants filled in, under supervision, a questionnaire consisting of 32 commonly used sugar-containing products, to calculate the number of sugar intakes per day. These data were gathered at baseline, and after 3, 6 and 12 weeks.

Smith 2003 undertook a randomised controlled trial in an oral and maxillofacial surgery outpatient clinic in a Welsh dental teaching hospital aimed at evaluating the effectiveness of an intervention to reduce alcohol consumption and misuse. The participants were all male, aged between 16 and 35 years, attending for follow-up treatment required for their alcohol-related facial injury. The intervention group (n = 75) had a brief, one-session, manual-guided discussion, based on the principles of motivational interviewing. The control group (n = 76) had treatment at the outpatient clinic as usual. Baseline measures of alcohol consumption were gathered, with a follow-up after 3 and 12 months.

The study by Bradbury 2006 involved edentulous patients aged 45 to 80 years attending dental-student teaching clinics for replacement conventional dentures at Newcastle Dental Hospital, UK. The intervention comprised of a dietary intervention tailored to a Stage of Change (from the Transtheoretical Model of behaviour change) aimed at increasing fruit and vegetable intake. The intervention group (n = 30) received two dietary counselling sessions, whereas the control (n = 28) received usual care. Baseline measures of the amount of fruit and vegetables consumed and Body Mass Index (BMI) were taken, with a follow-up 6 weeks after receiving their replacement dentures (about 10 weeks after baseline).

The study by Hoogstraten 1983 was undertaken in the Netherlands. Participants were all adults living in a suburban Dutch village who had recently registered as a patient of the group dental practice. The patients were randomly assigned to one of three groups: 1) 30 minutes of instruction by a dental hygienist; 2) before the same instruction as group 1, participants were shown a 10 minute film; and 3) the control, who had no instruction at all. The instruction given by the hygienist included the relationship between sugar consumption and dental health. However, it also included information on oral hygiene, methods of improving oral hygiene, the use of fluoride, and the benefit of regular visits to the dentist. Data on dental behaviour including sugar consumption were collected using a self report questionnaire at baseline and 6-12 months later. Data were presented as means and standard deviations of sugar consumption measured on a scale 1-5, with a higher score denoting more 'positive' behaviour.

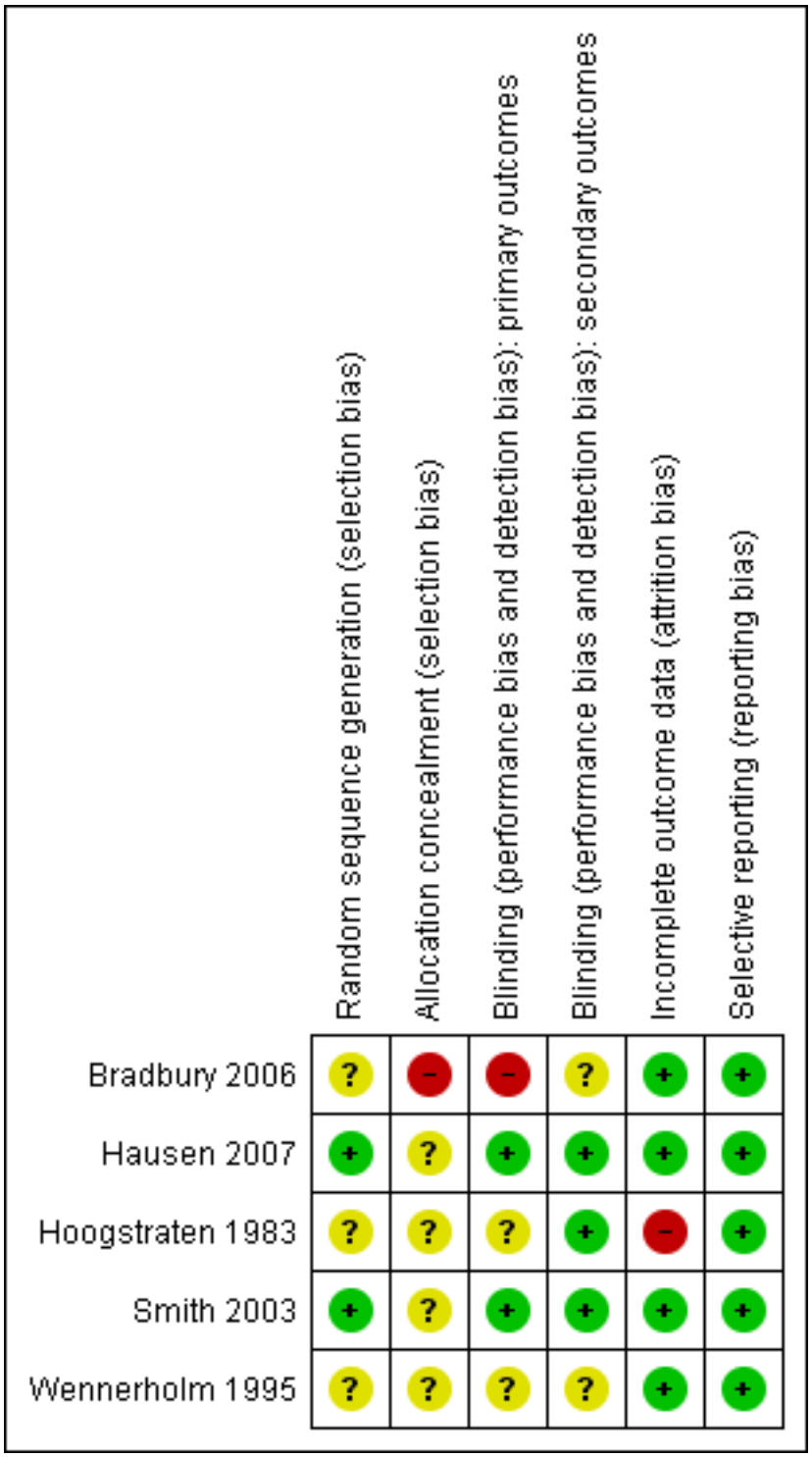
The study by Hausen 2007 was the only study included involving children. All children aged 11 to 12 years in a town in Finland were screened for the presence of active initial caries lesions, and where at least one such lesion was detected, children were invited to receive a baseline dental examination and to be enrolled into a randomised controlled trial. These children were randomly assigned to two groups. The experimental group (n = 250) received an "individually designed patient-centred preventive programme aimed at identifying and eliminating factors which had led to the presence of active caries". The control group (n = 247) received basic prevention offered as standard in public dental clinics in the town. The individualised programme of prevention was delivered by dental hygienists trained in counselling including understanding stages of change and different strategies for counselling conversations. Counselling specifically included dietary counselling, with emphasis on identifying when during the course of the day snacking occurred, and involving emphasis on the importance of regular meals, the role of fermentable carbohydrates in the caries process, and the harmful effects of frequent snacking. Data on dietary behaviour were gathered at baseline, at follow-up after 2 and 4 years using a questionnaire that included questions on oral health-related behaviours with a 7-point Likert scale describing the frequency of the behaviour.

Risk of bias in included studies

For an overview of the risk of bias in the included studies *see* the Risk of Bias tables under Characteristics of included studies tables and Figure 1. We used a generally accepted rule of thumb to judge whether there was an acceptable loss to follow-up Schulz and Grimes 2002. This is a simple 5 and 20 rule: a fewer than 5% loss represents little bias and a greater than 20% loss poses serious threats to validity. In order to avoid biases associated with non-random loss of participants, results for all patients who are

randomly assigned should be analysed, and the analysis done including all patients as part of the group to which they were initially assigned (intention-to-treat analysis). We therefore noted whether the study reported that an intention-to-treat analysis was undertaken, and whether there is evidence to support the claim.

Figure 1. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



Overall, two trials were assessed as being at high risk of bias (Hoogstraten 1983; Bradbury 2006) and the remaining three were assessed as being unclear of the risk of bias.

Allocation

Two trials were judged to be at low risk of bias with regard to generation of random sequence (Smith 2003; Hausen 2007); three provided insufficient information. Four trials were assessed as being at unclear risk of bias with regard to allocation concealment; one trial was judged to be at high risk of bias (Bradbury 2006).

Blinding

It is recognised that it is not always feasible to blind participants and investigators to interventions, however, blinded outcome assessment of the primary outcome was undertaken in two trials (Smith 2003; Hausen 2007), and blinded outcome assessment for secondary outcomes in three trials (Hoogstraten 1983; Smith 2003; Hausen 2007). One trial was assessed as being at high risk of bias with regard to blinding of the primary outcome (Bradbury 2006) with the nutritionist involved in delivering the intervention also involved in gathering outcome data. The remaining trials were deemed to be at unclear risk of bias regarding blinding of outcome assessment due to insufficient information.

Incomplete outcome data

One trial was judged to be at high risk of bias due to 28% drop-out rate and insufficient information on reasons for drop-outs by group (Hoogstraten 1983). All other trials were considered to be at low risk of attrition bias.

Selective reporting

No trials were assessed as being at risk of selective outcome reporting.

Effects of interventions

For an overview of the results *see* Additional Table 1; Table 2; Table 3; Table 4; and Table 5.

In four out of the five included studies a significant change in dietary behaviour was found for at least one of the primary outcome variables (Wennerholm 1995; Smith 2003; Bradbury 2006; Hausen 2007). In the single-intervention study by Wennerholm 1995, there was a significant reduction in mean sugar intake frequency both at main meals and between meals, found at both the 3 and 6 week follow-up, when compared to baseline. At the 12 week follow-up (6 weeks after completing the intervention) there was no significant difference in mean sugar intake frequencies compared to baseline. This analysis however, does not take into account imbalances in sugar intake frequency at baseline; and a secondary analysis is not appropriate given the very limited size of the sample and design of the study.

Smith 2003 showed that the difference in dietary behaviour (with respect to alcohol consumption) between intervention and control groups actually widened over time; with slight, but not significant differences seen at the 3 month follow-up, and significant differences detected after 12 months of follow-up. The risk ratio (RR) of drinking more than 21 units of alcohol per week was 0.88 (95% confidence interval (CI) 0.64 to 1.22) after 3 months and 0.52 (95% CI 0.32 to 0.85) after 12 months. In other words, 3 months after the intervention, the risk of drinking above a 'sensible' limit was 88% of the risk of those who had not had the intervention and this was not statistically significant; whereas after 12 months the risk of drinking above this limit was about half (52%) of the risk of those who had not had the intervention.

Bradbury 2006 also showed a change in dietary behaviour following the intervention. The effect of the intervention on fruit and vegetable intake was assessed by one-way analysis of co-variance adjusted for baseline intake. A significant change in the weight of fruit (but not vegetables) consumed was found in the intervention group ($P < 0.001$), but not in the control. Significant differences in the proportion of patients (at follow-up) in the Action Stage of Change (compared to Pre-Action Stages) were reported for both the consumption of fruit and vegetables: e.g. 75% of participants were in the Action Stage in relation to fruit consumption in the intervention group, compared to only 29% of participants in the Action Stage in the control.

Although the authors in this study state that there was also a higher proportion of participants (at follow-up) who reported drinking fruit juice in the intervention group than in the control ($P = 0.03$), the statistical analysis undertaken compares change within groups, rather than comparing intervention and control at follow-up, which is more appropriate. Numbers in this analysis are small and there is an imbalance in proportions, between the intervention and control groups at baseline. Although the difference between intervention and control groups at follow-up approaches significance, it is not significant ($P = 0.07$). The risk rate of starting to drink fruit juice after not drinking it, was 0.23 for the intervention group, and 0.21 for the control; i.e. there was a 23% risk of starting to drink juice in the intervention group, but also a 21% risk of this in the control (risk ratio of starting to drink juice = 1.09 (95% CI 0.42 to 2.85)). There was also no statistically significant difference in the secondary outcome (BMI) when the intervention and control groups were compared ($P = 0.22$) in this study.

When the dietary data in the multi-intervention study by Hausen 2007 were analysed, only one (using xylitol products more than three times a day) of the seven dietary behaviours investigated showed that a significant change had occurred. The statistical anal-

ysis in the paper is a Chi^2 test of changes between baseline and follow-up which is not appropriate. However, a secondary analysis of the data comparing intervention and control groups for using xylitol more than three times a day, shows that there is a significant difference when intervention and control groups are compared at follow-up (RR 1.32; 95% CI 1.04 to 1.68).

The results from the multi-intervention Hoogstraten 1983 study are inconclusive due to fundamental problems with study design and statistical analysis. Baseline scores for mean sugar consumption for the control group (2.89, standard deviation (SD) = 0.99) are significantly lower than in the two intervention groups (individual instruction (mean = 3.41, SD = 1.50); film plus individual instruction (mean = 3.53, SD = 1.27). The statistical analysis reports differences in the mean sugar consumption for both the intervention groups, but not for the control, compared to baseline. However, a more conventional analysis of trial data would involve comparing intervention and control, or analysing change taking into account baseline differences. Given that baseline data were only collected for half of the sample; the study design issues mean that further statistical analysis is not warranted.

DISCUSSION

The Scottish Intercollegiate Guidelines Network 2007 (SIGN) guidelines relating to preventing dental caries in children at high caries risk, recommend that "given that high caries risk patients are presenting in the dental surgery, dental health education advice should be provided to individual patients at the chairside as this intervention has been shown to be beneficial". The guidelines do however acknowledge that in spite of the importance of the area, this issue is poorly researched. The results of this systematic review confirm that the evidence to support this type of intervention is weak; not because the findings of studies do not support this type of intervention, but that only a few studies have been undertaken, and many of these are poorly designed and reported.

It is surprising to find that in spite of a general acknowledgement that among other risk factors for dental caries, the local effect of dietary sugars plays a fundamental role in the initiation of the disease; only one study was identified in the review which involved a single intervention reducing dietary sugar intake in a dental setting. Although meeting inclusion criteria, even this study (Wennerholm 1995) was a small scale experiment involving reducing sugar consumption for a period of time, with a primary focus of looking at the effects of sugar restriction on *Streptococcus mutans* and *Streptococcus sobrinus* in saliva and dental plaque. Carried out in an educational institution with a high risk of bias, this study can hardly be taken as an evidence base to support one-to-one dietary interventions focusing on the control of dietary sugars delivered at the chairside.

Two other studies (Hoogstraten 1983; Hausen 2007) were also included in the review which involved attempting to change behaviour in relation to dietary sugars; both of these were multi-intervention studies. Messages about improving oral hygiene were given as well as messages about reducing dietary sugars. In these multi-intervention studies, although changes in dietary behaviour were described at both baseline and follow-up, it remains a possibility that any changes in dietary behaviour may have been a consequence of a general raising of oral health awareness (as a result of both oral hygiene and dietary advice), rather than purely because dietary advice education in itself was tailored and effective.

The Medical Research Council document 'Framework for the development and evaluation of randomised controlled trials for complex interventions' states that "the greater the difficulty in defining what exactly are the 'active ingredients' of an intervention and how they relate to each other, the greater the likelihood that one is dealing with a complex intervention" (Campbell 2000). This perspective is taken from the field of complexity science where a system is considered as a set of elements that interact together within a dynamic environment. In other words: a multiple intervention involves not just the sum of the component parts of the intervention, but there is also some interaction between these elements which is inevitable (Hawe 2004). Future trials of behaviour change interventions undertaken in a dental setting will need to take note of these methodological challenges.

Identifying the component parts of an intervention involving behaviour change is particularly problematic at present because of a lack of common nomenclature used by researchers. Terms such as 'behavioural counselling' can mean different things to different researchers and this lack of standardised definitions of the techniques used in behaviour change interventions mean that it is difficult to replicate effective interventions or identify techniques contributing to effectiveness across interventions (Michie 2011). Whilst motivational interviewing (used in the Smith 2003 study) is an example of a technique where reviewers can reasonably assume that standard procedures are used which are likely to elicit the same underlying change behaviour (Abraham and Michie 2008); the Hausen 2007 study describes dietary counselling which was "interactive and based on mutual understanding", which is more open to interpretation. The Bradbury 2006 study reports that the intervention consisted of individual counselling sessions with an individually tailored nutrition education package. Although counsellors were trained in determining goals for the counselling, understanding Stages of Change and on different strategies for counselling conversations, the report is not specific in which techniques were applied. Definitions of 26 behaviour change techniques, with theoretical frameworks are now available, and being developed further (Abraham and Michie 2008), which will help to improve the reporting of future studies.

There is also a move to promote improvements in reporting of behaviour change interventions by extending CONSORT guide-

lines for these types of studies (WIDER 2011). Editors are recommended to expect the reporting of behaviour change intervention studies to include: 1) the intervention development, 2) the change techniques used in the intervention, and 3) the causal processes targeted by the change techniques. These developments will help to improve the consistency of reporting this type of study, and the likelihood of being able to undertake evidence synthesis once more data are available.

The review identified a further 14 studies, all randomised controlled trials, where a one-to-one dietary intervention had been undertaken alongside interventions aiming to improve oral hygiene. In these 14 studies data on dietary behaviour change were not collected or reported and the studies were therefore excluded (Characteristics of excluded studies). However, in a typical dental practice setting, since dental caries is a multi-factorial disease, other issues (fluoride exposure, plaque removal) in addition to dietary advice are likely to be addressed by those delivering preventive care for patients. This raises the issue of how we might appropriately evaluate the effectiveness of this type of complex intervention.

In terms of summarising the findings from studies included in the review; inferences from these are limited by study design and analysis issues. In the Hoogstraten 1983 study, baseline data were only collected for half of the sample, and significant imbalances between intervention and control groups at baseline exist. Whilst mean sugar consumption reduced in the 'instruction only' intervention group, and not in the control. However, methodological issues mean that these results must be seen as unreliable. The study by Hausen 2007 contains fewer sources of bias and is therefore the only study involving data concerned with dietary sugars behaviour which are reasonably reliable. Data on seven different dietary behaviours were reported, with only one behaviour (using xylitol products more than three times a day) showing a significant change following the intervention.

Although very few studies exist which are concerned with dietary behaviour change in a dental setting, it is striking that a wide variety of outcome measures have been used. Even where the focus of the intervention is the prevention of dental caries, authors have used: number of sugar intakes per day (main meals and between meals) (Wennerholm 1995); frequency of sweet consumption (Tan 1979); mean sugar consumption using a 1-5 Likert scale (Hoogstraten 1983); and frequency of using: xylitol products, eating candy, drinking soft drinks, drinking sports drinks, nibbling, eating warm meals and eating healthy snacks (Hausen 2007). Combinations of sugar amount/frequency and food adhesiveness are known to be better predictors of caries risk than the amount of sugar (Ruxton 2010), and so future studies may need to use a greater range and complexity of dietary behaviour outcome measures. Appropriate handling of the statistical analysis of multiple measures will however be necessary.

The Hausen 2007 study was the only study of the five, where a subsequent publication reported cost effectiveness. An incremental cost effectiveness ratio (ICER) was calculated which expresses the cost associated with each extra unit of outcome (the mean of the individual differences in DMFS scores between baseline and follow-up). The ICER was EUR 34.07 per averted DMF surface. However, these calculations were based on the costs of the dietary intervention undertaken alongside counselling on toothbrushing practices, and the contribution of each cannot be assessed separately. The analysis did show that total costs decreased year after year, and for the last 2 years the experimental regimen was less expensive than the standard dental care. The authors suggest that the experimental regimen would probably have been more cost-effective than standard dental care if the follow-up period had been longer, the regimen less comprehensive, and/or if dental nurses had been used to deliver the intervention rather than dental hygienists. The relative contribution of dietary counselling to overall prevention of disease in a multi-intervention package of prevention therefore becomes relevant. What would have been the size of the health outcome had only a dietary intervention been undertaken, or would removing this component from the intervention have made the regimen more cost-effective? These are important questions for future studies.

There is some evidence that interventions aiming to change dietary behaviour in a dental setting can be effective. Two studies were identified which involved interventions to change dietary behaviour focused on improving general, rather than oral health. Smith 2003 showed that a brief, one session intervention based on the principles of motivational interviewing was effective in reducing alcohol consumption in young adult males; and Bradbury 2006 showed that an intervention involving dietary counselling tailored to a Stage of Change was effective at increasing fruit and vegetable consumption of edentulous patients. There is therefore some basis for using one-to-one interventions in the dental setting as an effective means of changing dietary behaviour, to the benefit of patients. It should however be noted that both the Smith 2003 and Bradbury 2006 studies were undertaken in a dental hospital environment, and so more studies are needed to look whether this type of intervention is effective in a dental practice setting.

The inclusion criteria used stipulated that participants were to be followed for a minimum of 1 month. Two of the five included studies had a follow-up of less than 12 months (Hoogstraten 1983; Bradbury 2006). The other three studies had a follow-up period of over a year (Wennerholm 1995; Smith 2003; Hausen 2007). This raises the question as to whether any of the dietary changes observed in the shorter period of follow-up, were sustainable longer term, sufficient to bring about general and oral health benefits. Whilst relatively few such interventions have been subjected to long-term analysis of effectiveness, it is possible that intervention effects may diminish over time once the stimulus for change is gone, and once competing demands and inertia divert patients' efforts elsewhere (Stange 2003). Likewise, there may be a differ-

ence seen between effects observed in the initial implementation of a programme in a setting such as a dental practice, and results observed once the intervention is institutionalised some time later. Future studies should ideally plan for a longer period of follow-up, to assess the impact of any dilution of the intervention over time.

Whilst there are relatively few studies, the dental setting does appear to have some potential in delivering effective preventive interventions aimed at improving general health. There are other opportunities such as the giving of diet advice to address diabetes, obesity and cardio-vascular disease which have yet to be explored. Given that dentists appear willing to undertake chairside screening for cardio-vascular disease (CVD) (Greenberg 2010); and that similar dietary factors are implicated in both CVD and oral disease, chairside dietary counselling as part of CVD risk-reduction strategies is suggested to be an appropriate task for the dental team (Touger-Decker 2010).

AUTHORS' CONCLUSIONS

Implications for practice

There is tentative evidence that one-to-one dietary interventions delivered in a dental setting aimed at promoting general rather than oral health, are effective at changing dietary behaviour. There is little evidence that one-to-one dietary interventions delivered in a dental setting aimed at preventing dental caries are effective, but mainly because very few studies have been undertaken in this area, and where studies have been undertaken, most have significant methodological weaknesses. There are no studies of one-to-one dietary interventions delivered in the dental setting which are aimed at preventing tooth erosion.

Implications for research

Further research is needed which is undertaken in a dental practice setting rather than a dental school setting to support the evidence that the delivery of one-to-one dietary interventions aimed at promoting general health are effective in the dental setting. There is also a need for studies related to changing dietary behaviour relevant to the prevention of tooth erosion, and more methodologically rigorous research which examines the effectiveness of one-to-one dietary interventions delivered in the dental setting concerned with changing dietary sugar behaviour to prevent dental caries.

Researchers involved in studies in the future will need to ensure that methods of randomisation are reported and allocation concealment ensured, that blinding is in place, and that there is a determination of sample size at the design stage. Statistical analysis needs to be focused on the comparison between the intervention and control groups, rather than looking at changes between baseline and follow-up for the intervention and control groups separately.

Identification of appropriate dietary outcome measures will be a challenge; for it will probably require more than one type of measure to be used (e.g. frequency as well as amount of sugar consumption, and possibly food adhesiveness where dietary interventions to prevent dental caries are concerned). Confounding variables such as fluoride exposure and oral hygiene should be controlled where possible. Where complex interventions are involved, the possibility of a synergistic effect of various components working together should be examined.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Bradbury 2006

Methods	A randomised controlled trial comparing dietary counselling sessions with usual care
Participants	Population: 66 edentulous patients. Setting: Dental-student clinics at Newcastle Dental Hospital for replacement of conventional dentures, UK Age: 45-80 years old. Inclusion criteria: Edentulous ≥ 1 year, community dwelling and not Type 1 insulin-diabetic Exclusion criteria: Non-insulin-dependent diabetics, those on a cholesterol-lowering diet if diagnosed < 6 months and participants with fruit and vegetable intakes ≥ 500 g/day
Interventions	Two one-to-one counselling sessions, with a tailored, written nutrition education package. Delivery of intervention was designed to fit with dental appointments for replacement dentures Control group: Received usual care for replacement dentures only Duration: Length of the session not reported. Personnel conducting interventions: Nutritionist.
Outcomes	Primary outcomes: 1) Readiness to change diet (Stage of Change) for a) fruit b) vegetables; 2) Total intake grams/day for a) fruit b) vegetables; 3) Drinks fruit juice Yes/No Stage of Change assessed pre- and post-intervention by means of an algorithm dividing pre-contemplators into those who were not aware of their low intake, by taking into account fruit and vegetable intake Three-day estimated food diary (two consecutive weekdays and one weekend day) with information of amount of fruit and vegetables consumed in grams per day. In the data analysis of food diary data: 'fruits' were identified as all fresh, frozen, canned, and dried fruits, including that in composite dishes, and also fruit juices. 'Vegetables' were identified as all fresh, frozen, canned, and dried vegetables, including beans and lentils, but not potatoes Secondary outcome: BMI [weight (kg)/height $(m)^2$]. Height was measured to the nearest 0.5 cm and weight was measured using a digital scale and with patients wearing light clothing, to the nearest 0.1 kg Time points measured: Food diary, questionnaire to assess perceived chewing ability, Stage of Change, and socio-demographic variables collected at baseline on 2nd week. Food diary and post-intervention questionnaire collected 6 weeks after participants received replacement dentures From diagram in the study report, follow-up was approximately 10 weeks after baseline (8 weeks after intervention)
Notes	The model of intervention adopted was the Stage of Change from the Transtheoretical Model of behaviour change

Risk of bias

Bradbury 2006 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	.."randomized and constrained" but no further details.
Allocation concealment (selection bias)	High risk	Randomisation of participants was undertaken prior to obtaining consent to participate in the trial. Since information given to the patients in the consenting process may have included information on whether they would be part of the intervention or control it is feasible that participants may have been more likely to consent to inclusion in the intervention group than in the control (or vice versa) Also, randomisation to intervention and control groups was undertaken before excluding certain participants on account of not meeting inclusion criteria
Blinding (performance bias and detection bias) primary outcomes	High risk	The same nutritionist delivered and evaluated the intervention
Blinding (performance bias and detection bias) secondary outcomes	Unclear risk	Unclear who collected BMI data.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Follow-up rate was 88% (n = 30) in intervention group and 88% (n = 28) in the control. Differences the same in each group. No intention-to-treat analysis
Selective reporting (reporting bias)	Low risk	All important expected outcomes reported

Hausen 2007

Methods	A randomised controlled trial comparing an "individually designed patient-centred preventive programme" to prevent dental caries with standard prevention offered in public dental clinics
Participants	Population: 497 children. Setting: Town of Pori, Finland. Age: 11-12-year-olds. Inclusion criteria: At least one active caries lesion at baseline Exclusion criteria: Children with learning and physical disabilities attending special schools

Interventions	The intervention group (n = 250) had an individually designed programme of prevention, with 'heavy emphasis' on interactive counselling. Counselling included dietary counselling, with emphasis on identifying when during the course of the day snacking occurred, and involving emphasis on the importance of regular meals, the role of fermentable carbohydrates in the caries process, and the harmful effects of frequent snacking Control (n = 247): Basic prevention offered as standard in public dental clinics. This included health education on dietary habits Duration: Not reported. Personnel conducting interventions: Five dental hygienists trained in counselling
Outcomes	Primary outcome: self report questionnaire using 7-point Likert scale relating to frequency of food/drink consumption. Seven different dietary outcomes were used and in the analysis classified as a dichotomous variable "favourable/unfavourable" according to the following: 1) Using xylitol products at least three times a day; 2) Eating candy less than daily; 3) Drinking soft drinks less than daily; 4) Drinking sports drinks no more than once a week; 5) Nibbling less than daily; 6) Eating warm meals at least twice a day; 7) Eating healthy snacks at least twice a day Secondary outcome: Caries increment. Time points measured: Follow-up after 2 and 4 years.
Notes	The dietary intervention was one of a number of interventions delivered together. Children in the experimental group were given toothbrushes and fluoride (1500 ppm) toothpaste. Fluoride and chlorhexidine varnish was applied to active initial caries lesions. Toothbrushing was demonstrated and fluoride and xylitol lozenges distributed. As well as dietary counselling, children received information about toothbrushing, fluoride, xylitol, *Streptococcus mutans* and plaque acidity. Children in the control group received fluoride varnish applications and information on oral hygiene self care as well as information on healthy dietary habits. Both experimental and control groups were exposed to community level oral health promotion Analysis compares baseline and follow-up rather than intervention and control

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer generated random numbers.
Allocation concealment (selection bias)	Unclear risk	Not reported.
Blinding (performance bias and detection bias) primary outcomes	Low risk	Examiner unaware of group allocation at baseline and follow-up
Blinding (performance bias and detection bias) secondary outcomes	Low risk	Examiner unaware of group allocation at baseline and follow-up

Hausen 2007 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	There was a 10% drop-out rate for the experimental group and 12% for the control. No intention-to-treat analysis
Selective reporting (reporting bias)	Low risk	All important expected outcomes reported.

Hoogstraten 1983

Methods	A randomised controlled trial comparing two intervention groups (instruction only and a dental health education film plus instruction) and a control (no instruction)
Participants	Population: 108 adults who had recently registered as a patient in the group practice Setting: Group practice in Abcoude, Netherlands. Age: 15-60 years old. Inclusion criteria: n/a. Exclusion criteria: Full dentures, no more than one person per family was admitted to the sample
Interventions	Two intervention groups and one control: Group 1 (n = 36): Instruction concerning the relationship between sugar consumption and dental health, oral hygiene, the use of fluoride, information about regular visits to the dentist. While presenting the information to the patient, the hygienist performed regular preventive care, such as scaling and polishing Group 2 (n = 36): Identical standard information as in group 1 with additional film - A Dutch version of 'Four Tons of Teeth' - shown before the same instruction as carried out for Group 1; and presenting more or less the same issues as the instruction Control group (n = 36): No instruction. Duration: Standard information took 30 minutes; film in group 2 took extra 10 minutes Personnel conducting interventions: Four dental hygienists.
Outcomes	Outcome: Sugar consumption measured on a scale 1-5, with a higher score denoting more 'positive' behaviour. Not stated whether this was frequency, timing or amount Baseline measurement only collected for half of the participants and 6-12 months after the intervention for all participants Time points measured: Baseline and 6-12 months later.
Notes	The dietary intervention was one of a number of interventions delivered together. Both experimental groups received information on oral hygiene as well as diet. Outcome measures included measures of oral hygiene behaviour Analysis compares baseline and follow-up rather than intervention and control

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	..."assigned at random" but no further details.

Hoogstraten 1983 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	Not reported.
Blinding (performance bias and detection bias) primary outcomes	Unclear risk	Not reported.
Blinding (performance bias and detection bias) secondary outcomes	Low risk	N/A.
Incomplete outcome data (attrition bias) All outcomes	High risk	The authors note that "as usual in longitudinal studies there was a certain drop-out of subjects"; 150 participants originally recruited (50 per group). 14 participants (28%) dropped out from each group; reasons not provided by group. Intention-to-treat analysis not mentioned
Selective reporting (reporting bias)	Low risk	All important expected outcomes reported.

Smith 2003

Methods	A randomised controlled trial comparing a dietary intervention focused on alcohol consumption and usual care with no intervention
Participants	Population: 151 males attending at local A&E department with facial injury and requiring follow-up treatment at a central specialist jaw and face clinic between January 1997 and July 1998 Setting: Oral and maxillofacial surgery department in Cardiff Dental Hospital Age: 16 to 35 years old. Inclusion criteria: Consumption of 8 or more units of alcohol prior to injury; having a permanent home address Exclusion criteria: Difficulty in understanding the content of the questionnaire; any severe psychiatric problem that would make the intervention impossible to administer
Interventions	The intervention was a one session manual-guided intervention based upon the principles of motivational interviewing Control group: No Intervention. Duration: 20 to 25 minutes. Personnel conducting interventions: Two senior general nurses trained by two clinical psychologists in motivational interviewing techniques
Outcomes	90I Drink Diary section measured alcohol consumption including typical week consumption; total consumption (of 84 days); and abstinent days (of 84 days) Outcome: Sensible drinking levels either 21 units alcohol or less per week or Not sensible: More than 21 units Time points measured: 3 months and 12 months after baseline.

Smith 2003 (*Continued*)

Notes	Both intervention and control groups consumed more than the recommended amount of alcohol per week at baseline

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number tables used after baseline assessment to allocate participants to test and control groups
Allocation concealment (selection bias)	Unclear risk	Not reported.
Blinding (performance bias and detection bias) primary outcomes	Low risk	Single blinding. Masking of the intervention conductor and participants was not possible. There was masking of the outcome assessment
Blinding (performance bias and detection bias) secondary outcomes	Low risk	N/A.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Follow-up rate at 3 months was 93% in intervention and 91% in the control. At 12 months 80% in the intervention group and 82% in the control were followed up. No intention-to-treat analysis
Selective reporting (reporting bias)	Low risk	All important expected outcomes reported.

Wennerholm 1995

Methods	A randomised controlled trial comparing recommended sugar reduction both between meals, and in main meals supported by a list of the sugar content of various food products; with no intervention
Participants	Population: 20 adults: 14 students at the Dental Technical School and 6 patients at the Department of Cariology, Göteborg University, Sweden Setting: Department of Cariology, Göteborg University. Age: Mean age of 30.3 years (SD = 12.5) for the test group and age mean of 27.4 years (SD = 9.4) for the control group Inclusion criteria: a) Having more than 300,000 CFU *S. mutans*/ml saliva b) harbouring both *S. mutans* and *S. sobrinus* in saliva c) eating sugar frequently. Exclusion criteria: None.
Interventions	In the test group participants were asked to refrain from sugar-containing foods between meals and to reduce sugar in main meals. Detailed information about sugar content of various food products was given to the participants at baseline

Wennerholm 1995 (*Continued*)

	Control group: No advice. Duration: 6 weeks. Personnel conducting interventions: One of the authors.
Outcomes	Primary outcome: The number of sugar intakes per day (both in between meals and main meals). Breakfast, lunch and dinner were defined as main meals. Data were collected by means of a standardised questionnaire consisting of lists of 32 commonly used sugar-containing products, recording the intake frequency of each product. Two or more products consumed on the same occasion were only scored as one intake. If a participant did not consume a sugar-containing product every day, but at least three times a week, a score of 0.5 was given. The subjects were allowed to consume one piece of fruit per day, and this was given a score of 1 Time points measured: Baseline, 3, 6 and 12 weeks.
Notes	Sugar intake frequency per day at baseline = 9.5 (SD = 1.9) in the test group and 7.2 (SD = 2.6) in the control group Analysis compares baseline and follow-up rather than intervention and control

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	.."randomly divided" but no further details.
Allocation concealment (selection bias)	Unclear risk	Not reported.
Blinding (performance bias and detection bias) primary outcomes	Unclear risk	Not reported.
Blinding (performance bias and detection bias) secondary outcomes	Unclear risk	Not reported.
Incomplete outcome data (attrition bias) All outcomes	Low risk	There were no withdrawals from the study.
Selective reporting (reporting bias)	Low risk	All expected outcomes reported.

BMI = body mass index; SD = standard deviation.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Araujo 2002	Dietary counselling was just one intervention of a multiple received by all study participants. Not possible to separate out the effect of dietary counselling alone
Aswini 2005	Only outcome measure included was pH.
Autio 2002	Intervention undertaken in a non-dental healthcare setting.
Blinkhorn 1981	Excluded because primary outcome of dietary behaviour change was not reported. Also, secondary outcomes of dental caries not possible to separate dietary intervention from co-interventions of oral hygiene instruction and fluoride tablet distribution
Cheng 2007	Dietary counselling was just one intervention of a multiple received by all study participants. Not possible to separate out the effect of dietary counselling alone
Cleary 1997	Outcome was "total soreness score". Length of follow-up only 10 days
Cosyn 2006	Only outcome measure reported was plaque.
Davies 2005	Intervention undertaken in a non-dental healthcare setting.
Dulgergil 2004	No dietary intervention given.
Edwards 1998	Not RCT. No control group. Also participants had a medical problem with systemic effects
Ekman 1990	Dietary counselling was just one intervention of a multiple. Not possible to separate out the effect of dietary counselling alone
Feldens 2007	Intervention undertaken in a non-dental healthcare setting.
Frostell 1991	Intervention was a family intervention, not one-to-one.
Fuller 1991	Intervention undertaken in a non-dental healthcare setting.
Gisselsson 1983	Dietary counselling was just one intervention of a multiple. Not possible to separate out the effect of dietary counselling alone
Goodall 2008	Not a dental setting (oral and maxillofacial surgery outpatient clinics)
Haresaku 2007	Only outcome measure reported was plaque.
Harrison 2007	Dietary counselling was just one intervention of a multiple. Not possible to separate out the effect of dietary counselling alone
Hautalahti 2007	Intervention undertaken in a non-dental healthcare setting.

(*Continued*)

Hilton 2004	Participants had a medical problem with systemic effects.
Hoerman 1990	Only outcome measure reported was plaque.
Hugoson 2003	Not a dietary intervention.
Johansson 2004	Only outcome measure reported was pH.
Johansson 2009	Intervention undertaken in a non-dental healthcare setting.
Joyston-Bechal 1992	Not RCT. No control group. Also participants had a medical problem with systemic effects
Kabil 2007	Participants had a medical problem with systemic effects.
Kahn 2008	Intervention undertaken in a non-dental healthcare setting.
Kallestal 2000	Individuals not randomised to control group. Mixed intervention with no dietary behaviour change outcomes reported
Kallestal 2005	Dietary intervention not given to all in the individual programme group. Mixed intervention for individual programme group with no behaviour change outcomes reported
Kandelman 1987	Intervention undertaken in a non-dental healthcare setting.
Karjalainen 1997	Intervention undertaken in a non-dental healthcare setting.
Karlsson 2007	Dietary intervention was given to all participants and it is not possible to separate the effect of dietary intervention alone
Kleber 2001	Only outcome measure reported was plaque.
Klock 1980	Dietary counselling was just one intervention of a multiple received by all participants. Not possible to separate out the effect of dietary counselling alone
Kovari 2003	Intervention undertaken in a non-dental healthcare setting.
Ly 2006	Only outcome measure reported was *Streptococcus mutans*.
MacEntee 2007	Intervention undertaken in a non-dental healthcare setting. Not a one-to-one dietary intervention
Mayer 2003	After contact with authors, study excluded because intervention undertaken in a non-dental healthcare setting
Meurman 2009	Dietary advice (planned regular meals; avoiding sugar; choosing healthy non-cariogenic food, drink and snacks), was just one intervention of a multiple received by all study participants. Not possible to separate out the effect of dietary counselling alone
Milgrom 2006	No dietary behaviour, oral health or general health outcome measures

(*Continued*)

Mäkinen 1976	No dietary behaviour, oral health or general health outcomes used
Rabinovitch 2006	Participants had a medical problem with systemic effects.
Seow 2003	Dietary counselling was just one intervention of a multiple received by all study participants. Not possible to separate out the effect of dietary counselling alone
Simons 2001	Intervention undertaken in a non-dental healthcare setting.
Stecksén-Blicks 2004	Only outcome measure reported was *Streptococcus mutans*.
Stecksén-Blicks 2008	Dietary intervention was given to all participants and it is not possible to separate the effect of dietary intervention alone
Stockstill 1989	Dietary intervention was aimed at achieving a diet high in carbohydrate and low fat and protein in order to facilitate uptake and conversion of L-trytophan to brain serotonin. No dietary change outcomes reported
Szoke 2001	Intervention undertaken in a non-dental healthcare setting.
Söderling 2001	Only outcome measure reported was *Streptococcus mutans*.
Tan 1979	RCT but randomised comparison not of one-to-one dietary advice versus no dietary advice
Thorild 2004	Not a dental setting.
Tsuboi 2003	Not in a dental care setting.
Vachirarojpisan 2005	Intervention was a group discussion and not a one-to-one.
Wennhall 2005	Not a RCT. There was a historic reference group acting as a control
West 2003	Not a one-to-one dietary intervention.
West 2004	No dietary behaviour, oral health or general health outcomes

RCT = randomised controlled trial.

DATA AND ANALYSES

This review has no analyses.

ADDITIONAL TABLES

Table 1. Bradbury 2006

	Baseline		**Follow-up**	
Outcome	Intervention	Control	Intervention	Control
Stage of Change (Consumption of fruit behaviour)				
Action	20% (6)	8% (2)	75% (22)*	29% (8)*
Pre-Action	80% (24)	92% (26)	25% (8)*	71% (20)*
* Significant difference between Intervention and Control P < 0.001				
Stage of Change (Consumption of vegetables behaviour)				
Action	23% (7)	25% (7)	75% (22)*	21% (6)*
Pre-Action	77% (23)	75% (21)	25% (8)*	79% (22)*
* Significant difference between Intervention and Control P < 0.001				
Mean (SD) grams/day				
Fruit	111 (80)	87 (82)	254 (194)*	106 (116)
Vegetables	157 (73)	168 (83)	224 (109)	175 (91)
* Significant difference in change in consumption in Intervention compared to Control P = 0.001				
Drinks fruit juice				
Yes	20% (6)	4% (1)	43% (13)	25% (7)
No	80% (24)	96% (27)	57% (17)	75% (21)
Mean (SD) BMI (kg/m^2)				
BMI	27.4 (3.5)	26.1 (3.3)	27.2 (3.4)	26.1 (3.4)

BMI = body mass index; SD = standard deviation

Table 2. Hausen 2007

	Baseline		Follow-up	
Outcome	Intervention	Control	Intervention	Control
Using xylitol products > 3x/day	21% (53)	23% (57)	41% (103) **	31% (77)**
Eating candy less than daily	74% (185)	77% (190)	86% (215)	83% (205)
Drinking soft drinks less than daily	71% (178)	69% (170)	77% (193)	75% (185)
Drinking sports drinks no more than 1x/week	81% (203)	87% (215)	87% (218)	86% (212)
Nibbling less than daily	41% (103)	44% (109)	52% (130)	53% (131)
Eating warm meals more than 2x/day	83% (208)*	74%* (183)	77% (193)	81% (200)
Eating healthy snacks at least 2x/day	69% (173)	65% (161)	71% (178)	68% (168)
*Significant difference at baseline analysis given in the paper **Significant difference between baseline and follow-up P < 0.001: analysis as reported in the paper				
Mean (95% CI) DMFS increment after 2 years			1.86* (1.50, 2.21)	2.44*** (2.12, 2.77)
Mean (95% CI) DMFS increment after 4 years			2.56* (2.07, 3.05)	4.60*** (3.99, 5.21)
* P < 0.05; ***P < 0.0001 Comparing Intervention and Control				

CI = confidence interval

Table 3. Hoogstraten 1983

	Baseline			Follow-up		
Outcome	Instruction Intervention	Film + Instruction Intervention	Control	Instruction Intervention	Film + Instruction Intervention	Control

Table 3. Hoogstraten 1983 (*Continued*)

Mean (SD) sugar consumption	3.41 (1.50)	3.53 (1.27)	2.89 (0.99)	3.58 (1.07)*	3.06 (1.12)*	2.88 (1.27)

*Significant difference between baseline and follow-up: analysis as reported in the paper

SD = standard deviation

Table 4. Smith 2003

	Baseline		**Follow-up 3 months**		**Follow-up 12 months**	
Outcome	Intervention	Control	Intervention	Control	Intervention	Control
% (No) men consuming 21 Units alcohol or less	40% (30)	46% (35)	51% (36)	45% (31)	73% (44)*	49% (30)*
% (No) men consuming more than 21 Units alcohol	60% (45)	54% (41)	49% (34)	55% (38)	27% (16)*	51% (31)*

* Significant difference between Intervention and Control P < 0.01

Table 5. Wennerholm 1995

Outcome	**Baseline**		**Follow-up 3 weeks**		**Follow-up 6 weeks**		**Follow-up 12 weeks**	
Sugar intake frequency (Mean (SD))	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control
Main meals	2.8 (0.5)	1.9 (1.1)	0.7 (0.7)***	1.9 (1.2)	0.8 (0.9)***	1.9 (1.1)	2.3 (0.8)	2.0 (0.9)
Between meals	6.7 (1.9)	5.3 (2.3)	0.8 (1.0)***	5.2 (2.9)	0.9 (1.0)***	4.6 (3.5)	5.6 (3.0)	4.7 (1.5)
Total	9.5 (1.9)	7.2 (2.6)	1.6 (1.4)***	7.1 (3.7)	1.8 (1.5)***	6.5 (4.2)	7.8 (3.5)	6.7 (2.2)

***Mean value significantly different from baseline P < 0.001 analysis as reported in the paper

SD = standard deviation

APPENDICES

Appendix 1. Cochrane Oral Health Group Trials Register search strategy

((diet* or dietary or dietician or food* or drink* or sugar* or sweet* or sucrose or beverage or "bottle caries") and ("health educat*" or "health promot*" or advice or advise* or educat* or teach* or train* or demonstrat* or counsel* or instruct* or behavi* or modif* or attitude*))

Appendix 2. Cochrane Central Register of Controlled Trials (CENTRAL) search strategy

#1 ORAL HEALTH
#2 Exp STOMATOGNATHIC DISEASES
#3 Exp HALITOSIS
#4 ((dental or tooth or teeth or enamel or root*) AND (decay* or caries or carious or white next spot* or plaque or reminerali* or demineral*))
#5 (periodont* or gingivitis or (gingiva* next inflamm*) or (gingiva* next bleed*) or (gingival* next pocket) or (periodont* next pocket) or (periodont* near attachment*) or (gingiva* near attachment))
#6 stomatitis or (mouth next ulcer*) or (oral next ulcer*) or (oral next candidiasis) or (aphthous next ulcer*) or (mouth near aphthae) or (oral near aphthae)
#7 (mucositis near oral)
#8 ((tooth next wear) or ((tooth or dental or teeth or enamel) and (erosion or abrasion)))
#9 halitosis or (mouth next odour) or (mouth next odor) or (mouth near malodour) or (mouth next malodour) or (breath near malodour)
#10 (bottle next caries) or (bottle next decay*) or (nursing and (decay or caries)) or (bottle next decay) or ((early next childhood) and (caries or decay))
#11 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10
#12 Exp ORAL HYGIENE
#13 Exp MOUTHWASHES
#14 Exp DENTIFRICES
#15 (oral next hygiene) or (mouth near care) or (dental near care) or (care near teeth) or (mouth next hygiene) or (plaque near control*) or (plaque near remov*)
#16 toothbrush* or tooth-brush*
#17 ((interdental next clean*) or (inter-dental next clean*) or (tooth near clean*) or (teeth near clean*) or (denture* near hygiene) or (denture* near clean*) or (tongue next scrap*) or (chewing next stick*) or (chewing next gum*))
#18 ((dental or tooth or teeth or interdental* or inter-dental*) and floss*)
#19 ((dental next plaque next index) or (dental next plaque next indices) or (DMF* next index) or (DMF next indices) or (dmf* next index) or (dmf* next indices) or (periodontal next index) or (periodontal next indices) or (oral next hygiene next index) or (oral next hygiene indices))
#20 #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19
#21 Exp DENTISTS
#22 Exp DENTAL AUXILIARIES
#23 dental next practice* or dental next clinic* or dental next hospital* or dentist* or dental hygienist* or dental next therapist* or dental next auxilliar* or dental next nurse* or dental near assistant* or dental next health next educator* or dental next student*
#24 #21 or #22 or #23
#25 DIET CARIOGENIC
#26 Exp DRINKING BEHAVIOR
#27 Exp DIETARY CARBOHYDRATES
#28 Exp FEEDING BEHAVIOR
#29 Exp AVITAMINOSIS
#30 (diet* or nutrition or (food near habit*) or (feeding near habit*))
#31 ((sugar next intake) or (diet* near sugar) or (sugar* near food*) or (sugar* near beverage*) or (sugar* near drink*) or (carbonated near beverage*) or (carbonated near drink*) or (fizzy near drink*) or (fizzy near beverage*) or alcohol)
#32 (baby near food*) or (babies near food*) or (baby near drink*) or (babies near drink*)

#33 ((dinky next feeder*) or ((baby or babies or infant*) and (comforter* or soother*)))
#34 CARIOGENIC AGENTS
#35 Exp SUCROSE
#36 wean* or sucrose
#37 ((supper near drink*) or (supper near bottle*) or (supper near snack*) or (night* near drink*) or (night* near bottle*) or (night* near snack*) or (evening* near drink*) or (evening* near bottle*) or (evening* near snack*) or (bed* near drink*) or (bed* near bottle*) or (bed* near snack*) or (sleep* near drink*) or (sleep* near bottle*) or (sleep* near snack*))
#38 (avitaminosis or (vitamin near deficien*) or (mineral near deficien*))
#39 (diet* or food* or (fruit next juice*) or sweet* or confectionery or xylitol or sorbitol or (sugar next free))
#40 #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39
#41 HEALTH EDUCATION DENTAL
#42 HEALTH EDUCATION
#43 PATIENT EDUCATION
#44 Exp HEALTH PROMOTION
#45 instruct* or advice or advise* or educat* or teach* or train*
#46 (((health* near promot*)) and (dental or teeth or mouth or periodont* or gingival* or (oral next health)))
#47 ((demonstrat* near toothbrush*) or (demonstrat* near "tooth brush*") or (demonstrat* near tooth-brush) or (demonstrat* near floss*) or (demonstrat* near "oral hygiene aid*") or (demonstrat* near "interdental cleaning") or (demonstrat* near wood-stick*) or (demonstrat* near "wood stick*") or (demonstrat* near "interdental massag*"))
#48 ((supervis* near toothbrush*) or (supervis* near floss*) or (supervis* near "oral hygiene") or (supervis* near "interdental cleaning") or (supervis* near wood-stick*) or (supervis* near wood next stick*) or (supervis* near "interdental massag*"))
#49 #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48
#50 HEALTH BEHAVIOR
#51 PATIENT COMPLIANCE
#52 ADOLESCENT BEHAVIOR
#53 Exp TOBACCO USE CESSATION
#54 DRINKING BEHAVIOR
#55 MOTIVATION
#56 ((behavior* OR behaviour*) AND (change OR changed OR changing or modify OR modified OR modification) or lifestyle)
#57 ((tobacco near cessation) or (smoking near stop) or (smoking near cessation) or (smoking near quit*) or (smoker* near quit*) or (tobacco near quit*))
#58 feed next back next device* or feedback next device*
#59 ((attitude* near (oral next health)) or (attitude near (oral next care)) or (attitude near (dental next health)))
#60 (((oral next hygiene) near improv*) or ((oral next health) near improv*) or ("gingival health" near improv*) or ("periodontal health" near improv*) or ("periodontal condition" near improv*) or (caries near reduc*))
#61 #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60
#62 Exp OBESITY
#63 obese or overweight or over-weight or weight or obesity or adiposity
#64 #62 or #63
#65 ((#11 or #20 or #24) AND #40 AND (#49 or #61 or #64))

Appendix 3. MEDLINE via OVID search strategy

1. Oral Health/
2. exp Stomatognathic Diseases/
3. Halitosis/
4. ((dental or tooth or teeth or enamel or root$) and (((decay$ or caries or carious or white) adj spot$) or plaque or remineral$ or demineral$)).mp.
5. (periodont$ or gingivitis or (gingival$ adj inflamm$) or (gingival$ adj bleed$) or (gingival$ adj pocket) or (periodont$ adj4 pocket) or (periodont$ adj4 attachment$) or (gingival$ adj attachment)).mp. 6. (stomatitis or (mouth adj4 ulcer$) or (oral adj4 ulcer$) or (oral adj4 candidiasis) or (aphthous adj4 ulcer$) or (mouth adj aphthae) or (oral adj aphthae)).mp.
7. (mucositis adj oral).mp.

8. ((tooth adj4 wear) or ((tooth or dental or teeth or enamel) and (erosion or abrasion))).mp.
9. (halitosis or (mouth adj odour) or (mouth adj odor) or (mouth adj malodour) or (mouth adj malodour) or (breath adj malodour)).mp.
10. ((bottle adj caries) or (bottle adj decay$) or (nursing and (decay or caries)) or (bottle adj decay) or ((early adj childhood) and (caries or decay))).mp.
11. or/1-10
12. exp Oral Hygiene/
13. exp Mouthwashes/
14. exp Dentifrices/
15. ((oral adj hygiene) or (mouth adj care) or (dental adj care) or (care adj teeth) or (mouth adj hygiene) or (plaque adj control$) or (plaque adj remov$)).mp.
16. (toothbrush$ or tooth-brush$).mp.
17. ((interdental adj clean$) or (inter-dental adj clean$) or (tooth adj clean$) or (teeth adj clean$) or (denture$ adj hygiene) or (denture$ adj clean$) or (tongue adj scrap$) or (chewing adj stick$) or (chewing adj gum$)).mp.
18. ((dental or tooth or teeth or interdental$ or inter-dental$) and floss$).mp.
19. ((dental adj plaque adj index) or (dental adj plaque adj indices) or (DMF$ adj index) or (DMF adj indices) or (dmf$ adj index) or (dmf$ adj indices) or (periodontal adj index) or (periodontal adj indices) or (oral adj hygiene adj index) or (oral adj hygiene indices)).mp.
20. or/12-19
21. exp Dentists/
22. exp Dental Auxiliaries/
23. ((((((((((((((((dental adj4 practice$) or dental) adj4 clinic$) or dental) adj4 hospital$) or dentist$ or dental hygienist$ or dental) adj4 therapist$) or dental) adj4 auxilliar$) or dental) adj4 nurse$) or dental) adj4 assistant$) or dental) adj4 health adj4 educator$) or dental) adj4 student$).mp.
24. or/21-23
25. diet, cariogenic/
26. exp Drinking Behavior/
27. exp Dietary Carbohydrates/
28. exp Feeding Behavior/
29. exp Avitaminosis/
30. (diet$ or nutrition or (food adj habit$) or (feeding adj habit$)).mp.
31. ((sugar adj intake) or (diet$ adj sugar) or (sugar$ adj food$) or (sugar$ adj beverage$) or (sugar$ adj drink$) or (carbonated adj beverage$) or (carbonated adj drink$) or (fizzy adj drink$) or (fizzy adj beverage$) or alcohol).mp.
32. ((baby adj food$) or (babies adj food$) or (baby adj drink$) or (babies adj drink$)).mp.
33. ((dinky adj feeder$) or ((baby or babies or infant$) and (comforter$ or soother$))).mp.
34. Cariogenic Agents/
35. exp Sucrose/
36. (wean$ or sucrose).mp.
37. ((supper adj drink$) or (supper adj bottle$) or (supper adj snack$) or (night$ adj drink$) or (night$ adj bottle$) or (night$ adj snack$) or (evening$ adj drink$) or (evening$ adj bottle$) or (evening$ adj snack$) or (bed$ adj drink$) or (bed$ adj bottle$) or (bed$ adj snack$) or (sleep$ adj drink$) or (sleep$ adj bottle$) or (sleep$ adj snack$)).mp.
38. (avitaminosis or (vitamin adj deficien$) or (mineral adj deficien$)).mp.
39. (diet$ or food$ or (fruit adj juice$) or sweet$ or confectionery or xylitol or sorbitol or (sugar adj4 free)).mp.
40. or/25-39
41. Health Education, Dental/
42. Health Education/
43. Patient Education/
44. exp Health Promotion/
45. (instruct$ or advice or advise$ or educat$ or teach$ or train$).mp.
46. ((health$ adj promot$) and (dental or teeth or mouth or periodont$ or gingival$ or (oral adj health))).mp.
47. ((demonstrate$ adj4 toothbrush$) or (demonstrate$ adj4 “tooth brush$”) or (demonstrate$ adj4 tooth-brush) or (demonstrate$ adj4 floss$) or (demonstrate$ adj4 “oral hygiene aid$”) or (demonstrate$ adj4 “interdental cleaning”) or (demonstrate$ adj4 wood-stick$) or (demonstrate$ adj4 “wood stick$”) or (demonstrate$ adj4 “interdental massage$”)).mp.
48. ((supervise$ adj toothbrush$) or (supervise$ adj floss$) or (supervise$ adj “oral hygiene”) or (supervise$ adj “interdental cleaning”) or (supervise$ adj wood-stick$) or (supervise$ adj wood next stick$) or (supervise$ adj “interdental massage$”)).mp.

49. or/41-48
50. Health Behavior/
51. Patient Compliance/
52. Adolescent Behavior/
53. exp "Tobacco Use Cessation"/
54. Drinking Behavior/
55. Motivation/
56. (((behavior$ or behaviour$) and (change or changed or changing or modify or modified or modification)) or lifestyle).mp.
57. ((tobacco adj 4 cessation) or (smoking adj4 stop) or (smoking adj4 cessation) or (smoking adj4 quit$) or (smoker$ adj4 quit$) or (tobacco adj quit$)).mp.
58. (((feed adj back adj device$) or feedback) adj device$).mp.
59. ((attitude$ adj (oral adj health)) or (attitude adj (oral adj care)) or (attitude adj (dental adj health))).mp.
60. ((oral adj hygiene adj improve$) or (oral adj health adj improve$) or ("gingival health" adj improve$) or ("periodontal health" adj improve$) or ("periodontal condition" adj improve$) or (caries adj reduce$)).mp.
61. or/50-60
62. exp Obesity/
63. (obese or overweight or over-weight or weight or obesity or adiposity).mp.
64. or/62-63
65. (11 or 20 or 24) and 40 and (49 or 61 or 64)

The above subject search was linked to the Cochrane Highly Sensitive Search Strategy (CHSSS) for identifying randomised trials in MEDLINE: sensitivity maximising version (2009 revision) as referenced in Chapter 6.4.11.1 and detailed in box 6.4.c of the *Cochrane Handbook for Systematic Reviews of Interventions,* Version 5.1.0 (updated March 2011).

1. randomized controlled trial.pt.
2. controlled clinical trial.pt.
3. randomized.ab.
4. placebo.ab.
5. drug therapy.fs.
6. randomly.ab.
7. trial.ab.
8. groups.ab.
9. or/1-8
10. exp animals/ not humans.sh.
11. 9 not 10

Appendix 4. EMBASE via OVID search strategy

1. "Oral Health".mp.
2. exp mouth disease/
3. Halitosis/
4. ((dental or tooth or teeth or enamel or root$) and (((decay$ or caries or carious or white) adj spot$) or plaque or reminerali$ or demineral$)).mp.
5. (periodont$ or gingivitis or (gingival$ adj inflamm$) or (gingival$ adj bleed$) or (gingival$ adj pocket) or (periodont$ adj4 pocket) or (periodont$ adj4 attachment$) or (gingival$ adj attachment)).mp.
6. (stomatitis or (mouth adj4 ulcer$) or (oral adj4 ulcer$) or (oral adj4 candidiasis) or (aphthous adj4 ulcer$) or (mouth adj aphthae) or (oral adj aphthae)).mp.
7. (mucositis adj oral).mp.
8. ((tooth adj4 wear) or ((tooth or dental or teeth or enamel) and (erosion or abrasion))).mp.
9. (halitosis or (mouth adj odour) or (mouth adj odor) or (mouth adj malodour) or (mouth adj malodour) or (breath adj malodour)).mp.
10. ((bottle adj caries) or (bottle adj decay$) or (nursing and (decay or caries)) or (bottle adj decay) or ((early adj childhood) and (caries or decay))).mp.
11. or/1-10
12. Mouth Hygiene/

13. Toothpaste/
14. "Dentifrices".mp.
15. ((oral adj hygiene) or (mouth adj care) or (dental adj care) or (care adj teeth) or (mouth adj hygiene) or (plaque adj control$) or (plaque adj remov$)).mp.
16. (toothbrush$ or tooth-brush$).mp.
17. ((interdental adj clean$) or (inter-dental adj clean$) or (tooth adj clean$) or (teeth adj clean$) or (denture$ adj hygiene) or (denture$ adj clean$) or (tongue adj scrap$) or (chewing adj stick$) or (chewing adj gum$)).mp.
18. ((dental or tooth or teeth or interdental$ or inter-dental$) and floss$).mp.
19. ((dental adj plaque adj index) or (dental adj plaque adj indices) or (DMF$ adj index) or (DMF adj indices) or (dmf$ adj index) or (dmf$ adj indices) or (periodontal adj index) or (periodontal adj indices) or (oral adj hygiene adj index) or (oral adj hygiene indices)).mp.
20. or/12-19
21. Dentist/
22. "Dental Hygienist$".mp.
23. ((((((((((((((((dental adj4 practice$) or dental) adj4 clinic$) or dental) adj4 hospital$) or dentist$ or dental) adj4 therapist$) or dental) adj4 auxilliar$) or dental) adj4 nurse$) or dental) adj4 assistant$) or dental) adj4 health adj4 educator$) or dental) adj4 student$).mp.
24. or/21-23
25. cariogenic diet/
26. Drinking Behavior/
27. Carbohydrate diet/
28. Feeding Behavior/
29. vitamin deficiency/
30. (diet$ or nutrition or (food adj habit$) or (feeding adj habit$)).mp.
31. ((sugar adj intake) or (diet$ adj sugar) or (sugar$ adj food$) or (sugar$ adj beverage$) or (sugar$ adj drink$) or (carbonated adj beverage$) or (carbonated adj drink$) or (fizzy adj drink$) or (fizzy adj beverage$) or alcohol).mp.
32. ((baby adj food$) or (babies adj food$) or (baby adj drink$) or (babies adj drink$)).mp.
33. ((dinky adj feeder$) or ((baby or babies or infant$) and (comforter$ or soother$))).mp.
34. Cariogenic Agent/
35. Sucrose/
36. (wean$ or sucrose).mp.
37. ((supper adj drink$) or (supper adj bottle$) or (supper adj snack$) or (night$ adj drink$) or (night$ adj bottle$) or (night$ adj snack$) or (evening$ adj drink$) or (evening$ adj bottle$) or (evening$ adj snack$) or (bed$ adj drink$) or (bed$ adj bottle$) or (bed$ adj snack$) or (sleep$ adj drink$) or (sleep$ adj bottle$) or (sleep$ adj snack$)).mp.
38. (avitaminosis or (vitamin adj deficien$) or (mineral adj deficien$)).mp.
39. (diet$ or food$ or (fruit adj juice$) or sweet$ or confectionery or xylitol or sorbitol or (sugar adj4 free)).mp.
40. or/25-39
41. Dental health education/
42. Health Education/
43. Patient Education/
44. Health Promotion/
45. (instruct$ or advice or advise$ or educat$ or teach$ or train$).mp.
46. ((health$ adj promot$) and (dental or teeth or mouth or periodont$ or gingival$ or (oral adj health))).mp.
47. ((demonstrate$ adj4 toothbrush$) or (demonstrate$ adj4 "tooth brush$") or (demonstrate$ adj4 tooth-brush) or (demonstrate$ adj4 floss$) or (demonstrate$ adj4 "oral hygiene aid$") or (demonstrate$ adj4 "interdental cleaning") or (demonstrate$ adj4 wood-stick$) or (demonstrate$ adj4 "wood stick$") or (demonstrate$ adj4 "interdental massage$")).mp.
48. ((supervise$ adj toothbrush$) or (supervise$ adj floss$) or (supervise$ adj "oral hygiene") or (supervise$ adj "interdental cleaning") or (supervise$ adj wood-stick$) or (supervise$ adj wood next stick$) or (supervise$ adj "interdental massage$")).mp.
49. or/41-48
50. Health Behavior/
51. Patient Compliance/
52. Child Behavior/
53. smoking cessation.mp.
54. (Drinking and alcohol).mp.

55. Motivation/
56. (((behavior$ or behaviour$) and (change or changed or changing or modify or modified or modification)) or lifestyle).mp.
57. ((tobacco adj 4 cessation) or (smoking adj4 stop) or (smoking adj4 cessation) or (smoking adj4 quit$) or (smoker$ adj4 quit$) or (tobacco adj quit$)).mp.
58. (((feed adj back adj device$) or feedback) adj device$).mp.
59. ((attitude$ adj4 (oral adj health)) or (attitude adj4 (oral adj4 care)) or (attitude adj4 (dental adj health))).mp.
60. ((oral adj hygiene adj4 improve$) or (oral adj health adj4 improve$) or ("gingival health" adj4 improve$) or ("periodontal health" adj4 improve$) or ("periodontal condition" adj4 improve$) or (caries adj4 reduce$)).mp.
61. or/50-60
62. exp Obesity/
63. (obese or overweight or over-weight or weight or obesity or adiposity).mp.
64. or/62-63
65. (11 or 20 or 24) and 40 and (49 or 61 or 64)
The above subject search was linked to the Cochrane Oral Health Group filter for EMBASE via OVID:
1. random$.ti,ab.
2. factorial$.ti,ab.
3. (crossover$ or cross over$ or cross-over$).ti,ab.
4. placebo$.ti,ab.
5. (doubl$ adj blind$).ti,ab.
6. (singl$ adj blind$).ti,ab.
7. assign$.ti,ab.
8. allocat$.ti,ab.
9. volunteer$.ti,ab.
10. CROSSOVER PROCEDURE.sh.
11. DOUBLE-BLIND PROCEDURE.sh.
12. RANDOMIZED CONTROLLED TRIAL.sh.
13. SINGLE BLIND PROCEDURE.sh.
14. or/1-13
15. ANIMAL/ or NONHUMAN/ or ANIMAL EXPERIMENT/
16. HUMAN/
17. 16 and 15
18. 15 not 17
19. 14 not 18

Appendix 5. CINAHL via EBSCO search strategy

S1 (MH "Oral Health")
S2 (MH "Stomatognathic Diseases+")
S3 (MH Halitosis)
S4 ((dental or tooth or teeth or enamel or root*)) and ((decay* or caries or carious or "white spot" or plaque or reminerali* or demineral*))
S5 (periodont* or gingivitis or (gingival* N1 inflamm*) or (gingival* N1 bleed*) or (gingival* N1 pocket) or (periodont* N4 attachment*) or (gingival* N1 attachment))
S6 (stomatitis or (mouth N4 ulcer*) or (oral N4 ulcer*) or (oral N4 candidiasis) or (aphthous N4 ulcer*) or (mouth N1 aphthae) or (oral N1 aphthae))
S7 (mucositis N1 oral)
S8 ((tooth N4 wear) or ((tooth or dental or teeth or enamel) and (erosion or abrasion)))
S9 (halitosis or (mouth N1 odour) or (mouth N1 odor) or (mouth N1 malodour) or (mouth N1 malodor) or (breath N1 malodour) or (breath N1 malodor))
S10 ((bottle N1 caries) or (bottle N1 decay*) or (nursing and (decay* or caries)) or (bottle N1 decay) or ((early N1 childhood) and (caries or decay)))
S11 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10

S12 (MH "Oral Hygiene+")
S13 (MH Mouthwashes+)
S14 (MH Dentifrices+)
S15 ((oral N1 hygiene) or (mouth N1 care) or (dental N1 care) or (care N1 teeth) or (mouth N1 hygiene) or (plaque N1 control*) or (plaque N1 remov*))
S16 (toothbrush* or "tooth brush*" or tooth-brush*)
S17 ((interdental N1 clean*) or (inter-dental N1 clean*) or (tooth N1 clean*) or (teeth N1 clean*) or (denture* N1 hygiene) or (denture* N1 clean*) or (tongue* N1 scrap*) or (chewing N1 stick*) or (chewing N1 gum*))
S18 ((dental or tooth or teeth or interdental* or inter-dental*) and floss*)
S19 ((dental N1 plaque N1 index) or (dental N1 plaque N1 indices) or (DMF N1 indices) or (DMF N1 index) or (periodontal N1 index) or (periodontial N1 indices) or (oral N1 hygiene N1 index) or (oral N1 hygiene N1 indices))
S20 S12 or S13 or S14 or S15 or S16 or S17 or S18 or S19
S21 (MH Dentists+)
S22 (MH "Dental Auxiliaries+")
S23 (dentist or (dental N4 practice*) or (dental N4 clinic*) or (dental N4 hospital*) or (dental N4 hygienist) or (dental N4 assistant*) or (dental N4 health N4 educator*) or (dental N4 student))
S24 S21 or S22 or S23
S25 MH Diet
S26 (MH "Drinking Behavior+")
S27 (MH "Dietary Carbohydrates+")
S28 (MH "Eating Behavior+")
S29 (MH "Avitaminosis+")
S30 (diet* or nutrition or (food N1 habit*) or (feeding N1 habit*))
S31 ((sugar N1 intake) or (diet* N1 sugar*) or (sugar* N1 food*) or (sugar* N1 beverage*) or (sugar* N1 drink*) or (carbonated N1 beverages*) or (carbonated N1 drink*) or (fizzy N1 drink*) or (fizzy N1 beverage) or alcohol)
S32 ((baby N1 food*) or (babies N1 food*) or (baby N1 drink*) or (babies N1 drink*))
S33 ((dinky N1 feeder*) or ((baby or babies or infant*) and (comforter* or soother*)))
S34 MH Cariogenic Agents
S35 (MH Sucrose+)
S36 (wean* or sucrose)
S37 ((supper N1 drink*) or (supper N1 bottle*) or (supper N1 snack*) or (night* N1 drink*) or (night* N1 bottle*) or (night* N1 snack*) or (evening* N1 drink*) or (evening* N1 bottle*) or (evening* N1 snack*) or (bed* N1 drink*) or (bed* N1 bottle*) or (bed* N1 snack*) or (sleep* N1 drink*) or (sleep* N1 bottle*) or (sleep N1 snack*))
S38 (avitaminosis or (vitamin N1 deficien*) or (mineral N1 deficien*))
S39 (diet* or food* or (fruit N1 juice*) or sweet* or confectionery or xylitol or sorbitol or (sugar N4 free))
S40 S25 or S26 or S27 or S28 or S29 or S30 or S31 or S32 or S33 or S34 or S35 or S36 or S37 or S38 or S39
S41 MH Dental Health Education or MH Nutrition Education
S42 MH Health Education
S43 MH Patient Education
S44 (MH "Health Promotion+")
S45 (instruct* or advice or advise* or educat* or teach* or train*)
S46 ((health* N1 promot*) and (dental or teeth or mouth or periodont* or gingival* or (oral N1 health)))
S47 ((demonstrate* N4 toothbrush*) or (demonstrate* N4 "tooth brush*") or (demonstrate* N4 tooth-brush*) or (demonstrate* N4 floss*) or (demonstrate* N4 "oral hygiene aid*") or (demonstrate* N4 "interdental cleaning") or (demonstrate* N4 wood-stick*) or (demonstrate* N4 "wood stick*") or (demonstrate* N4 "interdental massage*"))
S48 ((supervise* N1 toothbrush) or (supervise* N4 "tooth brush*") or (supervise* N4 tooth-brush*) or (supervise* N1 floss*) or (supervise* N1 "oral hygiene") or (supervise* N1 "interdental cleaning") or (supervise* N1 wood-stick*) or (supervise* N1 "wood stick*") or (supervise* N1 "interdental massage*"))
S49 S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48
S50 MH Health Behavior
S51 MH Patient Compliance
S52 MH Adolescent Behavior
S53 MH Smoking Cessation or MH smoking cessation programs

S54 MH Drinking Behavior
S55 MH Motivation
S56 (((behavior* or behaviour*) and (change or changed or changing or modify or modified or modification)) or lifestyle)
S57 ((tobacco N4 cessation) or (smoking N4 stop*) or (smoking N4 cessation) or (smoking N4 quit*) or (smoker* N4 quit*) or (tobacco N1 quit*))
S58 ("feed back device*" or "feedback device*")
S59 ((attitude* N1 (oral N1 health)) or (attitude* N1 (oral N1 care)) or (attitude* N1 (dental N1 health)))
S60 ((oral N1 hygiene N1 improve*) or (oral N1 health N1 improve*) or ("gingival health" N1 improve*) or (caries N1 reduce*) or ("periodontal health" N1 improve*) or ("periodontal condition" N1 improve*))
S61 S50 or S51 or S52 or S53 or S54 or S55 or S56 or S57 or S58 or S59 or S60
S62 (MH Obesity+)
S63 (obese or overweight or over-weight or weight or obesity or adiposity)
S64 S62 or S63
S65 S11 or S20 or S24
S66 S49 or S61 or S64
S67 S40 and S65 and S66

The above subject search was linked to the Cochrane Oral Health Group filter for CINAHL via EBSCO:

S1 MH Random Assignment or MH Single-blind Studies or MH Double-blind Studies or MH Triple-blind Studies or MH Crossover design or MH Factorial Design
S2 TI ("multicentre study" or "multicenter study" or "multi-centre study" or "multi-center study") or AB ("multicentre study" or "multicenter study" or "multi-centre study" or "multi-center study") or SU ("multicentre study" or "multicenter study" or "multi-centre study" or "multi-center study")
S3 TI random* or AB random*
S4 AB "latin square" or TI "latin square"
S5 TI (crossover or cross-over) or AB (crossover or cross-over) or SU (crossover or cross-over)
S6 MH Placebos
S7 AB (singl* or doubl* or trebl* or tripl*) or TI (singl* or doubl* or trebl* or tripl*)
S8 TI blind* or AB mask* or AB blind* or TI mask*
S9 S7 and S8
S10 TI Placebo* or AB Placebo* or SU Placebo*
S11 MH Clinical Trials
S12 TI (Clinical AND Trial) or AB (Clinical AND Trial) or SU (Clinical AND Trial)
S13 S1 or S2 or S3 or S4 or S5 or S6 or S9 or S10 or S11 or S12

Appendix 6. PsycINFO via OVID search strategy

1. "Oral Health".mp.
2. "Stomatognathic Diseases".mp.
3. Halitosis.mp.
4. ((dental or tooth or teeth or enamel or root$) and (((decay$ or caries or carious or white) adj spot$) or plaque or reminerali$ or demineral$)).mp.
5. (periodont$ or gingivitis or (gingival$ adj inflamm$) or (gingival$ adj bleed$) or (gingival$ adj pocket) or (periodont$ adj4 pocket) or (periodont$ adj4 attachment$) or (gingival$ adj attachment)).mp.
6. (stomatitis or (mouth adj4 ulcer$) or (oral adj4 ulcer$) or (oral adj4 candidiasis) or (aphthous adj4 ulcer$) or (mouth adj aphthae) or (oral adj aphthae)).mp.
7. (mucositis adj oral).mp.
8. ((tooth adj4 wear) or ((tooth or dental or teeth or enamel) and (erosion or abrasion))).mp.
9. (halitosis or (mouth adj odour) or (mouth adj odor) or (mouth adj malodour) or (mouth adj malodour) or (breath adj malodour)).mp.
10. ((bottle adj caries) or (bottle adj decay$) or (nursing and (decay or caries)) or (bottle adj decay) or ((early adj childhood) and (caries or decay))).mp.
11. or/1-10
12. Oral Hygiene.mp.

13. (Mouthwash$ or mouthrinse$).mp.
14. (Dentifrice$ or toothpaste$).mp.
15. ((oral adj hygiene) or (mouth adj care) or (dental adj care) or (care adj teeth) or (mouth adj hygiene) or (plaque adj control$) or (plaque adj remov$)).mp.
16. (toothbrush$ or tooth-brush$).mp.
17. ((interdental adj clean$) or (inter-dental adj clean$) or (tooth adj clean$) or (teeth adj clean$) or (denture$ adj hygiene) or (denture$ adj clean$) or (tongue adj scrap$) or (chewing adj stick$) or (chewing adj gum$)).mp.
18. ((dental or tooth or teeth or interdental$ or inter-dental$) and floss$).mp.
19. ((dental adj plaque adj index) or (dental adj plaque adj indices) or (DMF$ adj index) or (DMF adj indices) or (dmf$ adj index) or (dmf$ adj indices) or (periodontal adj index) or (periodontal adj indices) or (oral adj hygiene adj index) or (oral adj hygiene indices)).mp.
20. or/12-19
21. Dentists/
22. Dental surgery/
23. ((((((((((((((((dental adj4 practice$) or dental) adj4 clinic$) or dental) adj4 hospital$) or dentist$ or dental hygienist$ or dental) adj4 therapist$) or dental) adj4 auxilliar$) or dental) adj4 nurse$) or dental) adj4 assistant$) or dental) adj4 health adj4 educator$) or dental) adj4 student$).mp.
24. or/21-23
25. (cariogenic adj4 diet$).mp.
26. (drinking adj4 (behavior or habit$)).mp.
27. (diet$ adj3 carbohydrates).mp.
28. "feeding behavior".mp.
29. Avitaminosis.mp.
30. (diet$ or nutrition or (food adj habit$) or (feeding adj habit$)).mp.
31. ((sugar adj intake) or (diet$ adj sugar) or (sugar$ adj food$) or (sugar$ adj beverage$) or (sugar$ adj drink$) or (carbonated adj beverage$) or (carbonated adj drink$) or (fizzy adj drink$) or (fizzy adj beverage$) or alcohol).mp.
32. ((baby adj food$) or (babies adj food$) or (baby adj drink$) or (babies adj drink$)).mp.
33. ((dinky adj feeder$) or ((baby or babies or infant$) and (comforter$ or soother$))).mp.
34. "Cariogenic Agents".mp.
35. (Sucrose or glucose).mp.
36. (wean$ or sucrose).mp.
37. ((supper adj drink$) or (supper adj bottle$) or (supper adj snack$) or (night$ adj drink$) or (night$ adj bottle$) or (night$ adj snack$) or (evening$ adj drink$) or (evening$ adj bottle$) or (evening$ adj snack$) or (bed$ adj drink$) or (bed$ adj bottle$) or (bed$ adj snack$) or (sleep$ adj drink$) or (sleep$ adj bottle$) or (sleep$ adj snack$)).mp.
38. (avitaminosis or (vitamin adj deficien$) or (mineral adj deficien$)).mp.
39. (diet$ or food$ or (fruit adj juice$) or sweet$ or confectionery or xylitol or sorbitol or (sugar adj4 free)).mp.
40. or/25-39
41. dental health education.mp.
42. ("Health Education" and counselling).mp.
43. Client Education/
44. Health Promotion/
45. (instruct$ or advice or advise$ or educat$ or teach$ or train$).mp.
46. ((health$ adj promot$) and (dental or teeth or mouth or periodont$ or gingival$ or (oral adj health))).mp.
47. ((demonstrate$ adj4 toothbrush$) or (demonstrate$ adj4 "tooth brush$") or (demonstrate$ adj4 tooth-brush) or (demonstrate$ adj4 floss$) or (demonstrate$ adj4 "oral hygiene aid$") or (demonstrate$ adj4 "interdental cleaning") or (demonstrate$ adj4 wood-stick$) or (demonstrate$ adj4 "wood stick$") or (demonstrate$ adj4 "interdental massage$")).mp.
48. ((supervise$ adj toothbrush$) or (supervise$ adj floss$) or (supervise$ adj "oral hygiene") or (supervise$ adj "interdental cleaning") or (supervise$ adj wood-stick$) or (supervise$ adj wood next stick$) or (supervise$ adj "interdental massage$")).mp.
49. or/41-48
50. Health Behavior/
51. patient compliance.mp.
52. ((adolescent or child) adj3 behavior).mp.
53. SMOKING CESSATION/
54. "drinking behavior".mp.

55. Motivation/ or Motivation training/
56. (((behavior$ or behaviour$) and (change or changed or changing or modify or modified or modification)) or lifestyle).mp.
57. ((tobacco adj 4 cessation) or (smoking adj4 stop) or (smoking adj4 cessation) or (smoking adj4 quit$) or (smoker$ adj4 quit$) or (tobacco adj quit$)).mp.
58. (((feed adj back adj device$) or feedback) adj device$).mp.
59. ((attitude$ adj (oral adj health)) or (attitude adj (oral adj care)) or (attitude adj (dental adj health))).mp.
60. ((oral adj hygiene adj improve$) or (oral adj health adj improve$) or ("gingival health" adj improve$) or ("periodontal health" adj improve$) or ("periodontal condition" adj improve$) or (caries adj reduce$)).mp.
61. or/50-60
62. exp Obesity/
63. (obese or overweight or over-weight or weight or obesity or adiposity).mp.
64. or/62-63
65. (11 or 20 or 24) and 40 and (49 or 61 or 64)
The above subject search was linked to the Cochrane Oral Health Group filter for PsycINFO via OVID:
1. exp clinical trials/
2. (clin$ adj25 trial$).ti,ab.
3. placebo$.ti,ab.
4. random$.ti,ab.
5. ((randomised adj controlled adj trial$) or (randomized adj controlled adj trial$)).mp.
6. (controlled adj clinical adj trial$).mp.
7. (random adj allocat$).mp.
8. ((singl$ or doubl$ or trebl$ or tripl$) adj25 (blind$ or mask$)).ti,ab.
9. (control$ adj4 trial$).mp.
10. (ANIMALS not HUMANS).sh.
11. or/1-9
12. 11 not 10

Appendix 7. ISI Web of Science search strategy

#1 (TS=ORAL HEALTH)
#2 (TS=STOMATOGNATHIC DISEASES)
#3 (TS=HALITOSIS)
#4. ((TS=dental or TS=tooth or Ts=teeth or TS=enamel or TS=root*) AND (TS=decay* or TS=caries or TS=carious or TS=white same TS=spot* or TS=plaque or TS=reminerali* or TS=demineral*))
#5 (TS=periodont* or TS=gingivitis or (TS=gingiva* same TS=inflamm*) or (TS=gingiva* same TS=bleed*) or (TS=gingival* same TS= pocket) or (TS=periodont* same TS=pocket) or (TS=periodont* same TS=attachment*) or (TS=gingiva* same TS=attachment))
#6 (TS=stomatitis or (TS=mouth same TS=ulcer*) or (TS=oral same TS=ulcer*) or (TS=oral same TS=candidiasis) or (TS=aphthous same TS=ulcer*) or (TS=mouth same TS=aphthae) or (TS=oral same TS=aphthae))
#7 (TS=mucositis same TS=oral)
#8 ((TS=tooth same TS=wear) or ((TS=tooth or TS=dental or TS=teeth or TS=enamel) and (TS=erosion or TS=abrasion)))
#9 (TS=halitosis or (TS=mouth same TS=odour) or (TS=mouth same TS=odor) or (TS=mouth same TS=malodour) or (TS=mouth same TS=malodour) or (TS=breath same TS=malodour))
#10 ((TS=bottle same TS=caries) or (TS=bottle same TS=decay*) or (TS=nursing and (TS=decay or TS=caries)) or (TS=bottle same TS=decay) or ((TS=early same TS=childhood) and (TS=caries or TS=decay)))
#11. #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10
#12 (TS=ORAL HYGIENE)
#13 (TS=MOUTHWASH* or TS= Mouthrinse*)
#14 (TS=DENTIFRICE* or TS=toothpaste*)
#15 ((TS= oral same TS=hygiene) or (TS=mouth same TS=care) or (TS=dental same TS=care) or (TS=care same TS=teeth) or (TS= mouth same TS=hygiene) or (TS=plaque same TS=control*) or (TS=plaque same TS=remov*))
#16 (TS=toothbrush* or TS=tooth-brush*)

#17((TS=interdental same TS=clean*) or (TS=inter-dental same TS=clean*) or (Ts=tooth same TS=clean*) or (TS=teeth same TS=clean*) or (TS=denture* same TS=hygiene) or (TS=denture* same TS=clean*) or (TS=tongue same TS=scrap*) or (TS=chewing same TS=stick*) or (TS=chewing same TS=gum*))
#18((TS=dental or TS=tooth or TS=teeth or TS=interdental* or TS=inter-dental*) and TS=floss*)
#19((TS=dental same TS=plaque same TS=index) or (TS=dental same TS=plaque same TS=indices) or (TS=DMF* same TS=index) or (TS=DMF same TS=indices) or (TS=dmf* same TS=index) or (TS=dmf* same TS=indices) or (TS=periodontal same TS=index) or (TS=periodontal same TS=indices) or (TS=oral same TS=hygiene same TS=index) or (TS=oral same TS=hygiene indices))
#20 #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19
#21 (TS=DENTISTS)
#22 (TS=dental surgery)
#23 ((((((((((((((((TS=dental same TS=practice*) or TS=dental) same TS=clinic*) or TS=dental) same TS=hospital*) or TS=dentist* or TS=dental hygienist* or TS=dental) same TS=therapist*) or TS=dental) same TS=auxilliar*) or TS=dental) same TS=nurse*) or TS=dental) same TS=assistant*) or TS=dental) same TS=health same TS=educator*) or TS=dental) same TS=student*)
#24 #21 or #22 or #23
#25 (TS=CARIOGENIC same TS= diet)
#26 (TS=DRINKING same (TS= BEHAVIOR or TS= habit*))
#27 (TS=diet same TS=CARBOHYDRATES)
#28 (TS=FEEDING same (TS=BEHAVIOR or TS=habit*))
#29 (TS=AVITAMINOSIS)
#30 (TS=diet* or TS=nutrition or (TS=food same TS=habit*) or (TS=feeding same TS=habit*))
#31 ((TS=sugar same TS=intake) or (TS=diet* same TS=sugar) or (Ts=sugar* same TS=food*) or (Ts=sugar* same TS=beverage*) or (TS=sugar* same TS=drink*) or (TS=carbonated same TS=beverage*) or (TS=carbonated same TS=drink*) or (TS=fizzy same TS=drink*) or (TS=fizzy same TS=beverage*) or TS=alcohol)
#32 ((TS=baby same TS= food*) or (TS=babies same TS=food*) or (TS=baby same TS=drink*) or (TS=babies same TS=drink*))
#33 ((TS=dinky same TS= feeder*) or ((TS=baby or TS=babies or TS=infant*) and (TS=comforter* or TS=soother*)))
#34 (TS=CARIOGENIC AGENTS)
#35 (TS=SUCROSE or TS=Glucose)
#36 (TS=wean* or TS=sucrose)
#37 ((TS=supper same TS=drink*) or (TS=supper same TS=bottle*) or (TS=supper same TS=snack*) or (TS=night* same TS=drink*) or (TS=night* same TS=bottle*) or (TS=night* same TS=snack*) or (TS=evening* same TS=drink*) or (TS=evening* same TS=bottle*) or (TS=evening* same TS=snack*) or (TS=bed* same TS=drink*) or (TS=bed* same TS=bottle*) or (TS=bed* same TS=snack*) or (TS=sleep* same TS=drink*) or (TS=sleep* same TS=bottle*) or (TS=sleep* same TS=snack*))
#38 (TS=avitaminosis or (TS=vitamin same TS=deficien*) or (TS=mineral same TS=deficien*))
#39 (TS=diet* or TS=food* or (TS=fruit same TS=juice*) or TS=sweet* or TS=confectionery or TS=xylitol or TS=sorbitol or (TS=sugar same TS=free))
#40 #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39
#41 (TS=HEALTH EDUCATION DENTAL)
#42 (TS=HEALTH EDUCATION)
#43 (TS=PATIENT EDUCATION)
#44 (TS=HEALTH PROMOTION)
#45 (TS=instruct* or TS=advice or Ts=advise* or TS=educat* or TS=teach* or TS=train*)
#46 (((TS=health* same TS=promot*)) and (TS=dental or TS=teeth or TS=mouth or TS=periodont* or TS=gingival* or (TS=oral same TS=health)))
#47 ((TS=demonstrat* same TS=toothbrush*) or (TS=demonstrat* same TS=tooth brush*) or (TS=demonstrat* same TS=toothbrush) or (TS=demonstrat* same TS=floss*) or (TS=demonstrat* same TS=oral hygiene aid*) or (TS=demonstrat* same TS=interdental cleaning) or (TS=demonstrat* same TS=wood-stick*) or (TS=demonstrat* same TS=wood stick*) or (TS=demonstrat* same TS=interdental massag*))
#48 ((TS=supervis* same TS=toothbrush*) or (TS=supervis* same TS= floss*) or (TS=supervis* same TS=oral hygiene) or (TS=supervis* same TS=interdental cleaning) or (TS=supervis* same Ts=wood-stick*) or (TS=supervis* same TS=wood same TS=stick*) or (TS=supervis* same TS=interdental massag*))
#49 #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48
#50 (TS=HEALTH BEHAVIOR)
#51 (TS=PATIENT COMPLIANCE)

#52 ((TS=ADOLESCENT or TS=child) same TS= BEHAVIOR)
#53 (TS=SMOKING CESSATION)
#54 (TS=DRINKING same (TS= BEHAVIOR or TS= habit*))
#55 (TS=MOTIVATION)
#56 (((TS=behavior* OR TS=behaviour*) AND (TS=change OR TS=changed OR TS=changing or TS=modify OR TS=modified OR TS=modification)) or TS=lifestyle)
#57 ((TS=tobacco same TS=cessation) or (TS=smoking same TS=stop) or (TS=smoking same TS=cessation) or (TS=smoking same TS=quit*) or (TS=smoker* same TS=quit*) or (TS=tobacco same TS=quit*))
#58 (((TS=feed same TS=back same TS=device*) or TS=feedback) same TS=device*)
#59 ((TS=attitude* same (TS=oral same TS=health)) or (TS=attitude same (TS=oral same TS=care)) or (TS=attitude same (TS=dental same TS=health)))
#60 (((TS=oral same TS=hygiene) same TS=improv*) or ((TS=oral same TS=health) same TS=improv*) or (TS="gingival health" same TS=improv*) or (TS="periodontal health" same TS=improv*) or (TS="periodontal condition" same TS=improv*) or (TS=caries same TS=reduc*))
#61 #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60
#62 (TS=OBESITY)
#63 (TS=obese or TS=overweight or TS=over-weight or TS=weight or TS=obesity or TS=adiposity)
#64 #62 or #63
#65 ((#11 or #20 or #24) AND #40 AND (#49 or #61 or #64))

Appendix 8. IADR and ORCA Conference Proceedings search strategy

Conference proceedings are available online at: http://iadr.confex.com/iadr/search.epl
(diet OR dietary behaviour OR dietary behavior)

Appendix 9. Dissertation Abstracts Online search strategy

diet and (behaviour or behaviour) and prevention and dental

WHAT'S NEW

Last assessed as up-to-date: 24 January 2012.

Date	Event	Description
16 April 2012	Amended	Additional tables linked to text.

HISTORY

Protocol first published: Issue 2, 2007

Review first published: Issue 3, 2012

CONTRIBUTIONS OF AUTHORS

Rebecca Harris (RH), Angela Ashcroft (AA) and Yvonne Dailey (YD) wrote the protocol. RH, Ana Gamboa (AG), YD, and AA were responsible for co-ordinating the review, screening search results, and screening retrieved papers against inclusion criteria. RH, AG, YD and AA were responsible for appraising the quality of papers. YD and AG were responsible for organising the retrieval of papers and writing to authors of papers for additional information. AG and YD were responsible for data management of the review including extracting data from papers and entering data into Review Manager. RH and YD were responsible for obtaining and screening data on unpublished studies. RH, AG and AA were responsible for the data extraction, quality assessment, interpretation and analysis of data. RH was responsible for writing the review. RH and AA conceived the idea for the review and RH was the guarantor for the review.

DECLARATIONS OF INTEREST

None.

SOURCES OF SUPPORT

Internal sources

- None, Not specified.

External sources

- British Orthodontic Society (BOS), UK.

The BOS have provided funding for the Cochrane Oral Health Group Global Alliance (*see* www.ohg.cochrane.org)

- British Society of Paediatric Dentistry (BSPD), UK.

The BSPD have provided funding for the Cochrane Oral Health Group Global Alliance (*see* www.ohg.cochrane.org)

- New York University (NYU), USA.

NYU have provided funding for the Cochrane Oral Health Group Global Alliance (*see* www.ohg.cochrane.org)

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The protocol also identified HealthStar (closed in 2000); ERIC (advised that retrieval rate would be small because of small numbers of randomised controlled trials); National Technical Information Service Database (NTIS) (advised that retrieval rate would be small because of small numbers of randomised controlled trials); and Database of Abstracts of Reviews of Effectiveness (DARE) (DARE reviews available in The Cochrane Library and overlap CENTRAL) to be included in electronic searching.

Controlled clinical trials were included in the protocol.

Change of title: 'One-to-one dietary interventions undertaken in a dental setting for a change in dietary behaviour and the prevention of dental caries and erosion'.

INDEX TERMS

Medical Subject Headings (MeSH)

Alcohol Drinking [prevention & control]; Carbonated Beverages [adverse effects]; Dental Care [*methods]; Dental Caries [prevention & control]; Dietary Carbohydrates [administration & dosage; adverse effects]; Feeding Behavior [*psychology]; Fruit; Oral Hygiene [education]; Randomized Controlled Trials as Topic; Vegetables

MeSH check words

Adolescent; Adult; Aged; Aged, 80 and over; Child; Humans; Middle Aged