

Methods for Combating Caries in Highly Susceptible Groups

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Review Article

Received: 21/09/2017

Accepted: 09/10/2017

Published: 16/10/2017

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Keywords: Oral health, Caries, Medication, Xerostomia, Dialysis, Bacteria, Medically compromised, Cancer

ABSTRACT

The number of people with special needs who need oral health services is rising dramatically. Many reports show that people with disabilities have more dental disease, more missing teeth and more difficulty obtaining dental care than other members of the general population.

“Special care” in oral health is required by many patients with a variety of medical, disabling or mental health conditions, where barriers exist to the provision of routine dental care.

Care for special-needs patients requires dental skills that are up to date. Services should be delivered with even more patience and empathy than are used with patients who are not developmentally disabled.

There are numerous challenges in providing oral health services for people with special needs that go beyond the normal considerations for other populations.

In this literature review, we tried to discuss several special care groups in regards to the oral condition that they might suffer from; either due to physical disabilities or due some medications or any other factors and how deals with these conditions.

INTRODUCTION

The Population of People with Special Needs is Increasing Dramatically

The number of people with special needs who need oral health services is rising dramatically. In this context, people with special needs refers to people who have difficulty maintaining good oral health or accessing oral health services because of a disability or medical condition ^[1].

Many reports show that people with disabilities have more dental disease, more missing teeth, and more difficulty obtaining dental care than other members of the general population ^[2-6]. People with disabilities also have a higher rate of dental caries than the general population, and almost two-thirds of community-based residential facilities report having inadequate access to dental care ^[7-9].

Untreated dental disease has been found in at least 25 percent of people with cerebral palsy; 30 percent of those with head injuries; and 17 percent of those with hearing impairment ^[3]. A study commissioned by the Special Olympics concluded that individuals with mental retardation have poorer oral health, more untreated caries, and a higher prevalence of gingivitis and other periodontal diseases than the general population ^[10]. People from lower socioeconomic groups and those covered by Medicaid have more dental disease and receive fewer dental services than the general population, and many individuals with disabilities are in these lower socioeconomic groups ^[2].

Special-care Dentistry

Special-care dentistry is the delivery of dental care tailored to the individual needs of patients who have disabling medical conditions or mental or psychological limitations that require consideration beyond routine approaches.

The special needs population has difficulty accessing dental care. In addition to the challenges a disability may prevent a patient in actually getting to a dental office, special-needs patients also often are unable to pay for dental care ^[11].

Special-needs Patients

“Special care” in oral health is required by many patients with a variety of medical, disabling or mental health conditions,

where barriers exist to the provision of routine dental care. The term ‘special care’ covers a wide range of conditions: systemic disorders, genetic disorders, mental and physical disabilities and patients undergoing medical treatment, where either the underlying condition or the treatment may complicate oral health care ^[12].

Many medical conditions puts the patient under the special need category, such as Down syndrome, cerebral palsy and phenylketonuria, dual diagnoses such as mental retardation and mental illness (schizophrenia, bipolar disorders and so forth), range-of-motion restrictions, these patients often have habits that may minimize their self-cleansing abilities (for example, pocketing food in the cheeks, habitual tongue movements, swallowing habits or mouth breathing). Caries management is a common dental treatment provided for those patients. Factors such as food impaction, regurgitation, xerostomia, and abrasion secondary to bruxing and grinding all affect the dentition and our ability to restore the teeth. In general, dentists to help patients maintain their dentition as long as their teeth can remain healthy and are not painful ^[13].

Providing Special Care in the General Dentistry Practice

Care for special-needs patients requires dental skills that are up to date. Services should be delivered with even more patience and empathy than are used with patients who are not developmentally disabled. The following tips illustrate that the practitioner needs special equipment less than compassion and tolerance:

- Use your pediatric care training.
- Take your time.
- Do a little of the procedure at a time.
- Practice show, tell and do.
- Establish a relaxed atmosphere.
- Establish a comfortable work area ^[13].

Patient Education

Educating and motivating patients to carry out effective daily oral hygiene can be challenging but immensely rewarding when efforts are successful. Some people with disability have no problems managing their oral hygiene. Others have difficulty because of lack of cognition to understand and remember what needs to be done, as in some learning disabilities; lack of manual dexterity, as in some physical disabilities; and lack of coordination, as in some neurological conditions.

Understanding how various conditions affect an individual’s ability to manage their oral hygiene and working with them to adapt the tools available for the task can make the difference between a person being reliant on a caregiver and being able to retain at least a degree of independence ^[14].

Challenges in Providing Oral Health Care for People with Disabilities

There are numerous challenges in providing oral health services for people with special needs that go beyond the normal considerations for other populations. These challenges require oral health professionals to have extraordinary training, empathy, patience and the desire to be successful ^[15].

Developing a Treatment Plan for a Person With Special Needs

The process of developing a dental treatment plan typically progresses through several phases. The first phase involves gathering data about the individual, which is then used to develop a diagnosis or set of diagnoses. A set of treatment recommendations are then determined and discussed with the patient and/or their caregiver. After discussion, a plan of treatment is developed to address the various diagnoses. The patient or caregiver must be informed about the benefits, risks, and alternatives to all the treatment options ^[15].

The Caries Management by Risk Assessment (CAMBRA) evaluation is a system for determining risk for developing dental caries that can apply to people with special needs ^[16]. The CAMBRA program begins with determining the patient’s relative risk for developing caries at present and in the future. To provide additional information about the patient’s oral environment, bacterial testing can be done as well. Several testing aids are available that measure relative titers of *Streptococcus mutans* and *Lactobacillus* ^[17]. A risk score from low to extremely high is then determined based on factors such as food intake and nutrition, home care, professional care, and the existing oral environment. These caries risk indicators are classified as either biologic risk factors or protective factors (both biologic and nonbiologic). Medications can then be prescribed based on the caries score from the indicators and bacterial testing.

Medical and other preventive products include antibacterial rinses, fluoride, xylitol mints and gum, sealants, and other adjuncts. Risk assessment, medical treatments, and health promotion strategies are all necessary parts of the preventive component of the treatment plan. These preventive strategies are described in greater detail elsewhere ^[18].

Examples of Special Care Groups

Older age group

The aging of the population combined with increased retention of natural teeth into old age means that clinicians now face a new caries challenge in older dentate patients. Many patients are living longer with more chronic medical conditions for which they are taking more medications. Minimal intervention dentistry (MID), a modern evidence-based approach to caries management in dentate patients, uses the medical model, whereby disease is controlled by the “oral physician” and an affiliated dental team. The main components of a geriatric approach to MID are assessment of the risk of disease, with a focus on early detection and prevention; external and internal remineralization; use of a range of restorations, dental materials and equipment; and surgical intervention only when required and only after disease has been controlled. There is increasing longitudinal evidence of these changing caries patterns in adult and older adult cohorts, with rampant caries often occurring in relatively short time periods^[19-21].

At any one point in time, not all older adults will have significant oral disease. However, many older adults will eventually experience significant oral disease as they become frailer, more dependent and more cognitively impaired. Oral disease management in MID involves the assessment and management of a diverse group of primary and modifying factors (diet, saliva, and fluoride or amorphous calcium phosphate [ACP]), integrated with an evaluation of the plaque–biofilm interface and the resultant dynamic oral disease process. For older patients, the practitioner may need to assess other modifying factors such as those discussed by Ettinger and Beck in the concept of rational dental treatment planning: social support, transportation, fear and anxiety, consent, restraint and perceived need^[22].

In particular, it is essential to assess the clinical pattern of demineralization and caries in the context of all modifying, primary (Saliva, Diet and Xylitol, Fluoride and Amorphous Calcium Phosphate) and biofilm factors (Chemoprophylactics). Because the processes of demineralization and remineralization are continuous, the mouth of an older adult who has active or rampant caries will exhibit areas with a range of demineralization, from low to high, and various degrees of cavitation^[22].

In deciding which preventive or therapeutic dental product to prescribe, the clinician must (1) review the oral diseases present and the greatest modifying factors, (2) try one product first, (3) add other products as needed over time, and (4) review and adjust the oral hygiene protocol as appropriate. In many older patients, the 2 main product categories to try first are those for saliva dysfunction and chemoprophylactics. Recaldent products may be helpful for dry mouth and prevention of caries. If the patient has high caries experience, then the use of a 5,000 ppm toothpaste or gel together with regular professional application of fluoride varnish is advised^[21].

Dialysis patients

As survival improves, more attention must be focused on Dental health, the incidence of a variety of dental conditions, such as periodontal disease, narrowing of the pulp chamber, enamel abnormalities, premature tooth loss and xerostomia, seems greater among dialysis patients. These problems may be related to a variety of factors, such as a relative state of immunosuppression, medications, renal osteodystrophy and bone loss, and restriction of oral fluid intake. Ensuring healthy dentition becomes increasingly important when a patient is a candidate for renal transplantation, given the immunosuppressive protocols that may further predispose to oral and possibly disseminated infection^[23].

In a 2-year follow-up study, Locsey et al.^[24] reported greater calculus formation, gingivitis, caries, atrophy of the alveolar bone, pathologic mobility proportional to bone resorption and tooth loss, pocket formation and necrotic teeth found under crowns, bridges and fillings.

Recommendations

1. Record the patient's medical history and medication list on the dental chart and review these documents at each visit.
2. The dialysis unit should notify the dentist once dialysis has been initiated.
3. Perform dental treatment of hemodialysis patients on non-dialysis days to ensure absence of circulating heparin.
4. Use local anesthetics with reduced epinephrine in all dialysis patients, as most are hypertensive.
5. See the patient for dental check-ups as regularly as would be the case if they were not undergoing dialysis.
6. For patients being considered for transplantation, complete all necessary dental care before the surgery.
7. Use antibiotic prophylaxis, if recommended by the patient's nephrologist^[23].

Radiotherapy

Long-term orofacial complications of radiotherapy to the head and neck region include particularly dry mouth (xerostomia), but loss of taste, limitation of jaw movement (trismus) and, less commonly, osteoradionecrosis (ORN) can be problems. Radiotherapy also complicates further surgery since the endarteritis in particular, impoverishes healing.

In children, cancer therapy may also result in long-term complications including enamel hypoplasia, microdontia, delay or failure of tooth development and eruption, and altered root formation, as well as maldevelopment in the craniofacial skeleton [25-31].

It is important to prevent and treat these orofacial complications of cancer therapy and this requires an oncological team that includes an experienced dental practitioner and hygienist. This is particularly important in children, since orofacial complications are up to three times as common as in adults having similar treatment [25,32].

Before Cancer Therapy

Oral health

Most patients (97%) need some attention to oral healthcare before starting radio- or chemotherapy for cancer [33]. The establishment and maintenance of oral health, and careful dental treatment planning are essential to minimise oral disease and the need for, and possible adverse consequences of, operative intervention [34-36].

Dental and periodontal disease should therefore be treated before cancer therapy and any oral infections controlled. Patients must achieve a good level of oral hygiene before radiotherapy or chemotherapy commence. Use of chlorhexidine and fluoride are recommended [37]. Chlorhexidine may reduce oral mutans streptococci and lactobacilli [38]. Dietary control and topical fluoride therapy are essential and must be continued for life or the duration of xerostomia.

Dyspraxia

Developmental dyspraxia is a neurological disorder that affects the way in which the brain processes information, impinging on the planning of what to do and how to do it and resulting in an impairment of the organisation of movement [39]. It is a common condition that impacts on the ability to carry out effective oral hygiene. Up to 10% of the population may show symptoms of dyspraxia, with around 2% being severely affected and with males four times more likely to be affected than females [40].

The Elements of Dyspraxia Likely to Affect Carrying out Oral Hygiene Tasks Include

1. Poor hand-eye co-ordination.
2. Lack of manual dexterity, particularly with two-handed tasks such as using cutlery, self-care and grooming, such as fastening clothes and brushing teeth.
3. Poor manipulative skills, such as difficulty with typing and writing.
4. Inadequate grasp, causing a poor 'pen grip'.
5. Difficulty planning and organising thought.
6. Poor memory, particularly short-term difficulty in following instructions, especially more than one at a time.
7. Difficulty with concentration leading to daydreaming, being easily distracted and slow to finish tasks all of which can impact on the provision of oral hygiene instruction and dental treatment [14].

All people with dyspraxia can improve their dexterity with encouragement and need help in practising simple tasks followed by step-by-step progress into more complex activities. This approach can be useful when providing oral hygiene instruction (OHI), provided it is coupled with patience and understanding [41].

The National Institute of Dental and Craniofacial Research Sets Out the Three Principle Reasons

1. Genetic or systemic disorders that affect oral health.
2. Undergoing medical treatments that cause oral problems.
3. Mental or physical disabilities that complicate oral hygiene or dental treatment.

Technical Aids and Methodical Instruction for People with Disability to Carry Out Effective Cleaning

People with disabilities often need extra help to achieve and maintain good oral health [42]. Technical aids and methodical instruction are often required to help people with disability to carry out effective cleaning without assistance [43]. Making a difference in the oral health of a person with a developmental or physical disability may go slowly at first, but determination can bring positive results and a significant impact on their quality of life [42].

Toothbrush adaptations

The most common tool for effective mechanical control of dental plaque is a toothbrush. The presence of physical and/or cognitive disabilities can create difficulties both in holding and manipulating a toothbrush. Various toothbrush adaptations are described in the literature to facilitate managing the brush for a diverse range of conditions [44].

Grasp manipulation and control

For patients whose main deterrent to personal self-care is related to grasp, manipulation or control of the brush, adaptations have been devised which include enlarged handles, hand attachments and elongated handles^[45]. The aim of the toothbrush adaptation is to provide a handle with a stable grip, whilst its shape enables the person to feel how to manipulate the brush in the mouth adequately during cleaning^[43]. For the limited shoulder or arm movement group of people, where there is limited arm and hand movement, the objective is to lengthen the handle of the brush with a material strong enough to maintain the brush in contact with tooth surfaces so as to apply sufficient lateral pressure to remove plaque effectively^[45].

Electric toothbrushes

A Cochrane review concluded that powered toothbrushes with a rotation-oscillation action are more effective than manual brushes in reducing plaque and gingivitis in the short-term and gingivitis in the long-term^[46,47]. They are reported to improve compliance and it is advised that the user should receive specific instruction to ensure correct use^[47].

Prevention

Prevention of oral disease is of paramount importance for individuals with disabilities, not only to prevent oral disease and its complications, but also to obviate the need for operative intervention and any associated difficulties^[48].

The three cornerstones of preventive dentistry for patients at high risk of developing caries are delivery of fluoride, good oral hygiene and well thought out diet^[43]. Ahlborg^[43] believes that, while it is often difficult to adapt or influence the specialised diet and there is variable success with strategies for oral hygiene for patients with disabilities, it is never impossible to add fluoride into a daily regime.

Fluoride

Fluoride can reduce caries^[49-51], fluoride is best applied to the whole surface of all teeth to have maximal protective effect, and this may be achieved by providing custom built carriers for each patient^[52] and using a gel containing 1% sodium fluoride placed in the carriers and applied to the teeth for 5 min per day^[53,54]. A 0.4% stannous fluoride gel used by patients for self-administration in customised carriers has also been recommended and may have the added advantage of reducing cariogenic bacteria^[55]. Brush-on application of fluoride has also been recommended^[56] as have sodium fluoride mouth rinses with chlorhexidine diacetate^[57].

Toothpaste is the most common way to introduce fluoride into the daily oral health regime. For individuals unable to tolerate toothpaste, a toothbrush dipped in 0.2% fluoride mouthwash can be used to provide daily fluoride application^[43].

Other caries reducing products

Other professionally-applied effective preventive measures include concentrated chlorhexidine varnishes (40% EC40) and 1% chlorhexidine with 0.1% thymol (Cervitec). Although subject to variability in patient response,^[58] both products inhibit *Streptococcus mutans* in interproximal plaque and saliva^[59,60] and may be applied around the gingival margin for sustained anti-cariogenic effects. Casein phosphopeptide-amorphous calcium phosphate complexes (CPP-ACP) have been shown to aid remineralisation in dental erosion^[60,61]. GC Tooth Mousse, which contains Recaldent© (CPP-ACP), is being suggested as particularly suitable for patients with a high caries risk due to xerostomia and low saliva pH. It can be applied daily using a dry gauze-protected finger or a cotton bud, making it suitable for use in patients who find cooperation difficult or who may be intolerant of fluoride trays^[62].

Dry Mouth (Xerostomia)

Dry mouth (xerostomia) is a complaint that is the most common salivary problem and is the subjective sense of dryness which may be due to:

1. Reduced salivary flow (hyposalivation) and/or
2. Changed salivary composition.

Patients who have chronically decreased salivary flow (hyposalivation) suffer from lack of oral lubrication, affecting many functions, and they may complain of dryness (xerostomia), and can develop dental caries and other infections (candidosis, or acute bacterial sialadenitis) as a consequence of the reduced defences^[63].

Causes

There are physiological causes of hyposalivation. Thus a dry mouth is common during periods of anxiety, due to sympathetic activity; mouth breathers may also have a dry mouth and advancing age is associated with dry mouth probably because of a reduction of salivary acini, with a fall in salivary secretory reserve.

Drugs

In older people complaining of xerostomia, are the cause. Indeed, the main causes of dry mouth are iatrogenic. There is

usually a fairly close temporal relationship between starting the drug treatment or increasing the dose, and experiencing the dry mouth. However, the reason for which the drug is being taken may also be important. For example, patients with anxiety or depressive conditions may complain of dry mouth even in the absence of drug therapy.

Irradiation

For malignant tumours in the head and neck region, such as oral cancer, can produce profound xerostomia. Other sources of irradiation such as radioactive iodine (¹³¹I) used for treating thyroid disease, may also damage the salivary glands, which take up the radioactive iodine.

Dehydration

As in diabetes mellitus, chronic renal failure, hyperparathyroidism, any fever or diabetes insipidus can cause xerostomia.

Diseases of salivary glands

It can also cause salivary dysfunction. These are mainly Sjögren's syndrome (a multisystem auto-immune condition); sarcoidosis; HIV disease; hepatitis C virus infection; liver diseases; and cystic fibrosis (mucoviscidosis) ^[63].

Complications of Hyposalivation**Dental caries**

It tends to involve smooth surfaces and areas otherwise not very prone to caries – such as the lower incisor region and roots. Hyposalivation may explain patients with uncontrollable recurrent caries, who are apparently complying with dietary advice ^[63].

Candidosis

It may cause a burning sensation or mucosal erythema, lingual filiform papillae atrophy, and angular stomatitis (angular cheilitis).

Halitosis**Ascending (suppurative) sialadenitis**

It presents with pain and swelling of a major salivary gland, and sometimes purulent discharge from the duct.

Keypoints for Dentists: Dry Mouth

Diagnosis is clinical but investigations may be indicated, including:

1. Blood tests (ESR and SS-A and SSB antibodies).
2. Eye tests (Schirmer).
3. Urinalysis.
4. Salivary flow rate tests (sialometry).
5. Salivary gland biopsy (labial gland biopsy).
6. Imaging.
7. Chest radiograph.
8. Sialography.
9. Scintiscanning.
10. Ultrasound.

Management of hyposalivation

Any underlying cause of xerostomia should if possible be rectified; for example, xerostomia producing drugs may be changed for an alternative, and causes such as diabetes should be treated. Patients should be educated into efforts to avoid factors that may increase dryness, and to keep the mouth moist.

Salivary substitutes may help symptomatically, a variety are available including

Drugs that may be effective at stimulating salivation may include the various cholinergic agents, notably pilocarpine. Given as ophthalmic drops placed intra-orally or as tablets, pilocarpine was effective in relieving symptoms and in improving salivation, in doses of up to 5 mg administered three times daily ^[64,65]. The tablet form of pilocarpine is, however, preferred as the dose is

better controlled, and the tablet is more convenient to use. Adverse effects of pilocarpine including sweating, rhinitis, headache, nausea and urinary frequency are mild, although pilocarpine is contraindicated in asthma, chronic obstructive airways disease or any bowel obstruction. Water or ice chips; frequent sips of water are generally effective.

As patients with objective xerostomia are at increased risk of developing caries it is important that they take a non-cariogenic diet and maintain a high standard of oral hygiene. The regular use of topical fluoride agents forms an important component of their long-term care. Salivation may be stimulated by using diabetic sweets or chewing gums (containing sorbitol or xylitol, not sucrose). Cholinergic drugs that stimulate salivation (sialogogues), such as pilocarpine, or cevimeline should be used only by a specialist. Oral complications should be prevented and treated ^[63].

Sugar in Medicines

Long-term use of sugar-based liquid medication is of particular concern as a caries risk in people with longstanding and chronic conditions ^[66].

Any dentate patient prescribed sugar-containing medicines should be warned of the risk of caries and advised to ask their doctor if a sugar-free preparation is available. If this request cannot be accommodated, appropriate caries preventive measures need to be put in place. Also, taking liquid medication through a straw, if its viscosity permits, reduces its potential for contact with the teeth ^[66].

More recently, the prolonged administration of glyceryl tri-nitrate (GTN) preparations for the treatment of ischaemic heart disease has been associated with localised caries in the area where the tablet is retained ^[67]. The tablet induces a rapid fall in pH and unusually, the lactulose in this form of preparation becomes considerably more cariogenic. Susceptible individuals who regularly use this form of GTN should be targeted for preventive advice ^[66].

Energy-rich food supplements prescribed to ensure adequate nutritional intake have a high carbohydrate and sugar content ^[68]. People are advised to sip them at frequent intervals throughout the day and, where there is a problem with swallowing, the liquid may be thickened to avoid the likelihood of its aspiration. This reduces oral clearance and increases the risk of caries yet further ^[69]. It is therefore important to check the contents for cariogenic sugars and ensure preventive measures are advised or instituted as required ^[66].

The impact of thirst and eating for consolation or comfort on oral health is often overlooked in patients with chronic conditions. This behaviour can result in caries and dental erosion because of frequent intake of acid sweets and drinks ^[43]. Management strategies include recommending sipping water at regular intervals during the day and chewing sugar-free gum, where possible ^[70,71].

suggested ways of reducing barriers to oral hygiene provision by professional carers include: the use of consolidated and organised care plans, the elements of which consider implementation of a single holistic assessment process; utilisation of oral risk assessment tools; development of team and multi-agency working; understanding, and safe address, of consent and restraint issues; access to oral hygiene equipment; support for the implementation and maintenance of aggressive preventive regimes; and robust systems for referral to oral healthcare services ^[72].

Implementing a Treatment Plan for the Operating Room

Having reviewed considerations of competency, time, and finances, a treatment plan for the hospital operating room can be made if the patient can't receive the treatment in a routine dental setting.

Restorative stability

Patients whose teeth have small to large carious lesions and normal saliva may have a choice of restorative material. Any teeth with compromise in hygiene or saliva may be limited to a glass ionomer restoration. The teeth to be restored should have adequate healthy tooth structure and be able to resist the occlusal forces. Posterior teeth that do not have anterior guidance are in jeopardy of excessive occlusal function and should be restored appropriately and, if tolerated, perhaps a night guard appliance should be used. For teeth that have deep grooves and have a risk factor for caries, sealants and varnishes should be considered. Glass ionomer sealants are easy to use, economical and efficacious.

Stainless steel crowns that are well adapted to the tooth are a good option for significantly broken down teeth, with large restorations that need coronal protection in teeth for which cast crowns are not suitable.

Restorations should use materials that can withstand the environment in which they reside. Composite restorations are best for restoring teeth with healthy enamel margins and moisture control. Less enamel in a preparation requires a restoration with physical retention, such as amalgam, or chemical retention, such as glass ionomer.

Fixed restorative options should be considered only when patients can maintain the hygiene and standard concepts of occlusion and when crown-to-root ratio is maintained. Keep margins of restorations supragingival and check occlusion. Fixed prosthodontic preparations under general anesthesia must be done with nasotracheal intubation or monitored anesthesia care in

order to manage occlusion and take impressions. Depending on location and cooperation of patients, the delivery of an appliance may be done with general anesthesia again, monitored anesthesia or possible oral sedation in a routine dental setting ^[73].

CONCLUSION

Given the dramatic increase in the number of people with special needs, the staggering health disparities in these populations, and the inability of the current oral health care systems to solve these problems, it is essential that oral health professionals become aggressively involved in partnership with policy makers, advocates, as well as general and social service professionals in addressing these issues. It will take an increased awareness of these problems and the engagement of many individuals and groups to create a world where people with special needs can also benefit from a lifetime of oral health.

REFERENCES

1. Paul G. New models for improving oral health for people with special needs. *CDA J.* 2005;33:625-633.
2. U.S. Department of Health and Human Services. *Oral Health in America: A Report of the Surgeon General.* Rockville. U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health. 2000.
3. *The Disparity Cavity: Filling America's oral health gap.* Oral Health America. 2000.
4. Oral health care of the mentally retarded and other persons with disabilities in the Nordic countries: Present situation and plans for the future. *Spec Care Dent.* 1995;15:65-69.
5. Feldman CA, et al. Special Olympics, special smiles: Assessing the feasibility of epidemiologic data collection. *s.l: J Am Dent Assoc.* 1997;128:1687-1696.
6. Waldman HB, et al. Use of pediatric dental services in the 1990s: Some continuing difficulties. *J Dent Child.* 2000;67:59-63.
7. Beck JD, et al. Oral health status in the United States: Problems of special patients. *J Dent Educ,* 1985;149:407-425.
8. White BA, et al. A quarter century of changes in oral health in the United States. *J Dent Educ.* 1995;59:19-60.
9. Waldman HB, et al. What if dentists did not treat people with disabilities? *J Dent Child.* 1998;65:96-101.
10. Horwitz S, et al. The health status and needs of individuals with mental retardation. *Special Olympics.* 2000.
11. <https://www.nidcr.nih.gov/OralHealth/OralHealthInformation/SpecialNeeds/SpecialCare.htm>
12. O'Connell, Anne. *Promoting the oral health of people with disabilities.* Dental Health Foundation. 2000.
13. Lawton L. Providing dental care for special patients: Tips for the general dentist. *J Am Dent Assoc.* 2002;133: 1666-1670.
14. Fiske A, et al. Access to special care dentistry, part 4. Education. *British Dent J.* 2008;205:119-130.
15. Glassman P, et al. Planning dental treatment for people with special needs. *Dent Clin N Am.* 2009;53: 195-205.
16. Young DA, et al. Curing the silent epidemic: Caries management in the 21st century and beyond. *J Calif Dent Assoc.* 2007;35:681-702.
17. Featherstone JDB, et al. Caries risk assessment in practice for age 6 through adult. *J Calif Dent Assoc.* 2007;35:703-713.
18. Glassman P. Oral health promotion with people with special needs. *Behavioral Dentistry.*
19. Chalmers JM. *The oral health of older adults with dementia.* University of Adelaide; 2001.
20. Thomson WM. Dental caries experience in older people over time: what can the large cohort studies tell us? *Br Dent J.* 2004;162:89-92.
21. Saunders RH, et al. Dental caries in older adults. *Dent Clin North Am.* 2005;49:293-308.
22. Ettinger RL, et al. Geriatric dental curriculum and the needs of the elderly. *Spec Care Dentist.* 1984;4:207-213.
23. Judith T, et al. The dental health status of dialysis patients. *J Can Dent Assoc.* 2002;68:4-8.
24. Locsey L, et al. Dental management of chronic hemodialysis patients. *Int Urol Nephrol.* 1986;18:211-113.
25. Dreizen S. Description and incidence of oral complications. *Natl Cancer Inst Monog.* 1990;9:11-15.
26. Welbury RR, et al. Dental health of survivors of malignant disease. *Arch Dis Child.* 1984;59:1186-1187.
27. Maguire A, et al. The long-term effects of treatment on the dental condition of children surviving malignant disease. *Cancer.* 1987;10:2570-2575.
28. Nunn JH, et al. Dental caries and dental anomalies in children treated by chemotherapy for malignant disease: A study in the north of England. *Intl Pediatr Dent.* 1991;1:131-135.

29. Purdell-Lewis DL, et al. Long-term results of chemotherapy on the developing dentition, caries risk and developmental aspects. *Commun Dent Oral Epidemiol.* 1988;16:68-71.
30. Sonis AL, et al. Dentofacial development in long-term survivors of acute lymphoblastic leukemia. *Cancer.* 1990;66:2645-2652.
31. Rosenberg SW. Chronic dental complications. *NCI Monogr.* 1990;9:173-178.
32. Stalman M, et al. Oral health in long-term survivors of childhood malignancies. *Dent Res.* 1986;65: 790-795.
33. Lockhart PB and Clark J. Pretherapy dental status of patients with malignant conditions of the head and neck. *Oral Surg.* 1994;77:236-241.
34. Sonis S, et al. Impact of improved dental services on the frequency of oral complications of cancer therapy for patients with non-head-and-neck malignancies. *Oral Surg Oral Med Oral Pathol.* 1988;65:19-22.
35. Keys HM and McCasland JP. Techniques and results of a comprehensive dental care program in head and neck cancer patients. *Intl Radiat Oncol Biol Phys.* 1976;1:859-865.
36. Greenberg MA, et al. The oral flora as a source of septicemia in patients with acute leukemia. *Oral Surg Oral Med Oral Pathol.* 1982;53:32-36.
37. Joyston-Bechal S, et al. Caries incidence, mutans streptococci and lactobacilli in irradiated patients during a 12 month preventive programme using chlorhexidine and fluoride. *Caries Res.* 1992;26:384-390.
38. Epstein JB, et al. The efficacy of chlorhexidine gel in reduction of *Streptococcus mutans* and *Lactobacillus* species in patients treated with radiation therapy. *Oral Surg Oral Med Oral Pathol.* 1991;71:1-5.
39. <http://www.dyspraxiafoundation.org.uk>
40. www.bbc.co.uk/health/conditions/dyspraxia2.shtml
41. <http://www.nclid.org>
42. Bethesda S. Practical oral care for people with developmental disabilities publication series. National Institute of Dental and Craniofacial Research; 2008.
43. Ahlborg B. Practical prevention. Disability and oral care. FDI World Dental Press, London; 2000.
44. Fiske J, et al. Managing the health of patients with physical disabilities. *Special Care Dentistry.* 2007;9:26.
45. Wilkins ME. Patients with special needs. Clinical practice of the dental hygienist. Lippincott, Philadelphia; 2004.
46. Robinson P, et al. Manual versus powered tooth brushing for oral health. *Cochrane Database Syst Rev.* 2005;1:CD002281.
47. Davies R. Manual versus powered toothbrushes: what is the evidence? *Dent Update.* 2006;33:159-162.
48. Scully C, et al. Special care in dentistry. Chapter 2. Churchill Livingstone, London; 2007.
49. Keene HJ, et al. Dental caries and *Streptococcus mutans* prevalence in cancer patients with irradiation-induced xerostomia, 1-13 years after radiotherapy. *Caries Res.* 1981;15:416-427.
50. Keene HJ and Fleming TJ. Prevalence of caries associated micro-flora after radiotherapy in patients with cancer of the head and neck. *Oral Surg Oral Med Oral Pathol.* 1987;64:421-426.
51. Keene HJ, et al. Cariogenic microflora in patients with Hodgkin's disease before and after mantle field radiotherapy. *Oral Surg.* 1994;78:577-581.
52. Horiot J, et al. Dental preservation in patients irradiated for head and neck tumors: A 10 year experience with topical fluoride and randomized trial between two fluoridation methods. *Radiother Oncol.* 1983;1:77-82.
53. Daly TE, et al. Prevention and management of dental problems in irradiated patients. *J Am Soc Prey Dent.* 1976;6:21-25.
54. Daly TE, et al. Management of problems of the teeth and jaws in patients undergoing irradiation. *Am J Surg.* 1972; 124:539-542.
55. Fleming TJ. Use of topical fluoride by patients receiving cancer therapy. *Curr Probl Cancer.* 1983;7:37-41.
56. Westcott WB, et al. Chemical protection against post-irradiation dental caries. *Oral Surg Oral Med Oral Pathol.* 1975;4:709-719.
57. Giertsen E, et al. In vivo effects of fluoride, chlorhexidine and zinc ions on acid formation by dental plaque and salivary mutans streptococcus counts in patients with irradiation-induced xerostomia. *Oral Oncol Eur J Cancer.* 1993;29B:307-312.
58. Ribero L, et al. The effect of different formulations of chlorhexidine in reducing levels of mutans streptococci in the oral cavity: Asystematic review of the literature. *J Dent.* 2007;35:359-370.

59. Twetman S and Petersson L. Efficacy of a chlorhexidine and a chlorhexidine-fluoride varnish mixture to decrease interdental levels of mutans streptococci. *Caries Res.* 1997;31:361-365.
60. Attin R, et al. Efficacy of differently concentrated chlorhexidine varnishes in decreasing Mutans streptococci and lactobacilli counts. *Arch Oral Biol.* 2003;48:503-509.
61. Reynolds E. Remineralization of enamel subsurface lesions by casein phosphopeptide-stabilized calcium phosphate solutions. *J Dent Res.* 1997;76:1587-1595.
62. Reynolds E. Anticariogenic complexes of amorphous calcium phosphate stabilized by casein phosphopeptides: A review. *Spec Care Dent.* 1998;18:8-16.
63. Felix C and Scully DH. Oral Medicine – Update for the dental practitioner: dry mouth and disorders of salivation. *British Dent J.* 2005;199:423-427.
64. Epstein JB and Schubert MM. Synergistic effects of sialogogues in management of xerostomia following radiation therapy. *Oral Surg Oral Med Oral Pathol.* 1987;64:179-182.
65. Fox PC, et al. Pilocarpine for the treatment of xerostomia associated with salivary gland dysfunction. *Oral Surg Oral Med Oral Pathol.* 1986;61:243-245.
66. Griffiths J and Boyle S. Holistic oral care - a guide for health professionals. Sections 2-3. Stephen Hancocks Ltd, London; 2005.
67. Walton A and Rutland R. Glycerol trinitrate preparation causes caries and changes to denture base material. *Br Dent J.* 1998;185:288-289.
68. Durrieu G, et al. Parkinson's disease and weight loss: A study with anthropometric and nutritional status. *Clin Autonomy Res.* 1992;2:153-157.
69. Hyland K, et al. Nutritional and dental health management in Parkinson's disease. *J Community Nurs Online.* 2000;14.
70. Ahlborg B. Treatment cushions in the dental care of patients with disabilities. *J Disabil Oral Health.* 2001;37-38.
71. Edgar W. Sugar substitutes, chewing gum and dental caries – a review. *Br Dent J.* 1998;184:29-32.
72. Fiske J, et al. Guidelines for the development of local standards of oral health care for people with dementia. *Gerodontology.* 2006;23:5-32.
73. Allen W. Treatment planning considerations for adult oral rehabilitation cases in the operating room. *Dent Clin N Am.* 2009;53:255-267.