Developing pathways for oral care in elders: challenges in care for the dentate the subject?

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Objective: This paper reviews potential age-associated risk factors for satisfactory oral function and oral disease to inform the development of care pathways for the older person.

Background: Alterations in dental status or both physical and biological change associated with age can impact on oral disease and oral function.

Materials and Methods: Older people tend to have fewer teeth and some are edentulous. Physical and biological changes in bodily function with age can also affect oral health care either directly or indirectly.

Results: Reductions in chewing ability impact on the foods people choose to eat because of perceived difficulty with chewing, with a potentially deleterious affect on dietary quality. This is worse in people with xerostomia where chewing and swallowing are impaired anyway. Change in the cell-mediated inflammatory response impacts on gingival and periodontal disease manifestation and progression. Sarcoopenia makes the physical act of toothbrushing more challenging. Caries remains a clinical problem that affects both the crowns and the roots of teeth. Coronal lesions tend to be around existing restorations where there is no evidence base about care/prevention.

Conclusion: The physical and clinical changes that occur with ageing require an altered pattern of care for older people which is adjusted to their disease risk and encourage diversity of foods consumption.

Keywords: ageing, oral health, age changes, gerodontology, caries, periodontal disease, nutrition.

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Introduction

Significant levels of oral disease in older populations\(^1\) pose a challenge to the dental professional in terms of the delivery of care. Both caries and periodontal disease continue to threaten oral integrity; superimposed on these we see challenges caused by tooth wear and long-term functional load on compromised teeth resulting in tooth fracture. The manifestations of these processes can either be a consequence of time with chronological change resulting in increased severity or there may be specific age-associated factors that increase disease risk and hence disease activity for older people.

The purpose of this article is to review potential age-associated risk factors for satisfactory oral function and oral disease to inform the development of care pathways for the older person.

Oral function and foods choice

Dietary change is required with increasing age because sarcopenia (loss of muscle bulk), a normal part of ageing, results in changed bodily metabolism. When there is less active muscle, the amount of energy the body consumes is reduced; this is reflected in European and WHO guidance about recommended levels of energy intake with increasing age; although interestingly, there is no commensurate reduction in the recommendations in the USA (Table 1).

There are, however, no changes in the requirements for protein and micronutrient intake, so while an older person needs less energy, they also need the same levels of micronutrients as before resulting in a need for a more ‘nutrient-dense’ diet. The message about eating less seems to be well recognised by older people, but the message
about altering the dietary pattern is less well recognised.

The dentition and our ability to chew foods to form a bolus for swallowing play a key part in foods choice. People who have fewer teeth are less likely to consume fruit, meat, beans and oils and more likely to include solid fat, alcohol and added sugars in their diet. Foods avoidance can pose a challenge for older people when whole fruit and raw vegetables are the most often avoided foods, particularly when these are a key component of a nutrient-dense diet to achieve adequacy of micronutrient intake with lower energy intake. This pattern of foods avoidance is seen in a variety of clinical scenarios including people who report ‘poor oral health’, periodontal disease, xerostomia, using dentures, having fewer anterior teeth and fewer posterior contacts. Rates of reported foods avoidance vary from study to study, but between 24 and 68% of subjects acknowledge some foods avoidance because of the mouth, teeth or dentures.

There are quite marked differences in diet between populations with an intact dentition (defined as 21 or more teeth), a compromised dentition or who are edentulous. Those who are edentulous are by far the worst off, but people with compromised dentitions also show significant variation. The dietary pattern associated with compromised oral function is low in fruits, vegetables and wholegrain and higher in solid fats intake with relatively normal levels of protein intake. Furthermore, there is limited evidence that reduced chewing efficiency affects foods comminution during bolus formation that in turn leads to altered patterns of foods absorption.

Oral function is by no means the sole determinant of foods choice and the value of food to the individual in terms of nutrition; however, teeth are an important covariable in a complex mix of physical, social and behavioural conditioning around foods selection and consumption. The special senses we associate with eating, taste and smell are also a critical part of food enjoyment. There is a general tendency for a reduction in taste acuity with increasing age for 4 of the 5 taste modalities. For some reason, the fifth modality ‘umami’ or savoury does not appear to be diminished with increasing age. Similarly, olfactory ability reduces with increasing age with high rates of failure of olfaction tests among older individuals. The combination of reduced taste acuity and olfaction makes eating a less pleasant experience, a bit like eating with a head cold all the time. Taste stimulants or intensive taste adjuvants may help people to enjoy their food more in older age. The final element of sense that changes with age is our preference for food texture, so foods that are crunchy or hard and those that require a longer chewing time are regarded as difficult while there is a preference for pulpy wet smooth and slimy textures.

One contributing variable to taste and foods enjoyment is saliva. All tastes and smells are dissolved in fluid in the taste and smell receptors prior to being detected. If there is an inadequate amount of saliva, taste is impaired. We now accept that in healthy, fit, unmedicated individuals, salivary secretory capacity is likely to be in excess of the amount of saliva we need for comfort and function; however, the secretory reserve is small and if challenged by polypharmacy or disease will relatively easily result in xerostomia. Ghezzi and co-workers demonstrated this clearly in an experimental model using an anticholinergic agent used to deliberately reduce
salivary flow and function during anaesthesia, with older people experiencing both more profound depression of salivary output and that the reduced output continued for an extended period of time.\(^{13}\)

The most common cause for xerostomia in older people is as a side effect of drugs used to manage the chronic diseases of old age including hypertension, irregular heart rhythm and depression among others. The effects of these drugs are cumulative because they impact on different parts of the salivary secretory pathway. On a practical basis, Nähr et al.\(^{14}\) showed clearly that the number of drugs that someone is taking is a useful proxy for their impact on salivary flow.

Low flow rates are not just associated with reductions in the amount of saliva, there is also evidence that there are lower levels of bicarbonate, calcium, phosphate and protein in the saliva of people with low levels of unstimulated flow compared with normal flow rates. Thus, the quality of the saliva is altered as well as the quantity, particularly its ability to buffer acid and to remineralise tooth tissue.\(^{15}\)

**Periodontal disease**

The consequences of periodontal disease are almost universally prevalent in populations of elders, although the levels of disease activity may be low. All of the evidence we have suggests that the severity of attachment loss increases with increasing age, but this does not mean that periodontal disease is either an ‘age change’ or is necessarily associated with ageing. We do see older people with very low levels of attachment loss, and there is varying evidence about the rate of progression of disease and the patterns of disease that present in this population.\(^{16-18}\)

The nature of the inflammatory response to a given challenge changes with increasing age. Using a classical ‘artificial gingivitis’ study with young and older volunteers who refrained from personal oral hygiene for 21 days, Holm-Pedersen et al.\(^{19}\) demonstrated the increased magnitude of inflammation in the older population (Fig. 1). They also showed that once the inflammatory trigger was removed (i.e. when the subjects started to brush their teeth again), recovery from these elevated levels of inflammation was as in the younger population with resolution within 4 to 5 days. Obviously, these oral changes reflect a similar pattern of inflammatory response systemically.

Inflammation per se plays a key role in the ageing process with a well-recognised pattern of elevation of inflammatory markers with increasing age alongside increasing immunosenescence.\(^{20,21}\) It is this ‘hyperinflammatory state’ that results in the exaggerated pattern of inflammatory response seen in older people. It appears that the underlying mechanism behind the alterations in inflammation is a result of derangement of the body’s normal redox defence mechanisms probably as a consequence of age-related, cumulative oxidative damage to a variety of genes and transcription factors involved in the redox pathway.\(^{20}\)

There is remarkably little evidence in the literature about optimum oral hygiene practices for the older person. The exposed architecture of the teeth changes with gingival recession resulting in the presence of concave rather than convex surfaces on all surfaces of some teeth. The alterations are particularly marked on molar teeth once the furcation starts to become exposed. There are a number of challenges to older people practicing optimal hygiene:

- **Vision**, presbyopia in old age necessitates people wearing spectacles to see close objects and yet most people brush their teeth when washing or bathing so are unlikely to be wearing glasses at the time. Furthermore, multifocal glasses have the ‘close focus’ section of the lens in the lower median field of each lens for normal reading. It is simply not biologically possible for someone to look into their own mouth using a mirror with the close focus area of such lenses.
- **Manual dexterity**, arthritic changes in hands and fingers can make the simple tasks of oral hygiene difficult, particularly if we are trying to encourage older people to use floss or other interdental cleaning aids that require a considerable degree of careful manipulation.

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**Figure 1** Changes in Gingival Index during an ‘experimental gingivitis study’ in young and old samples. The subjects refrained from toothbrushing at day 0 and recommenced brushing at day 21.\(^{19}\)

• Habit, toothbrushing is a ritual habit, a large majority of people report brushing twice per day and yet the outcome in terms of keeping teeth clean is lamentably poor. Hygiene habits need to be reviewed on a regular basis to try to optimise personal cleaning and limit the impact of age-associated change in dental architecture.

Sarcopenia is an often-overlooked factor. Loss of muscle bulk is one of the known musculoskeletal changes associated with ageing. The pattern of muscle fibre loss is also characteristic with the fast twitch and fine motor control being lost preferentially. This results not only in impaired dexterity but also in a tendency to fatigue at low levels of physical activity when fine muscle control is required, and this can result in fatigue being a limiting factor in compliance with personal oral hygiene. One approach to managing this problem is to accept that oral hygiene has two purposes, social cleanliness and disease prevention. For disease prevention, cleaning the teeth once every 48 h will be sufficient, so a targeted approach to hygiene can be adopted where the patient is encouraged to get their mouth socially clean on a twice daily basis but then focuses one quadrant of the mouth at each session to ensure maximal cleaning over a 48-h rotation. One question we often forget when trying to help people with oral hygiene is that they may get tired practicing it. If this is the case, then a strategy involving specific targeted cleaning at different times of the day may be beneficial.

Caries

Caries is a significant clinical problem in older people, and not only caries on the roots of teeth but also coronal decay. This latter is most likely to be in the form of Caries Associated with Restorations (CARS) rather than new carious lesions starting on enamel surfaces. There are very few data available about CARS we do know that it occurs in about 7% of adults and is more common in groups who would be regarded as having high caries risk so people who report infrequent dental attendance, not brushing their teeth and smoking\textsuperscript{22}. There are remarkably few data though about how to prevent CARS from occurring.

Intuitively, it would seem logical that restorations with marginal gaps would be more likely to develop caries in or around the gaps. The limited evidence that we have suggests that a marginal gap is NOT of significance in relation to the development of caries unless it is greater than 250 to 400 µm\textsuperscript{23,24}. This size of gap exceeds the ability of saliva to ‘hide’ the discrepancy with precipitated salivary proteins\textsuperscript{25}. The evidence that we have also suggests that CARS lesions tend to occur on tooth tissue proximal to the edge of the restoration rather than in the interface between restorative material and tooth commonly in association with marginal overhangs or other discrepancies acting as plaque stagnation areas\textsuperscript{26}.

It might be expected that incorporating fluoride into a restorative material would help to reduce caries activity at its periphery. Glass-ionomer cements (GICs) have natural and to all intent and purpose indefinite fluoride release, albeit it at low levels. Randall and Wilson undertook a narrative review of clinical trials of GICs to try to identify any caries inhibitory effects and were not able to find any\textsuperscript{27}. There are several possible reasons for this, either there was insufficient fluoride release for there to be a benefit, caries diagnostic methods were inaccurate, or there was a consistent design flaw in the studies that they were reviewing.

These studies were a mix of restorations placed to manage caries and to manage cervical wear in populations of adults with relatively low caries risk and who also received preventative advice, all of these would tend to counterbalance any impact of fluoride from the material as each trial was relatively small so would be underpowered to show a small effect.

McCombe and co-workers studied caries developing around GIC or composite resin restorations placed in patient with radiation-induced xerostomia. They found that further decay occurred in both study groups but that patients managed using GICs developed fewer new carious lesions\textsuperscript{28,29}. This suggests that in a high caries risk group, there is a small benefit from the fluoride release associated with a GIC.

Root caries is a clinical problem that is relatively unique to the older person, and it is found in increased proportions in men, in people from poor social backgrounds and in those who report infrequent dental attendance. It is more prevalent in populations living in long-stay care and is clearly associated with poor hygiene, the use of a removable partial denture and frequency of sugars intake. Even sugar used to sweeten beverages is of significance. The detailed epidemiology of caries I covered elsewhere\textsuperscript{1}.

One further concern in older people is the use of medicines with prolonged oral clearance (POC) which are either acidic or contain sugars as a flavouring/preservative. Baqir and Maguire

showed that regular and long-term POC medicine use was higher in ‘old’ older people, particularly among women, and prescribed medicines represent bulk of POC medicine use (9.8%). Twenty-eight percent of POC prescriptions were sugars containing oral liquids with drugs prescribed generically being less likely to be sugars-free. Most drugs are available in sugars-free formulation, but there is no compulsion to prescribe the sugars-free versions for older adults, while in contrast, there is for children, and sugars-containing drugs are cheaper than their sugars-free counterparts. In addition to the sugars content, it should be remembered that many drugs are also acidic or have a potential to cause dry mouth.

Conclusions

The older dentate subject is becoming more prevalent internationally and presents a variety of different challenges to the dentist that include variation in disease patterns as well as differences in physiological requirements for health as a consequence of age-related change in metabolism and body composition. The dentist needs to be aware of the altered requirements of the older person and altered disease risk to allow for the development of effective are pathways for this age group.

Conflicts of interest

None declared.


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