

Consensus on root caries

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Public health aspects of root caries

The number of people aged 80 or over is expected to triple by 2050, from 137 million in 2017 to 425 million in 2050 in the world. Aging population is projected to have a profound effect on the health care and many countries are likely to face in the coming decades (United Nations Report, 2017).

Root caries is one of the major and preventable global oral health concerns in ageing population (Petersen et al., 2005; Hariyani et al., 2017; 2018). However, this disease might be underrated and misdiagnosed in clinical practice.

Despite the decrease in coronal caries in childhood, untreated root caries increases dramatically in aging population (Kassebaum et al. 2015), which can result in tooth loss if not managed. The number of retaining teeth can affect nutritional status in older people which in turn can be associated with overall health and quality of life (Friedman and Lamster, 2016). Therefore, increasing awareness among clinicians to detect and manage root caries at early stage would enhance the overall quality of life in older population.

Root caries and clinical stages

The clinical criteria for root caries have an impact on describing root caries whether they are active or arrested (inactive). Active root caries is characterised as soft or leathery, rough, and light brown or yellowish, however, it should be noted that colour is not a good indicator with regards to severity of root caries (Baysan et al., 2001; Baysan and Lynch, 2004; Beighton et al., 1993; Ekstrand et al., 2008; Papas et al., 2007).

In this respect, the arrested root carious lesions are defined as hard, smooth lesions with a distance of >1-2 mm from the nearest gingival margin and require no further treatment (Beighton et al., 1993) unless aesthetics would be a

concern. In terms of the degree of remineralisation or arrestment, root caries is either completely remineralised through body lesion or partially remineralised with considerable mineral contents on lesion surface.

Previously, Baysan and Lynch (2004) introduced a descriptive index (Root Caries Severity Index, RCSI) with respect to both Beighton (1992) and Lynch (1994) findings. The RCSI subdivided active lesions with a leathery texture into three categories, bearing in mind the accessibility for self-cleaning, cavitation, and lesion size as follows:

Score 0: Hard structure as normal adjacent sound dentine.

Score I: Leathery and approaching a 'Hard' texture, and easily cleansable.

Score II: Leathery, shallow cavitated, and where the surface of the exposed sound dentine could easily be maintained plaque-free.



Figure 1. An example of root caries in Score II which is mostly seen in clinical practice-Photo by Dr Baysan

Score III: Leathery where pulpal integrity is judged to be at risk, difficult to maintain plaque-free, cavitated, and large.

Score IV: Soft structure.



Figure 2. Root carious lesions with different clinical severity-Photo by Dr Baysan

Management of root caries

There are two main approaches for the management of root caries; non-invasive/minimally invasive and restorative. The latter approach remains clinically challenging. This is due to high organic content of root dentine, close proximity to gingivae and dental pulp, difficulty in obtaining direct access in some cases and moisture control. Therefore, the strategy of managing root caries by caries removal and the subsequent restoration of the tooth is far from ideal in terms of efficacy, practicality, prognosis, cost, and patient comfort.

In this respect, data from clinical studies demonstrated that survival rate of restorations on root caries was between 65% and 90% up to two years (Hu et al., 2005; Lo et al., 2006; Gil-Montoya et al., 2014). Interestingly, Hayes et al., (2014) in their systematic review reported the lack of adequate evidence to recommend any restorative material for the management of root caries.

Therefore, there is clearly an urgent need to evolve and justify alternative effective strategies. Preventive treatment regimens for root caries might be considered to have a better long-term prognosis than restorative approaches. However,



Figure 3. Typical noncavitated root carious lesion

cavitated root caries are less likely to reverse from active to inactive status compared to non-cavitated lesions (Baysan et al., 2001; Sleibi et al., 2021). Interestingly, less mineralised dentine has limited ability to provide a favourable foundation for remineralisation (Wefel et al., 1995). It might also be related to the difficulty in keeping these cavitated lesions free from micro-organisms (Baysan et al., 2001). Therefore, early detection of root carious lesions when they are non-cavitated and strategies to promote remineralisation with inhibiting demineralisation are paramount for the management of root caries.

In this respect, Minimally Invasive Dentistry (MID) has widely been implemented to manage root caries including control of dietary carbohydrate intake, improvement of plaque control (active biofilm control), antimicrobial agents such as gels containing sodium hypochlorite, chewing gums, different concentrations and types of fluoride containing toothpastes with or without bioglass, fluoridated water, salt or milk, professionally-applied topical fluoride (gels, varnishes, solution of silver diamine fluoride), arginine-based toothpastes, amorphous calcium phosphate and casein phosphopeptide (ACP-CPP), mouthrinses, and ozone applications with or without fluoride applications (Burgess 2002; Baysan 2002; Sleibi 2019; Sleibi et al., 2021).

Fluoride can be delivered at community levels i.e., fluoridated water, milk and/or salt and at individual levels i.e., professional and/or self-care applications (Burgess 2002).

When the restoration is required, Atraumatic Restorative Treatment using glass ionomer cements can be considered as these lesions are not capable to be reversed to hard lesions by the employment of remineralisation strategies.

Consensus statement on root caries

9th ConsEuro Congress in Berlin in June 2019, the European Federation of Conservative Dentistry (EFCD), the European Organization for Caries Research (ORCA), and the German Association of Operative Dentistry (DGZ) conducted a joined Delphi workshop to address the question of '*How to Intervene in the Caries Process in Older Adults: A Joint ORCA and EFCD Expert Delphi Consensus Statement*'. (Paris et al., 2020).

In preparation of this consensus, a systematic review on the management of root caries was also performed (Meyer-Lueckel et al., 2019).

Management strategies for root caries Non-Invasive Interventions

Non-invasive approaches for the management of root caries target the aetiological factors affecting

the lesion process i.e., diet, removal of biofilm, promoting remineralisation and inhibiting demineralisation. Therefore, many non-invasive strategies target the patient level care and/or the entire oral cavity. Individual root carious lesions can additionally be treated with local topical application such as varnishes containing sodium fluoride.

Recommendations

- Oral hygiene instructions using a standard fluoridated (1,450 ppm) toothpaste would be recommended for accessible root carious lesions. Careers also need to be involved in this care.

Strength of recommendation: moderate;
agreement: 88%; **median:** 10

- In aging population, high concentration of sodium fluoride containing toothpaste (5,000 ppm) should be preferred over regular toothpaste (1,450 ppm) for increased root caries susceptibility with or without active lesions.

Strength of recommendation: moderate;
agreement: 88%; **median:** 10

- In older adults with increased root caries susceptibility and/or active root lesions, dental varnishing containing high concentration of fluoride (>20,000 ppm) can be applied.

Strength of recommendation: weak;
agreement: 88%; **median:** 10

- Active root carious lesions can be treated with silver (diamine) fluoride (SF >30%). **Strength of recommendation:** weak; **agreement:** 80%; **median:** 10

It should be noted that the following recommendation was discussed in the consensus meeting however this recommendation was later rejected due to missing acceptance in the Delphi:

- In older adults with increased susceptibility of root caries, dental varnish containing chlorhexidine ($\geq 1\%$) can be considered.

Strength of recommendation: weak;
agreement: 48%; **median:** 7

Micro-Invasive Interventions

Micro-invasive interventions such as sealing methods are widely used to prevent and manage enamel caries lesions.

Due to lack of scientific evidence regarding their application on root caries or dentine, no recommendation was made.

Invasive Interventions

Invasive approaches to manage cavitated root carious lesions involve at least partial removal of diseased tissue and restoration of the resultant defect by alloplastic materials such as resins, metals, or cements.



Figure 4. These types of lesions require restorative approaches-Photo provided by Dr Baysan

These measures usually aim to alleviate the symptoms of the lesion process. The restorative materials used are currently inert and needs to be accompanied with non-invasive interventions to treat the underlying disease process.

It should be noted that restorative treatments for root carious lesions may have poor prognosis compared to coronal restorations due to the reasons mentioned previously (especially in high-risk/multi-factorial situations such as patients with dry mouth). Therefore, an assumption that a restoration improves oral health quality is not acceptable and needs to be critically evaluated.

Recommendations

- Active and cavitated root lesions that are not capable of being arrested by non-invasive measures, therefore restorative strategies need to be considered.

Strength of recommendation: moderate;
agreement: 92%; **median:** 10

- Composite resin, resin-modified or conventional glass-ionomer restorations can be considered depending on aesthetics and moisture control.
Strength of recommendation: moderate;
agreement: 96%; **median:** 10
- In case of compromised moisture control and handling concerns, glass-ionomer cements may be preferable.
Strength of recommendation: weak;
agreement: 84%; **median:** 10
- Atraumatic restorative technique may result in high failure rates than conventional restorative techniques, however this technique can be applied in cases of difficulty in access and dependent patients.
Strength of recommendation: moderate;
agreement: 88%; **median:** 10

As a conclusion, the scientific evidence for the treatment of root caries in older adults is relatively scarce when compared to the treatment of children and adults with coronal caries. Therefore, many of the consensus recommendations are based on weak evidence. Further research is required in this field.

Summary

Active root carious lesions can be managed by non-invasive/minimally invasive strategies according to their location and lesion depth when the reversal of lesions can be achieved (Nyvad et al., 1999). Therefore, early detection of these lesions is crucial. Studies reported that non cavitated lesions are more likely to reverse and arrested when compared to cavitated lesions (Baysan et al., 2001; Baysan 2002; Sleibi et al., 2021).

The aetiology of dental caries is similar in all age groups, however pathogenic and protective factors with patients' abilities might be differently weighted in aging population. However, management strategies and concepts for root caries are challenging due to high organic content of root dentine, close proximity to gingivae and dental pulp, difficulty in obtaining direct access in some cases and moisture control. The scientific evidence for root caries is still scarce.

As a conclusion, a tailored approach for the management of root caries in older population by considering the individual physical and mental abilities as well as requirements and expectations would be recommended to optimise quality of life. Further evidence with respect to early detection and management of root caries is required.

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