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Guidance on posterior resin composites: Academy of Operative Dentistry - European Section

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ABSTRACT

There have been many developments in operative dentistry in recent years, including a progressive shift to the use of resin composites, rather than dental amalgam, in the restoration of posterior teeth. This shift allows the adoption of minimal intervention approaches, thereby helping to conserve and preserve remaining tooth tissues and structures. This paper presents the position of the Academy of Operative Dentistry European Section (AODES) in relation to posterior resin composites. The AODES considers adhesively bonded resin composites of suitable composition and properties to be the ''material of choice'' for use in direct minimal intervention approaches to the restoration of posterior teeth. In so doing, the AODES emphasises the importance of the practice of evidence-based minimal intervention dentistry, including the use of refurbishment and repair techniques to extend the longevity of restorations. Guidance, based on best available evidence, has been made in relation to certain aspects of resin composite placement techniques in posterior teeth.

Introduction

Operative dentistry remains the mainstay of dental practice. It accounts for a large element of the oral healthcare provided by dental practitioners on a daily basis. Much of this care comprises the prevention and diagnosis of caries, the restoration of diseased and damaged teeth, and the monitoring and care of teeth previously restored. The replacement of defective restorations continues to be a very common procedure.

Traditionally, in most countries of the world, dental amalgam has been the material most commonly used for the restoration of posterior teeth affected by caries. The

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popularity of dental amalgam stems from practitioners' familiarity with its handling, ease of placement, predictable performance in clinical service and low cost.[1] However, dental amalgam suffers the major limitation, amongst others, that cavities destined to be restored with this material invariably have to be modified, at the expense of sound tooth tissue, to provide necessary resistance form and mechanical retention. Without reliance on modern approaches to prevention, the traditional, widespread use of dental amalgam has, in many countries, created a phenomenon known, in particular in the UK, as the ''heavy metal generation'' – the cohort of ageing patients who received many extensive restorations of amalgam in the 1970s and 80s, during the so-called ''drill and fill'' era.[2] Such patients present a significant and growing challenge clinically, with ever-increasing costs associated with the maintenance of their restored teeth by means of replacement restorations, and more advanced forms of care, including endodontic treatments and crownwork, as indicated clinically.

In contrast to the use of dental amalgam, the use of adhesively bonded resin composite materials, which are increasingly found to perform as well as dental amalgam in clinical service, allows the adoption of minimal intervention approaches to the restoration of posterior teeth.[3] This, together with the capacity to repair posterior resin composites in ways which are not possible with dental amalgams, helps conserve and preserve tooth tissues, let alone provide more biomechanically-favourable restored tooth units.[4,5] The main disadvantages associated with the use of resin composites in the restoration of posterior teeth include contraction on polymerisation and relatively long placement times, which may extend to nearly twice the time taken to complete an equivalent procedure using dental amalgam. However, the use of careful application techniques may largely eliminate the potentially damaging effects of polymerisation contraction, and when considering placement times, it is to be remembered that completed posterior resin composites are typically finished to a much higher standard than a newly placed restoration of dental amalgam.[6]

Recently, the United Nations Environmental Programme has put in place arrangements – the Minamata Treaty – for a phase-down in the use of dental amalgam as part of an overall objective to reduce environmental mercury levels.[7] The implementation of the arrangements set out in the Minamata Treaty will necessitate new thinking and approaches in the practice and teaching of operative dentistry, which is anticipated to accelerate the rate of shift to the use of resin composites in restoration of posterior teeth.[8,9] Indeed, the Minamata Treaty may be considered to signal the beginning of the end for dental amalgam. A similar decision was published by the European Commission in July 2012.[10]

Posterior resin composites: the evidence

Lingering scepticism in relation to the suitability of resin composites for the restoration of posterior teeth is not supported by the growing body of relevant evidence. In a comprehensive review of clinical outcome studies, Manhart et al. reported a mean annual failure rate of 2.2% for direct posterior resin composites, in comparison to an annual failure rate of 3% for restorations of dental amalgam.[11] The Nijmegen group has for several years followed a large cohort of patients in whom posterior resin composites have been placed in a primary care setting.[3,12] They have published 10- and 12-year outcome data demonstrating comparable longevity for restorations of dental amalgam and resin composites, including large restorations of both materials. In low caries risk patients the performance of posterior resin composite restorations was superior to that of dental amalgam. Large composite restorations showed annual failure rates of 1%. In high caries risk patients there was a tendency for more failures of the posterior resin composites, significantly for smaller restorations, and annual failure increased to more than 3%. Similar findings were obtained in two clinical trials comparing restorations of dental amalgam and resin composites placed in the management of primary caries in children.[13,14] Analysis of insurance data from the northwest USA revealed that within a group of more than 300,000 patients with restorations placed during 1993–1999, the probability of survival of an amalgam restoration was 94% over five years if the patient was followed up by the same dentist. The corresponding figure for posterior resin composites was 93%. When patients changed dentist, the probability of survival of both amalgam and resin composite over the five-year period dropped to 60%.[15] A Brazilian group has published data, based on long observation times (up to 22 years), demonstrating annual failure rates of 1–3% with the use of resin composites in the restoration of posterior teeth.[16,17] A recently-published prospective study of posterior resin composite restorations placed by several practitioners in a large group of children and young adults in Denmark found an annual failure rate of 2% over the eight years follow-up period.[18] A study of similar design demonstrated a 2.9% annual failure for resin composite restorations, compared to 1.6% for restorations of dental amalgam after 4.6 years observation.[19] These data suggest, contrary to thinking typically based on the findings of cross-sectional surveys,[20] that the overall success of posterior resin composite restorations may be found to match, and in specific situations exceeds that of restorations of dental amalgam, even in patients with a relatively high caries risk.[3,12] A more recent investigation of replacement rates for restorations placed with US Navy and Marine Corps Personnel revealed no increased risk of restoration replacement when comparing posterior resin composite restorations to those of amalgam.[21]

In the management of specific conditions, including cracked tooth syndrome, often found in patients with extensive restorations of dental amalgam, and tooth wear, the use of resin composites has been found to offer many advantages, in particular when the use of a resin composite strengthens the remaining tooth structure and avoids the need to resort to more invasive and costly procedures such as the provision of a crown.[22,23] Furthermore, surveys of the teaching in dental schools over the past 20 years have demonstrated a progressive shift in countries across the world to the use of posterior resin composites in an ever-expanding range of situations.[24–38] In most European and, it is understood, many other countries around the world, dental students now gain greater experience in the placement of resin composites than amalgam in the restoration of posterior teeth.