# Clinical diagnosis of recurrent caries

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The term "recurrent caries" denotes caries of the tooth at the margin of restorations. The phenomenon has been known since the early days of restorative dentistry,[1] and it was the basis for the extension-for-prevention concept of G.V. Black's well-established principles of cavity preparation. Since tooth brushing was the only recognized way to prevent caries at that time, an obvious solution to prevent recurrent caries was to place the cavosurface margin in a location where the toothbrush might have had access to the plaque. Present-day knowledge calls for approaches other than removal of intact dental tissues to minimize the risk of developing recurrent caries.

**Repair and refurbishing of restorations save tooth structure and increase the life span of the restoration.**

Recurrent caries occurs after a restoration has been functional for some time. The term typically is used in North America. Because this type of carious lesion develops after the initial caries has been removed and replaced by a restorative material, the term "secondary caries" is used more commonly than "recurrent caries" in European languages, including English, for caries that has developed adjacent to margins of restorations.

In this article, I review available information related to recurrent caries, including its relative frequency as a reason for the replacement of different types of restorations, the location of the lesions, the bacteriology of the lesions, the criteria for the clinical diagnosis of recurrent caries and treatment of the lesions. In this context, it is important to differentiate recurrent caries from primary caries and remaining caries. Primary caries starts and progresses on an intact, previously unrestored tooth

## ABSTRACT

**Background.** The clinical diagnosis of recurrent caries is the most common reason for replacement of all types of restorations in general dental practice. Marked variations in the diagnosis of the lesions have been reported. The prevention of recurrent lesions by the use of fluoride-releasing restorative materials has not been successful.

**Types of Studies Reviewed.** The author focused on practice-based studies in the literature. These studies are not scientifically rigorous, but they reflect "real-life" dental practice. Few experimental studies on recurrent carious lesions in vivo have been reported, but bacteriological studies indicate that the etiology is similar to that of primary caries.

**Results.** Recurrent carious lesions are most often located on the gingival margins of Class II through V restorations. Recurrent caries is rarely diagnosed on Class I restorations. The diagnosis is difficult, and it is important to differentiate recurrent carious lesions from stained margins on resin-based composite restorations. Overhangs, even minute in size, are predisposed to plaque accumulation and the development of recurrent caries. The development of recurrent lesions is unrelated to microleakage.

**Clinical Implications.** As recurrent carious lesions are localized and limited, alternative treatments to restoration replacement are suggested. Polishing may be sufficient. If not, exploratory preparations into the restorative material adjacent to the localized defect can reveal the extent of the lesion. Such explorations invariably show that the lesion does not progress along the tooth-restoration interface. The defect, therefore, may be repaired in lieu of being completely replaced. Repair and refurbishing of restorations save tooth structure. These simple procedures also increase the life span of the restoration.

**Key Words.** Recurrent caries; case reports; microleakage; practice-based research.

surface. Caries left behind, intentionally or unintentionally, during restorative treatment is referred to as "remaining caries," which may be at the cavity margin or, more commonly, in the dentin under a restoration.

## FREQUENCY OF DIAGNOSED RECURRENT CARIES

Ever since the G.V. Black period, the clinical diagnosis of recurrent caries has been shown in studies from many countries, including the United States, to be the most common reason by far for replacement of all types of restorations in permanent and primary teeth.[2-23] The percentage of restorations in adults that were replaced because of the clinical diagnosis of recurrent caries was consistently about 50 percent, with a range of 45 to 55 percent. The percentage was somewhat more for amalgam than for resin-based composite restorations, and it was somewhat less for restorations in primary teeth because of the relatively high percentage of bulk fractures of restorations in these teeth and their short life spans. Recurrent caries and discoloration of resin-based composite restorations combined represent a higher percentage of replacements than do recurrent caries for amalgam restorations alone. The restorations replaced as a result of the diagnosis of recurrent caries is much higher in general dental practice than in controlled clinical trials in which recurrent caries represents 2 to 3 percent of the failures.[24]

**Clinical diagnosis of recurrent caries constitutes a major part of the dental treatment provided to patients in a general dental practice.**

The ratio of restoration replacement to primary restorations in general dental practice has been reported to be as high as 80:20 for resin-based composite restorations and 70:30 for amalgam restorations,[7] and even higher ratios have been reported.[25] More recent studies indicate that this ratio is about 50:50 for restorations in permanent teeth.[14-18,20] This ratio apparently moved toward the 50:50 level for replaced primary restorations in Scandinavia in the 1980s.[9,10,26,27] Many factors affect this ratio, including the age of the population studied and the replacement ratio being higher in the permanent teeth of adolescents than in adults and being lower in the primary dentition.[9,10,25] The status of patient's oral health and dental care, including participation in caries prevention programs, also plays a role.

On the basis of the information presented, it may be concluded that the clinical diagnosis of recurrent caries constitutes a major part of the dental treatment provided to patients in a general dental practice. This diagnosis may result in billions of dollars in restorative treatment worldwide. Therefore, it is important to analyze the available knowledge on the nature of recurrent caries and to explore possible preventive and alternative treatments to replace restorations that have received this diagnosis.

## LOCATION OF CLINICALLY DIAGNOSED RECURRENT CARIES

Studies have been conducted in which general practitioners were asked to indicate where recurrent carious lesions were located on diagrams of teeth, with outlines of the extent of the restorations examined.[28-30] These studies have shown that recurrent caries was seen predominantly on the gingival margins of all types of Class II through Class V restorations, while it was rarely associated with Class I restorations or on the occlusal part of Class II restorations. Recurrent caries was seen more often on the occlusal part of resin-based composite restorations than on the amalgam restorations. These findings will not surprise experienced clinicians.

Several factors may predispose a person to recurrent caries that is seen primarily on the gingival surface. This area is prone to contamination during the restoration by gingival fluid and saliva leaking between the matrix and the cavosurface margin, especially if a rubber dam is not used. As soon as the first portion of the restorative material is inserted, it obscures the gingival floor, making visual inspection difficult or impossible. Deficiencies in the adaptation of the restorative materials may cause voids that may lead to recurrent caries.[31,32] Polymerization shrinkage of resin-based materials also tends to cause crevices at the gingival margins when the curing light is used from the occlusal aspect. Bonding to dentin and cementum also is less effective at the gingival cavosurface margin than is bonding to enamel. Thus, polymerization shrinkage will tend to pull the material away from the gingival part of the cavity preparation, which often is located in dentin and cementum. Furthermore, the gingival aspect