

Treatments for hypersensitive noncarious cervical lesions

A Practitioners Engaged in Applied Research and Learning (PEARL) Network randomized clinical effectiveness study

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Finding effective methods other than restoration to treat hypersensitive noncarious cervical lesions (NCCLs) remains a problem. Like other dentists, practitioner-investigators (P-Is) in the Practitioners Engaged in Applied Research and Learning (PEARL) Network were eager to find alternatives to restoration of these hypersensitive lesions but had little guidance as to what is effective.¹ In 2007, the PEARL Network executive committee, on the basis of a vote by the P-Is, directed the Network's management team to develop and implement a study comparing the use of a chemoactive potassium nitrate dentifrice, application of a sealant or restoration with resin-based composite (RBC) in treatment of NCCLs. The New York University-based PEARL Network, New York City, includes The EMMES Corporation, Rockville, Md., which is the Network's data coordinating center, and is a practice-based research network (PBRN) that through March 2013 was supported by a seven-year grant from the National Institute of Dental and Craniofacial Research (NIDCR). The PEARL PBRN was described in a recent article² and is in the process of becoming self-sustaining.

ABSTRACT

Background. The Practitioners Engaged in Applied Research and Learning (PEARL) Network conducted a three-armed randomized clinical study to determine the comparative effectiveness of three treatments for hypersensitive noncarious cervical lesions (NCCLs): use of a potassium nitrate dentifrice for treatment of hypersensitivity, placement of a resin-based composite restoration and placement of a sealant.

Methods. Seventeen trained practitioner-investigators (P-Is) in the PEARL Network enrolled participants (N = 304) with hypersensitive posterior NCCLs who met enrollment criteria. Participants were assigned to treatments randomly. Evaluations were conducted at baseline and at one, three and six months thereafter. Primary outcomes were the reduction or elimination of hypersensitivity as measured clinically and by means of patient-reported outcomes.

Results. Lesion depth and pretreatment sensitivity (mean, 5.3 on a 0- to 10-point scale) were balanced across treatments, as was sleep bruxism (present in 42.2 percent of participants). The six-month participant recall rate was 99 percent. Treatments significantly reduced mean sensitivity ($P < .01$), with the sealant and restoration groups displaying a significantly higher reduction ($P < .01$) than did the dentifrice group. The dentifrice group's mean (standard deviation) sensitivity at six months was 2.1 (2.1); those of the sealant and restoration groups were 1.0 (1.6) and 0.8 (1.4), respectively. Patient-reported sensitivity (to cold being most pronounced) paralleled clinical measurements at each evaluation.

Conclusions. Sealing and restoration treatments were effective overall in reducing NCCL hypersensitivity. The potassium nitrate dentifrice reduced sensitivity with increasing effectiveness through six months but not to the degree offered by the other treatments.

Practical Implications. Sealant or restoration placement is an effective method of immediately reducing NCCL sensitivity. Although a potassium nitrate dentifrice did reduce sensitivity slowly across six months, at no time was the reduction commensurate with that of sealants or restorations.

Key Words. Noncarious cervical lesion; bruxism; root sensitivity; resin-based composite; dental sealant; dentin-bonding agents; dentifrices; premolar; molar; restorative dentistry; operative dentistry.

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BACKGROUND

Tooth hypersensitivity is defined as pain caused by a nonnoxious stimulus. Teeth with exposed dentin or gingival recession are subject to dentin hypersensitivity. Tooth hypersensitivity can occur owing to abrasion, erosion or attrition of the enamel surface, which exposes the underlying dentin, or to gingival recession, which exposes the root surface. Such exposed surfaces near the gingival crest are referred to as "NCCLs." Hypersensitivity generally is ascribed to fluid flow in open dentin tubules exposed by lesion progression.³⁻⁶

The authors of a comprehensive 2011 review regarding the etiology and prevalence of NCCLs pointed out the multifactorial causes of these lesions, including occlusion (abfraction) as a contributing factor.⁷ This review, when extended to consider restorative strategies, led the authors to suggest RBC restoration of these lesions on the basis of the results of studies one year or more in duration.⁸

Results from a 1998 study of dentists' diagnosis and treatment of NCCLs indicated that the majority treated NCCLs via restoration,⁹ confirming earlier findings by Bader and colleagues.¹⁰ Guidelines published by the American Academy of Operative Dentistry in 2003 suggest a more conservative approach.¹¹ Much of the clinical research regarding NCCLs in the last few years has concentrated on bonding agents and type of RBC used in the restoration.¹²⁻¹⁶ The factors affecting bonding to cervical dentin also have been reviewed.¹⁷ Other reviews of the etiology and management of NCCLs appeared in 2011.^{18,19}

Investigators in an extensive 1994 review of the etiology of NCCLs discussed the multifactorial causes of these lesions,²⁰ and several subsequent reviews²¹⁻²³ supported its contentions. Bader and colleagues¹ established these causes of NCCLs in a case-control study. Prevalence and risk factors reported in China in 2011²⁴ and previously in Trinidad²⁵ are in line with findings in the United States and Europe. Although a review of articles published before 2005 showed little evidence that occlusion causes NCCLs,²⁶ occlusion more recently was implicated as an important factor in several reviews.^{27,28} Results from the most recent comprehensive review of clinical studies suggests that this relationship still is in question,²⁹ and proponents of abfraction noted the multifactorial etiology for NCCLs as the basis for a substantial proportion of these lesions.³⁰

The most comprehensive clinical study of NCCLs is that of Lussi and Schaffner,³¹ who

examined 204 participants in two age groups (26-30 and 46-50 years). At six years after evaluation, each of 55 participants was reexamined by the treating dentist by using the same indexes. NCCL defects were more pronounced in the older group at each recall. Lesions exhibited a distinct progression, and multiple regression analysis revealed that the progression of wedge-shaped lesions positively correlated with frequency of toothbrushing and age. Hypersensitivity remained the same as these lesions progressed. Lesion development and progression also has been followed in a dental student population.^{28,32} Sleep bruxism appears to be related to NCCLs.³³ In a German study of participants (mean [standard deviation {SD}] age 28.4 [4.9] years) without and with sleep bruxism, the prevalence of NCCLs was 12.1 percent and 39.7 percent, respectively.³⁴ In the sleep bruxism group, 62.1 percent of study participants and 36.4 percent of control participants reported hypersensitivity. This suggests that hypersensitive NCCLs are present in approximately 35 to 40 percent of all participants with these lesions, particularly among those with sleep bruxism. In general, NCCLs increase in prevalence with age, and NCCL hypersensitivity is a problem for many participants.

The effectiveness of conservative methods for the reduction of hypersensitivity, such as coatings or precipitating agents, is greatly reduced after four to 13 weeks of treatment.^{35,36} Investigators in a double-masked, randomized, placebo-controlled clinical trial compared methods for occluding dentin tubules.³⁷ Positive treatment effects ($P < .05$) were present for all test treatments at four weeks and were not different from one another. Results from another study of the use of oxalic acid applied before a dentin-bonding agent (DBA) adhesive showed a significantly higher reduction in sensitivity compared with use of the DBA alone.³⁸ Missing from these studies were comparisons with a chemoactive dentifrice and with restoration, as well as longer-term outcomes (six months or more). The authors of the oxalic acid application study³⁸ noted that their results were contaminated by a strong placebo effect from a water rinse. The same strong placebo effect also was

ABBREVIATION KEY. **AH:** Appreciable hypersensitivity. **DBA:** Dentin-bonding agent. **HS:** Hypersensitivity. **NCCL:** Noncarious cervical lesion. **NIDCR:** National Institute of Dental and Craniofacial Research. **NPAS:** Numeric Pain Assessment Scale. **PBRN:** Practice-based research network. **PEARL:** Practitioners Engaged in Applied Research and Learning. **P-I:** Practitioner-investigator. **RBC:** Resin-based composite.

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