Restorative and Periodontal Considerations for the Treatment of Noncarious Cervical Lesions

Abstract: The etiology and treatment of angular cervical tooth defects remains a controversial topic in current dental therapy. The treatment of these lesions is compounded when the cervical tooth lesion is accompanied by gingival recession. This article presents an interdisciplinary approach to treatment of cervical tooth defects, recognizing the contemporary status of restorative and periodontal treatment. Treatment is based on the severity of the tooth surface defect, the extent of root exposure present, and the classification of the gingival recession. Where possible, restoration of cervical lesions should be avoided, thus circumventing the dilemma of restoring pathologic dentin. Periodontal root coverage procedures are the preferred treatment because of the high predictability for complete root coverage when treating Miller Class I and II gingival recessions.

Robert R. Winter, DDS
Private Practice
(Limited to Prosthodontics)
Newport Beach, California

Associate Professor of Clinical Dentistry — Primary Oral Health Care
University of Southern California
Los Angeles, California

Affiliate Assistant Professor of Graduate Prosthodontics
University of Washington
Seattle, Washington

Clinical Associate Professor
Department of Comprehensive Care
Case Western Reserve University
Cleveland, Ohio

Edward P. Allen, DDS, PhD
Private Practice
(Limited to Periodontics)
Dallas, Texas and Newport Beach, California

Clinical Professor
Department of Periodontics
Baylor College of Dentistry
Dallas, Texas

Founder
Center for Advanced Dental Education
Dallas, Texas

The etiology and treatment of angular cervical tooth defects remains a controversial topic in current dental therapy. This problem is compounded when the cervical tooth lesion is accompanied by gingival recession. Angular cervical tooth defects were first recognized and described by Zsigmondy in 1894. Miller in 1907 characterized the noncarious cervical lesion (NCL) as a slow and gradual loss of tooth substances resulting in smooth, wedge-shaped defects along the cemento-enamel junction (CEJ). The classic treatment of these lesions has been to restore the exposed root surface to alleviate the patient’s root sensitivity, to improve the unesthetic appearance of the root color, or to satisfy the dentist’s perceived need to place a restorative material to minimize further progression of the lesion. If gingival recession has occurred in the absence of a cervical lesion, the appropriate therapy is to provide periodontal treatment to re-establish the original gingival height.

The purpose of this article is not to provide a definitive answer to the etiology of the lesion, but to give guidelines for treatment of the lesion, recognizing the contemporary status of restorative and periodontal treatment.

Incidence

The incidence of NCLs reported in the literature ranges from 5% to 85% of the population. The wide variation...
is probably because of the sample size and age range of the sample. There is a significant increase in incidence with increasing age. Most frequently, these lesions are found in bicuspid and canine teeth (Figure 1), with fewer incidences in molar and anterior teeth. The lesions are most often found on the buccal aspect but can be identified occasionally on the lingual or palatal aspect. They are generally found supragingivally with infrequent occurrence subgingivally. The most accepted index to categorize tooth wear in the cervical region has been proposed by Smith and Knight, known as the Tooth Wear Index. The classifications on this index are as follows: 0 = no change in contour; 1 = minimal loss of contour; 2 = defect < 1 mm deep; 3 = defect 1 mm to 2 mm deep; 4 = defect > 2 mm deep, or pulp exposure, or exposure of secondary dentin. The loss of tooth structure has been described classically by the terms abrasion, attrition, and erosion. Abrasion is the wearing away of tooth structure through some unusual or abnormal mechanical process. Attrition is the act of wearing or grinding down by friction and is limited to the contacting surfaces of teeth. Erosion is the progressive loss of tooth substance by chemical processes that do not involve bacterial action. The loss of cervical tooth structure in the absence of caries has been termed noncarious cervical lesion, stress-induced cervical lesion, and abfraction.

The etiology of NCLs remains highly controversial and most likely multifactorial in nature. Compelling evidence in the literature can be found to support the hypothesis that these lesions are formed solely by abrasion and/or erosion.

Experimentally induced toothbrush abrasion duplicates the classical clinical shapes of NCLs. Cervical abrasions are classified as V-shape/wedged (50% incidence), U-shape/rounded (25% incidence), and mixed-wedged/rounded (28% incidence). Analysis shows progression of the morphology of the lesions. Toothbrush abrasion begins apical to the CEJ, progresses to dentin, and then undermines enamel with loss of the original CEJ. There also is evidence to support occlusal forces as a cause of the lesions. Wedge-shaped lesions at the CEJ have been attributed primarily to biomechanical loading forces that cause flexure and failure of the enamel and dentin. This abrasion hypothesis is based on a significant stress concentration in the cervical area, causing tooth breakdown. Finite element analytical models of cuspal flexure support the contribution of stress induction in these lesions.

Investigations of the relationship between NCLs and premature dental contacts reveal a highly significant positive correlation between the incidence of NCLs and premature contacts. Some investigations and studies have found that there is no correlation between occlusal forces and NCLs. The purpose of this article is to provide treatment guidelines for teeth which exhibit gingival recession and have cervical lesions, not to prove or disprove any etiologic theories. Because of the lack of consensus regarding the etiology of NCLs, their treatment is confounding. Treatment decisions become more perplexing when NCLs are complicated by gingival recession. The Miller classification provides guidelines for predictability of root coverage. Complete root coverage can be predictably achieved in Class I and II recession where there is no loss of interdental bone or soft tissue. In Class III
recession where there is loss of papillary height because of bone loss, only partial root coverage can be achieved.

Periodontal root coverage procedures are highly predictable for Class I and II recessions even when root surface defects are present. Success rates for complete root coverage range from 92% to 99%, and are stable over time. With current procedures using either a connective tissue graft or an acellular dermal matrix graft, the outcome is highly esthetic and the surgical site is often undetectable. The usual palatal donor site for connective tissue can be eliminated because of the introduction of AlloDerm® (LifeCell Corporation, Branchburg, NJ), an acellular dermal matrix. This makes the procedure less invasive and traumatic, with faster healing time because of the elimination of a second surgical site. The acellular dermal matrix provides a scaffold that the host cells infiltrate and replace. The thick, dense bound-down tissue that results creates a zone of stable marginal tissue which is resistant to gingival recession (Figure 2).

Restorative clinical challenges exist to bond to pathological dentin substrates, such as carious and sclerotic dentin. Sclerotic dentin is physiologically altered by the body’s natural defense mechanism and pathologically altered by the presence of bacterial colonization. Partial or complete obliteration of the dentinal tubules with rod-like sclerotic casts are observed. Tooth sensitivity varies depending on the tubular patency. In most NCLs, the tubules are completely occluded and therefore, no tooth sensitivity is found.

The clinical challenge in restoring NCLs arises because it is more difficult to adhere to cervical sclerotic dentin than normal dentin, both in vitro and vivo, even if etch times are increased. After etching, sclerotic casts that obliterated the dentinal tubules are still

### Table 1. Classification of Noncarious Cervical Lesions (NCLs)

<table>
<thead>
<tr>
<th>NCL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCL1</td>
<td>&lt; .5 mm defect</td>
</tr>
<tr>
<td>NCL2</td>
<td>.5 to 2 mm defect without involving CEJ</td>
</tr>
<tr>
<td>NCL3</td>
<td>.5 to 2 mm defect with loss of CEJ and enamel contour</td>
</tr>
<tr>
<td>NCL4</td>
<td>≥ 2 mm defect in root and loss of cervical enamel</td>
</tr>
</tbody>
</table>

### Table 2. Treatment of Noncarious Cervical Lesions: Miller Gingival Recession Classification

<table>
<thead>
<tr>
<th>Class I and II</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCL1</td>
<td>1. RCP</td>
</tr>
<tr>
<td></td>
<td>2. Possible restoration required to improve esthetics</td>
</tr>
<tr>
<td>NCL2</td>
<td>1. Contour tooth, smooth irregularities or ledges</td>
</tr>
<tr>
<td></td>
<td>2. RCP</td>
</tr>
<tr>
<td>NCL3</td>
<td>1. Restore enamel of tooth to re-establish original CEJ and contour remaining exposed root</td>
</tr>
<tr>
<td></td>
<td>2. RCP to CRM</td>
</tr>
<tr>
<td>NCL4</td>
<td>1. Restore the deepest portion of lesion to proper physiologic contour and shape the remaining portion of the defect to a convex or flat root form</td>
</tr>
<tr>
<td></td>
<td>2. Establish the CRM as coronal as possible</td>
</tr>
<tr>
<td></td>
<td>3. RCP to CRM</td>
</tr>
</tbody>
</table>

* Root coverage is predictable to a level 3 mm from the papilla tip.

NCL = noncarious cervical lesions; RCP = root coverage procedure; CEJ = cemento-enamel junction; FGM = free gingival margin; CRM = cemento-restorative margin
The clinical challenge in restoring NCLs arises because it is more difficult to adhere to cervical sclerotic dentin than normal dentin, both in vitro and vivo, even if etch times are increased.

present, resulting in minimal or no resin tag formation. The zone of resin-impregnated sclerotic dentin was found to be thinner than those observed in normal dentin.\textsuperscript{35} When compared to normal cervical root dentin, the tensile bond strength of adhesives to cervical sclerotic dentin is 20% to 45% lower.\textsuperscript{36} The reduction may be because of the absence of resin tags and incomplete hybridization in sclerotic dentin. This is attributed to the occluded dental tubules with sclerotic casts that prevent the optimal resin infiltration and a hypermineralized surface that is more resistant to acid-etching. Tay and Pashley's article is an excellent review of this topic.\textsuperscript{37}

**Conclusion**

If possible, restoration of cervical lesions should be avoided. Reshaping and smoothing cervical defects with subsequent periodontal root coverage procedures will circumvent restorative dilemmas. The restoration of abfraction lesions only partially relieves the stresses in the cervical region. If an eccentric occlusal contact is found, occlusal adjustment is recommended to minimize the lateral stresses and possible tooth flexure. Altering tooth-brushing techniques to eliminate any horizontal movement patterns and instead brush vertically from the gingiva toward the tooth will minimize the abrasive component of wear.

**References**