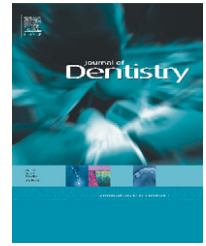


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Review

The association between occlusal factors and noncarious cervical lesions: A systematic review

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ABSTRACT

Objectives: This study aimed to systematically review the scientific evidence for the association between noncarious cervical lesions (NCCL) and occlusal risk factors (ORF) [occlusal interferences in excursive movements; occlusal force; premature contacts; type of guidance; skid of centric occlusion to maximum intercuspitation] in adults.

Sources: Pubmed, Web of Science, Cochrane, Lilacs, Clinical Trials, National Research Register and National Institute for Health were searched.

Study selection: From 1082 potentially eligible studies, 106 were selected for full text analysis. Two independent reviewers ($Kappa = 0.8$; $p < 0.001$) selected the studies, abstracted information and assessed quality based on standardised scales. Six cross-sectional, two case-controls and one clinical trial were included. Several occlusal variables were analysed among the studies, but there was no standardisation of the units used in the analysis of occlusal factors. The majority of studies did not find significant associations between NCCL and ORF. Three studies found associations between NCCL and some variables (occlusal contact area, right canine guidance, premature contacts in centric relation and working side) ($p < 0.05$). The methodological quality varied across studies, and there was high heterogeneity among them.

Conclusion: Current scientific evidence does not support an association between ORF and NCCL. Further prospective studies with standardised methods are vital to strengthen the evidence.

Clinical significance: Understanding the risk factors for NCCL is important to control the causes and to help the dentist choose the best approach for the patient. The evidence does not support intervention to alter some occlusal factors for the prevention or control of the progression of NCCL.

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1. Introduction

Noncarious cervical lesions (NCCL) involve the loss of hard tissue from the cervical areas of teeth through processes

unrelated to caries.^{1,2} The prevalence of NCCL has been reported to vary between 5–85%.³ This large variation in the prevalence can be attributed to the different ages and sexes of the participants in the studied populations and the diverse

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criteria used to distinguish lesions caused by one precise aetiologic factor.^{3,4} The aetiology of NCCL continues to be discussed in the literature. While the various possible causes and their degree of involvement may be controversial, there is overwhelming evidence that the cause of NCCL is multifactorial.^{5,6} Noncarious loss of tooth structure can result from different mechanisms, such as erosion (dental manifestations of chemical or electrochemical degradation) and friction, including attrition (endogenous mechanical wear) and abrasion (exogenous mechanical wear).⁷ These processes of tooth reduction, however, do not explain the development of wedge-shaped defects or subgingival lesions.⁸ Lee and Eakle⁹ further developed a proposal that was first discussed by Lehman and Meyer,¹⁰ which stated that stress may play a role in the aetiology of NCCL.⁹ Grippo¹¹ later called these lesions “abfractions,” which literally means a “breaking away” and is derived from the Latin words *ab* (away) and *fractio* (breaking). Engineering studies support the “abfraction theory” as tensile stress resulting from oblique occlusal forces may cause disruption of the bonds between the hydroxyapatite crystals and the separation of the enamel from the dentine. Compressive forces acting together with tensile stresses are also considered to cause microfracture, fatigue, flexure, and deformation of the tooth structure.^{12,13} In addition, as enamel is quite thin and the Hunter-Schreger Band (HSB) packing densities are very low at the cervical regions of tooth crown, abfractions may be passively facilitated by HSB patterns.¹⁴

Patients should be informed of the possible aetiologies and implications of the presence of lesions, along with the methods of prevention, treatment alternatives, and expected prognosis.⁶ Understanding the risk factors of NCCL is important in controlling the causes and to assist the dentist in choosing the best approach for the patient. The available evidence that supports the association between occlusal stress and cervical wear is derived from finite element analysis and laboratory studies, with little clinical data to provide confirmation. Recently, a review evaluated the association between occlusion and NCCL.¹⁵ However, an additional analysis that involves multiple electronic databases, a broader search strategy and a study quality appraisal based on standardised scales is recommended. Therefore, as the sufficient evaluation of this topic is lacking, this study aimed to systematically search for scientific evidence on the association between occlusal factors (occlusal interference in excursive movements; occlusal force; premature contacts; type of guidance; and skid of centric occlusion to maximum intercuspitation) and NCCL in adults.

2. Materials and methods

2.1. Selection of articles

This systematic review included cross-sectional studies, case-control studies, cohort studies and clinical trials conducted in adult humans that evaluated the presence of NCCL (outcome) associated with occlusal risk factors (exposure). Occlusal risk factors included any type of occlusal interference in excursive movements; occlusal force; premature contacts; type of guidance; and presence of skid of centric occlusion to

maximum intercuspitation (CO-MI skid). In October and November 2010, two reviewers (AGS and CCM) searched seven databases (PubMed, Web of Science, Cochrane, Lilacs, Clinical Trials, National Research Register – UK, and the National Institutes of Health) without restrictions on language or the date of publication. The literature search was updated in May 2012. The following search strategy was used in PubMed, Web of Science and Cochrane: ((non-carious cervical lesions OR noncarious cervical lesions OR non-carious cervical lesions OR tooth wear [Mesh] OR tooth abrasion [Mesh] OR dental abrasion OR cervical abrasion OR tooth erosion [Mesh] OR dental erosion OR tooth attrition [Mesh] OR dental attrition OR dental abfraction OR abfraction* OR abfraction lesions OR tooth abfraction) AND (dental occlusion [Mesh] OR bite force [Mesh] OR dental stress analysis [Mesh] OR occlusion factors OR premature contacts OR occlusal load* OR occlusal contacts OR risk factors [Mesh] OR pathology [Mesh]) NOT (“animal-s”[Mesh] NOT “humans”[Mesh])). The Cochrane Library included: the Cochrane Database for Systematic Reviews, the Database of Abstracts of Reviews of Effectiveness, the Cochrane Controlled Trials Register and the Cochrane Review Methodology Database. Lilacs, Clinical Trials, National Research Register (UK) and the National Institutes of Health were searched using the following combined keywords: noncarious cervical lesions, dental occlusion, occlusal contacts, bite force, dental stress analysis, risk factors, tooth wear, abfraction lesions, dental abfraction, tooth abfraction, tooth abrasion, dental abrasion, tooth erosion, dental erosion, tooth attrition, and dental attrition. The online search retrieved 925 references from PubMed, 73 from Web of Science, 49 from Cochrane and 201 from other sources (Fig. 1). After the duplicate references were removed, a total of 1082 studies were entered in Reference Manager® (Reference Manager, Thomson Reuters, version 12.0.3). A list provided by the Reference Manager was analysed, and articles were selected based on abstracts and/or titles. Two reviewers (A.G.S. and C.C.M.) were calibrated on the application of the inclusion and exclusion criteria. As a calibration exercise, the reviewers thoroughly discussed the criteria and applied them to a sample of 20% of the retrieved studies. This exercise was repeated until an excellent agreement was obtained ($\kappa = 0.81$). The inclusion criteria were: cross-sectional studies, case-control studies, cohort studies and clinical trials related to NCCL; reviews related to NCCL; and references without abstracts but presenting titles related to NCCL. Reviews related to NCCL were initially evaluated to allow for a manual search on their reference lists. However, review articles were not included. Among the studies that were not selected, classification proceeded as follows: reviews unrelated to NCCL; non-human studies; case reports or case series; surveys; different outcomes than NCCL; references without abstracts but presenting titles unrelated to NCCL; in vitro studies (laboratorial, extracted teeth, fossils, skulls, finite element analysis); and studies that reported on restorative materials, treatments in humans, diagnostic methods of NCCL or wear indexes (for a list of excluded abstracts and/or titles, see Appendix 1).

The reviewers independently applied the criteria for the selection of studies, and disagreements were resolved by consensus. A total of 976 studies were excluded, and 106 were selected for the full text reading.

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