

## Abfraction Theory: Controversy Analysis, scoping review protocol

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### ADMINISTRATIVE INFORMATION

**Support** - University of Foggia.

**Review Stage at time of this submission** - Data extraction.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202370052

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 13 July 2023 and was last updated on 13 July 2023.

### INTRODUCTION

**Review question / Objective** The PICO question was formulated as follows: What is the actual effect of abnormal or non-axial occlusal stresses on the occurrence of NCCL? Can the cause of these lesions be attributed to a defined etiopathological mechanism known as abfraction?

**Background** The main cause of mineralized dental tissue destruction is dental caries, which affects approximately 90% of the adult population and has a prevalence of 50% in children. However, carious lesions are not the sole cause of mineralized tooth tissue loss. Non-Carious Cervical Lesions (NCCLs) are another type of tissue loss, primarily affecting the cervical third of the tooth crown.

NCCLs originate from two well-accepted pathological mechanisms: erosion and abrasion, in addition to friction lesions that affect the occlusal surfaces of the teeth. Erosive processes involve acidic chemical actions that erode the mineralized tooth surface, while abrasive processes result in tissue wear through mechanical actions, often caused by objects such as toothbrushes. The prevalence of NCCLs is approximately 10-40% . Black previously reported this percentage for the population in Illinois. Typically, adults over the age of 30 are affected by these lesions, with the premolars being the teeth most commonly involved. Symptoms include progressive and continuous mineralized tissue loss over time, primarily at the cervical level on the vestibular surfaces of the teeth. Patients may perceive a step-like sensation, clear margins, and gingival recessions.

As dentin is exposed, the affected teeth become increasingly sensitive. Patients experience heightened sensitivity to heat and cold, especially after consuming cold drinks and foods. Sensitivity is also more pronounced during brushing. At this stage, patients often seek dental consultation to alleviate the symptoms. The lesion tends to deepen over time toward the dental pulp, leading to either a fracture of a part of the dental crown or symptomatic pulpitis.

Both abrasion and erosion alone cannot fully explain all types of NCCLs found in some patients. For certain lesions, an attempt is made to associate tooth wear phenomena with an etiopathological mechanism known as abfraction. Abfraction combines the etiological events of erosion or abrasion with abnormal and continuous occlusal loads over time, primarily exerted on the vestibular surfaces of the dental crowns. This causes non-cariou lesions in the cervical areas, typically with clear margins. Specifically, when a tooth is subjected to non-axial overload, stress concentrates on the vulnerable cervical area, leading to the breaking of hydroxyapatite crystals in the enamel near the gingival margin and eventually resulting in wedge-shaped lesions.

**Rationale** Only one systematic literature review specifically on abfractions was conducted. This review, conducted by Duangthip et al. in 2017, concludes that most studies report an association between occlusal stress and non-cariou cervical lesions. However, a detailed analysis of this review highlights some controversies. Initially, the title of the review identifies NCCLs in a more general way, which theoretically should recognize only an erosive or abrasive etiology (mainly due to brushing trauma), with clinical characteristics that should be different from those of abfractions. Therefore, the analysis of the studies should be conducted only on a specific subset of lesions, clearly differentiating them from cases where the erosive and abrasive etiology is clearly identifiable. Furthermore, Duangthip et al. clearly state that there are no clinical studies linking occlusal stress to NCCLs, and out of a total of 38 laboratory studies conducted, only 9 suggest that stress is a mechanism for NCCLs, although the majority of studies agree that occlusal stress is concentrated on the cervical region of the tooth. Furthermore, a difficulty emerges in performing a specific longitudinal clinical study on abfractions, mainly due to the hypothetical mechanism of action which takes a long time to manifest its effects on the cervical areas. The objective of this focused review is to detail the etiological events involved in the abfraction phenomenon, particularly by examining anomalous

occlusal forces, analyzing the evidence supporting this etiological hypothesis, and highlighting the controversies that characterize this theory.

## METHODS

**Strategy of data synthesis** Studies have been identified through bibliographic research on the PubMed and Scopus database.

In addition, a gray literature search was performed on Google Scholar and Opengray (DANS EASY Archive); potentially eligible articles were also searched among references from literature reviews on Abfraction.

The authors responsible for researching the studies used the following key words in the databases: Abfraction and NNCL. The key words used on PubMed are shown below;

Search: abfraction OR NCCL OR non-cariou cervical lesions "abfraction"[All Fields] OR "abfractions"[All Fields] OR "NCCL"[All Fields] OR ("non-cariou"[All Fields] AND ("cervic"[All Fields] OR "cervicals"[All Fields] OR "cervices"[All Fields] OR "neck"[MeSH Terms] OR "neck"[All Fields] OR "cervical"[All Fields] OR "uterine cervicitis"[MeSH Terms] OR ("uterine"[All Fields] AND "cervicitis"[All Fields]) OR "uterine cervicitis"[All Fields] OR "cervicitis"[All Fields]) AND ("lesion"[All Fields] OR "lesion s"[All Fields] OR "lesional"[All Fields] OR "lesions"[All Fields]))

Translations

abfraction: "abfraction"[All Fields] OR "abfractions"[All Fields] cervical: "cervic"[All Fields] OR "cervicals"[All Fields] OR "cervices"[All Fields] OR "neck"[MeSH Terms] OR "neck"[All Fields] OR "cervical"[All Fields] OR "uterine cervicitis"[MeSH Terms] OR ("uterine"[All Fields] AND "cervicitis"[All Fields]) OR "uterine cervicitis"[All Fields] OR "cervicitis"[All Fields] lesions: "lesion"[All Fields] OR "lesion's"[All Fields] OR "lesional"[All Fields] OR "lesions"[All Fields].

**Eligibility criteria** The studies considered included randomized clinical trials, prospective studies, and retrospective studies that evaluated the presence of NCCLs attributed to the etiopathological mechanism of abfraction. Reports, manuscripts, and all potentially eligible articles were subjected to a full-text analysis to determine their suitability for qualitative and quantitative analysis. The following criteria were applied during the evaluation of the papers:

**Inclusion:** All clinical studies assessing NCCLs in relation to abfraction.

**Exclusion:** In vitro studies, laboratory studies, case reports, case series, review meta-analyses, studies lacking an English abstract, and clinical studies

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that did not differentiate reported data on carious cervical lesions.

**Source of evidence screening and selection** The search for suitable reports was conducted by 2 reviewers (M.D. and D.S) with a 3rd reviewer (G.I.) tasked with choosing whether to include studies in conflict situations.

The 2 reviewers, after deciding in agreement: the eligibility criteria, the databases, the keywords to use, independently carried out the search for the reports, reporting the number of articles obtained for each keyword and for each bank in word tables data used;

Manuscripts or reports that were found to be duplicates from the various databases were purged and removed from the final count using EndNote 9 software (Philadelphia, PA, USA);

Other duplicates were subsequently manually deleted by the authors after the screening phase (studies with references from databases or systematic reviews on which it was not possible to automatically upload the references to EndNote).

The 2 reviewers then compared the included manuscripts and discussed the conflicting manuscripts to decide which manuscripts should be included.

**Data management** The characteristics and type of data to be extracted from the studies were decided jointly by the 2 reviewers immediately after the study selection phase; the data concerned: the first author, the year of publication, the bibliographic reference, the type of study, the number of patients, the gender, the number of lesions present for the different groups as well as the main results and conclusions of the study. Data were extracted independently by the 2 reviewers in 2 different tables and subsequently compared and reported in a 3rd table with a 3rd reviewer who verified correct data entry.

**Language restriction** Only clinical studies in English.

**Country(ies) involved** Italy.

**Keywords** Non-Carious Cervical Lesions; dental erosion; dental abrasion; abfraction; conservative; restorative; Caries.

**Contributions of each author**

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