

Prevalence and Clinical Parameters of Cervical Abrasion as a Function of Population, Age, Gender, and Toothbrushing Habits: A Systematic Review

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ABSTRACT

Aim: To determine specific differences in prevalence and etiology of cervical abrasion (CA) related to age, gender, and population and to recommend optimal management protocols.

Background: Cervical abrasion is a part of a spectrum of regressive changes in teeth called noncarious cervical lesions (NCCLs). These are physiological or pathological alterations as a function of time, related to physical and/or chemical factors. There are multiple variables involved in the pathogenesis and management of these lesions. There may be age-, gender-, and population-based differences in prevalence and clinical parameters of CA.

Results: Our review selected 24 studies from an initial 3,876 titles. We found significant differences in prevalence of CA in relation to age, toothbrushing frequency, brush type, and brushing technique. There were definite conclusion regarding type of teeth affected and appropriate management to enhance quality of life of the patients. Data on CA are inconsistent and need standardization.

Conclusion: Cervical abrasion varies in prevalence across countries. However, it exhibits definite age-related increase. There is no gender predilection. The frequency of toothbrushing, type of brush, brushing technique, and use of dentifrice influences the prevalence. Certain teeth are more susceptible to abrasion than others. Resin-modified glass ionomers were reported to be better for treating this condition.

Clinical significance: There is no standardized methodology to diagnose the presence and clinical severity of dental abrasion. This affects data on prevalence, habits, and management. Standardized protocol and tools may be developed for the same, and would improve outcomes particularly in vulnerable groups like geriatric populations, which are mainly affected by this condition.

Keywords: Dental diseases, Prophylaxis, Systematic review, Tooth abrasion, Tooth wear.

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INTRODUCTION

Dental abrasion or cervical abrasion (CA) is the pathological wear of tooth substance due to abnormal mechanical processes not directly related to mastication. It is seen mainly on exposed root surfaces of teeth especially on the facial surfaces, but rarely seen even on incisal and proximal surfaces. Improper toothbrushing combined with injudicious use of abrasive dentifrices is accepted by most researchers to be the central cause of abrasion. The enamel being relatively resistant to wear is usually spared but the cementum and dentin are affected. Conventional knowledge holds that use of a hard or medium toothbrush with vigorous force is associated with CA. More frequent brushing of teeth may also be a causative. The technique of toothbrushing is important. Recommended techniques like the Bass method and Roll method appear to be safer, while horizontal toothbrushing is especially implicated in increased prevalence of CA.^{1,2}

Abrasion is usually seen as a sharp-angled wedge or V-shaped defect in the root side of the facial cervical line and is associated with gingival recession. Its relation with toothbrushing is exemplified by the fact that it is observed to affect the contralateral quadrants depending on the left or right handedness of the individual. Toothpastes with higher abrasive content seem to be associated with higher CA. Even the use of toothpicks and strenuous flossing has been associated. There are some other uncommon association of CA related to habits and occupation. Pipe smokers, tailors, and carpenters, etc., have distinct patterns of abrasion based

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on their activity. However, these other causes are a miniscule proportion of the cases of abrasion.²

Cervical abrasion belongs to a group of lesions termed noncarious cervical lesions (NCCLs) that also include erosion and abfraction. There is usually more than one particular type of NCCL in every affected individual. In recent years, it is increasingly clear that abrasion, erosion, and abfraction may not be mutually exclusive and may develop in the same individual synchronously

or metachronously. The etiology of such lesions may also not be as clear-cut as previously believed. The multifactorial nature of these lesions makes it difficult for clinicians to manage due to variability in pathogenesis and individual characteristics that may depend on age, type of teeth, relevant habits, and occlusal patterns.^{3,4}

Since the abrasive process is rather slow, there is formation of secondary and tertiary dentin to protect the pulp. Sclerotic dentin is another protective response that has treatment implications. Retention of dental plaque, sensitivity, pulp damage, and periodontal disease progression are few of the undesirable effects of CA. Treatment is aimed toward managing the symptoms, restoring the morphology of the teeth, and treating soft tissue pathology. If untreated, pulpal exposure and infection, as well as periodontal deterioration are possible. Therefore, CA must be managed appropriately with suitable restorative procedures.⁵

There is a public health incentive to assessing the demographic parameters related to CA including population, age, and gender, etc., to determine if there are significant differences in prevalence, risk factors, symptoms, measurements, and treatment outcomes. A thorough review of clinical studies needs to be performed to address these critical issues related to lesion management.

MATERIALS AND METHODS

Research Question

A research question was formulated as far as possible adhering to the PICOS (population, intervention, control, and outcomes) format. This was aimed at determining if there are significant differences in the prevalence and clinical factors associated with CA in different populations, genders, and age groups.

“Are there significant differences in prevalence, risk factors, symptoms, measurements, and treatment outcomes of dental abrasion with respect to population, age, and gender?”

Sources, Search, and Study Selection

Electronic literature searches of Pubmed/Medline database and the Cochrane Study register, and other online sources were undertaken. Keywords applied include “dental abrasion,” “CA,” and “NCCLs,” etc. Original articles in journals with adequate impact and citation were preferred. The literature search was done until December 2018. Published European language articles in scientific journals were selected with year range from January 1970 to December 2018. As would be mentioned in results, the majority of the articles were dated from January 1974 to December 2018. Inclusion and exclusion criteria were formulated and applied (Table 1). Major inclusion criteria included clinical studies with good metrics and standard study design with adequate data items required in the analysis. English language or translated versions were acceptable. Human studies in persons with permanent dentition and good periodontal status (not beyond gingival recession related to CA), with acceptable neuromuscular coordination were selected. Studies without proper study design, inadequate data, untranslatable scripts, and dated earlier than 1970 were excluded.

Data Collection

A customized data extraction form was generated for this review. Basic information, important details, outcomes, and other measures were included. Two independent observers collated the data and filled the forms. In case of disagreement, a consensus was reached.

Table 1: Inclusion and exclusion criteria

<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
Clinical human studies in Cochrane Library and Pubmed listing of acceptable quality	Trials deemed to be unsuitable for our analysis due to lack of adequate information and major deficits in study design and methods, etc.
Studies that specifically mention the prevalence, clinical parameters, and treatment protocol of cervical abrasion and noncarious cervical lesions in general	Studies that do not reference cervical abrasion in main title or text or include only cervical erosion, attrition, and abfraction as stand-alone lesions
Studies that factor in toothbrushing as an integral component of the pathogenesis of cervical lesions	Studies that do not adequately include data on toothbrushing
Publications ranging from year January 1970 to December 2018	Studies earlier than 1970
English and European language articles (including translations)	Languages without translated versions
Studies in healthy human participants with permanent dentition and otherwise healthy periodontal status	Studies of people with periodontal disease, and disabilities that prevent proper coordination required for toothbrushing

Data Items

The variables for data collection were tabulated. The included variables were setting/country, sample size, and demographic characteristics including age, gender, socioeconomic status, symptoms, toothbrushing parameters (brush type, technique, and frequency), number and type of teeth commonly affected, the index of tooth wear employed, and other relevant analyses.

Quality Assessment

Assessment of quality is critical to the validity of any review process. There are numerous procedures and guidelines available. The present review planned to employ the methodological quality assessment using the Cochrane tool for risk of bias, with seven major criteria. Each selected study was assessed in order to gather clear evidence of quality research and elimination of all possible biases. This was done by assessing the following:

- Selection bias (which includes randomization and allocation concealment),
- performance bias (blinding of personnel and participants),
- detection bias (blinding of assessment),
- attrition bias (incomplete outcome data),
- reporting bias (selective reporting), and
- other causes of possible bias.

Two researchers independently assessed these criteria and gave judgment of “high risk,” “unclear risk,” or “low risk.”

Qualitative and Quantitative Syntheses

Depending upon the characteristics of the selected studies and the various data items retrievable from these studies, qualitative and quantitative syntheses of the collated data was performed.

RESULTS AND ANALYSIS

Search Details

Electronic search of the literature showed a total of 3,961 titles. Researching after removal of duplicate titles reduced the number to 3,876. Careful visual identification of relevant articles and filtering of titles reduced the results to 63. By applying all inclusion and exclusion criteria, the total number of studies selected for the review was 24. Table 1 illustrates the inclusion and exclusion criteria. Flowchart 1 shows the preferred reporting items for systematic reviews and meta analyses (PRISMA)-based selection process.

Data Customization and Compilation

Tables 2 to 5 record the concise and categorized information compiled after comprehensive evaluation of the 24 studies that had been selected after applying all criteria. The order of the evaluation had been randomized and performed by two independent evaluators in order to eliminate timeline and interobserver bias. These data were based upon a summation of the evaluator reports after discussion on conflicting findings and achieving consensus. The 24 studies have been reported between 1976 and 2018. Most of the studies are cross-sectional in nature. They had good representation from countries all over the world. Sample sizes ranged from a minimum of 32 to a maximum of 2,707. The total number of samples in the 24 studies totaled 11,401 participants. Most studies had adequate data on most of the parameters that had been agreed upon by the researchers. Key exclusions from further analysis were socioeconomic status and symptoms, since there was negligible data on these two parameters. A separate analysis of treatment of CA was included separately.⁶⁻²⁹

Quality Assessment

Applying the Cochrane risk of bias tool, assessment of the selected studies revealed that overall the significant risk of bias was low. Randomization and allocation concealment were not applicable in these studies since most of the studies were cross-sectional

in nature. Many authors did not explicitly include the key terms in their methodology, which is a requirement in many methodological assessments. However, further analysis of the methodology revealed that they had adhered to the required guidelines and omitted to report as such. Most of the studies stated blinding of assessment and observer independence. There were no reports of incomplete data or dropouts. All the data were reported and compiled in the studies, and no evidence of selective reporting was found.

Consensus opinion and judgment of two observers were required to classify the studies in each of the seven criteria as "low risk," "unclear risk," or "high risk." Analysis showed that two studies achieved the acceptable "low-risk or unclear" judgment in 6 criteria, three studies achieved it in 5 criteria, six studies scored 4, and seven studies scored 3. Six studies had achieved acceptable judgment in 2 criteria. A majority of 75% of the selected studies had acceptable judgment in 3 or more criteria. Therefore, the overall quality assessment was found to be acceptable to conduct qualitative syntheses of the 24 studies. However, quantitative synthesis was not deemed possible due to the lack of adequate controlling and standardization among the different studies. The parameter-wise observations based on exhaustive analysis of 24 studies are presented in the succeeding section.⁶⁻²⁹

Qualitative Synthesis

Geographic, Sample, and Prevalence Data

The region-wise analysis of the studies reveals that the European region has the highest number of selected studies (7) and samples (5,314) compared to five from the US, four from Brazil, three from China, two each from Africa and Pakistan, and one from India. Country-wise China has the highest number of participants at 3,502, followed by Germany (2,707). Romania has the least number of participants (50). Regarding the time period, six studies were from the years 1976 to 2000, nine studies from 2001 to 2010, and nine studies from 2011 to 2018. Most of the studies were cross-sectional.

Flowchart 1: Screening process adapted from PRISMA flowchart (2009)

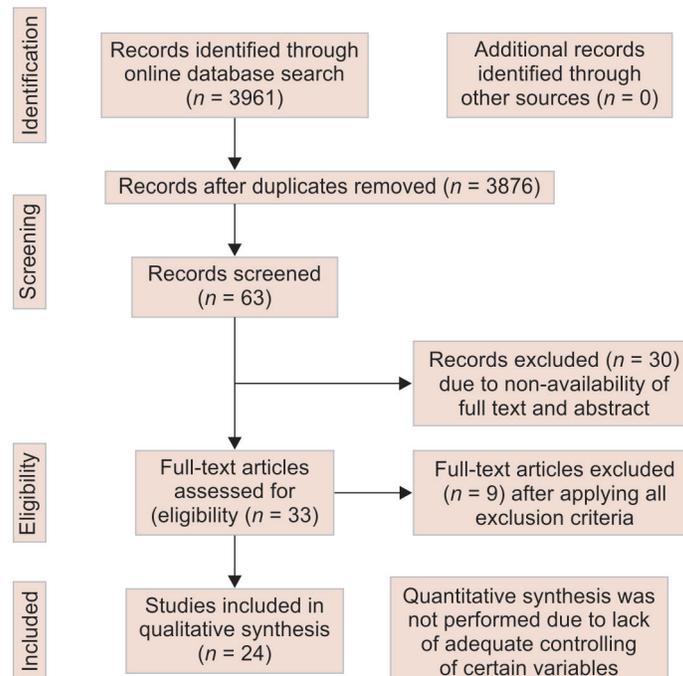


Table 2: Cervical abrasion data in North American region

Author	Year	Country	Setting	Samples	Gender	Important findings	Toothbrushing data				Main cause	Prevalence	Index (TWI)	Teeth most affected	Mean number of teeth
							Frequency	Type	Technique	Age factor					
Hand et al. ⁶	1986	US	Elder	520	No data reporter	No data	No data reported	No data reported	No data reported	Vigorous brushing	56%	30% have more than 1	No data reported	No data reported	
Radentz et al. ¹¹	1976	US	Army	80	(66 and 14)	Higher hygiene in abrasion cases	No data reported	No data reported	No data reported	Vigorous brushing	No data reported	No data reported	No data reported	No data reported	
Piotrowski et al. ¹²	2001	US	Army veterans	32	No data reported	No significant related to firm brushing	No data reported	No data reported	No data reported	Firm brushing	No data reported	No data reported	No data reported	No data reported	
Aw et al. ¹⁸	2002	US	General	57	No data reported	No data reported	No data reported	No data reported	No data reported	No data reported	No data reported	91% had index of 3	70% on posterior teeth, 65% on maxillary teeth, and 46% on premolars.	3	
Bader et al. ²⁰	1996	US	Dental patients	264	No data reported	Technique is significant	3x/day more lesions	Hard	More in people with lower arch first and facial first brushing	No data reported	No data reported	No data reported	No data reported	No data reported	
Total of 5 studies														953	

Table 3: Cervical abrasion data in European region

Author	Year	Country	Setting	Samples	Gender	Important findings	Toothbrushing data				Main cause	Prevalence	Index (TWI)	Teeth most affected	Mean number of teeth
							Frequency	Type	Technique	Age factor					
Boric ⁷	2004	Croatia	General	555	No data reported	No data reported	No data reported	No data reported	No data reported	No data reported	No data reported	Lower premolars more than 1	Lower premolars	No data reported	
Sangnes ⁸	1976	Norway	General	533	No data reported	Good hygiene	2/day	No data reported	No data reported	Did not influence	No data reported	45%	No data reported	No data reported	No data reported
Bergström ¹³	1988	Stockholm	General	250	No data reported	Correlates with less periodontal health	No significant difference	No data reported	No data reported	No data reported	21-60	85% (22% deep)	No data reported	No data reported	No data reported
Bergström ¹⁴	1979	Stockholm	General	818	No data reported	Bristle firmness and tooth-paste type not as significant	2x related to lesions	No data reported	No data reported	Significant difference between horizontal and roll (lowest) technique	18-65	30% (12% deep)	No data reported	No data reported	No data reported
Marinescu ²²	2017	Romania	General	50	18 and 32, higher in males	Did not specify abrasion	No data reported	No data reported	No data reported	34% vertical, 52% ocular, 14% horizontal	18-56	62% 18-30 years had 62% and 31-56 years had 60%	No data reported	No data reported	No data reported
Akgül et al. ²⁴	2003	Turkey	Patients	428	186 and 242	More in old age, male gender, and frequency of brushing	Yes	No data reported	No data reported	Not significant	20+	No data reported	No data reported	No data reported	No data reported
Bernhardt et al. ²⁹	2006	Germany	General	2,707	No data reported	Mostly focused on abrasions	Or of 1.87 in 2x brushing, or of 2.07 in for 3x or more	No data reported	No data reported	No data reported	20-59	No data reported	No data reported	First premolars	No data reported
				Total of 7 studies	5,341										



Table 4: Cervical abrasion data in South American/African region

Author	Year	Country	Setting	Samples	Gender	Important findings	Toothbrushing data				Main cause	Prevalence	Index (TWI)	Teeth most affected	Mean number of teeth
							Frequency	Type	Technique	Age factor					
Pegoraro et al. ¹⁵	2005	Brazil	General	70	No data reported	No data reported	No data reported	No data reported	25-45 years	No data reported	88%	No data reported	No data reported	5.61	
Telles et al. ¹⁶	2007	Brazil	Dental students	48	28 and 20	Occlusal stress could also be a factor	No data reported	No data reported	16-24 years showing more lesions in older people	No data reported	17.23% of all teeth	No data reported	No data reported	5.8	
Faye et al. ¹⁷	2005	Senegal		655	No data reported	Horizontal brushing in 55% patients	No data reported	No data reported	19-31 years	No data reported	17.10% (112) of which 77% were CA	No data reported	No data reported	No data reported	
Brandini et al. ¹⁹	2011	Brazil	Dental students	58	15 and 43	Medium/hard brushing and higher force had greater NCCLS	Not significant	Med/hard	Not significant	Hard brushing, tooth-paste not significant	53.50%	93% in post-sup quad, more in right	No data reported	No data reported	
Bomfim et al. ²¹	2015	Brazil	Workers	100	55 and 45	Age related increase, also with smoking	No data reported	No data reported	20-68 years	No data reported	Total 19.4%, 5.03% in 18-34 years, 12.5% in 35-44 years, 28.5% in 45-68 years	No data reported	No data reported	No data reported	
Oginni et al. ²⁵	2003	Nigeria	Patients	106	No data reported	Use of local more abrasive dentrifices cause more prevalence	No data reported	No data reported	Abrasion increases with age	Tooth brushing	62.3%	No data reported	50.8% on left side in right-handed	5.94	
Total of 6 studies														1,037	

Table 5: Cervical abrasion data in South and Central Asian regions

Author	Year	Country	Setting	Samples	Gender	Important findings	Toothbrushing data				Prevalence	Index (TWI)	Teeth most affected	Mean number of teeth		
							Frequency	Type	Technique	Age factor					Main cause	
Kumar et al. ⁹	2015	India	Special needs	383	170 and 213	Brush type, technique, frequency was significant	23.8% 2X	Hard	29%	Combination 27% and horizontal 26%	12-15 years	Toothbrush	19-25%	No data reported	No data reported	
Ahmed et al. ²³	2009	Pakistan	Patients	95	69 and 26	Weak age correlation, no effect on occlusion, bruxism	No significant difference			No data reported	50.3 mean	73% horizontal brushing	No data reported	No data reported	7.06	
Sadaf and Ahmed ²⁶	2014	Pakistan	Patients	90	67 and 23	No significant gender difference	2/day not significant	Yes—hard		No data reported		No data reported	38.90%	No data reported	No data reported	
Zhang et al. ²⁷	2015	China	Students	720	360 each	Brushing less than 2x per day and duration less than 2 minutes increased tooth wear	No data reported	No data reported		No data reported	15-19 years	No data reported	No data reported	No data reported	No data reported	
Zi Yun et al. ²⁸	2015	China	General	1,759	No data reported	Elderly group had more factors associated with lesions	No data reported	No data reported		Brushing method was significant in middle age group but not significant in older age group	35-44 years and 65-74 years	No data reported	76.8% and 81.3%	82% middle age group had index of 2 and 64% of older group had index of 2. Index 4 was in 3.4% and 8%, respectively	Seen more in first premolars	3.4 and 4.4
Que et al. ¹⁰	2013	China	General	1,023	No data reported	Lesions assoc with age and periodontal status	Or 4.2 for 2X with horizontal comp to 1X vertical			Or 1.59 for horizontal vs vertical in 60-69 years age group	20-69 years highest in 60-69 years age group	No data reported	61.70%	No data reported	Premolars	No data reported
													Total 6 studies	4,070		

Fifteen out of the 24 studies included prevalence rates. Only one of the five US studies explicitly noted the prevalence rate as 56%. Four EU studies noted the prevalence at 30%, 45%, 62%, and 85%. The four Brazilian prevalence rates ranged from 17% to a high of 88%. African rate was 17%. Chinese reported a high prevalence of 60–80% while India had a range of 19–25%.^{6–8,10,13–17,19,21,22,24–26,28}

Age and Gender Data

Seventeen studies had noted the age range of the participants.^{6–8,10,11,13–17,19,21,22,24–26,28} The ages varied from schoolchildren (12–15 years) to middle age and elderly (60–69 years). Age-wise data agreed by our researchers suggested a gradual increase in prevalence with age. The 12–30 years age group had a rate of 19%, the 31–45 years group ranged from 30% to 60%, while the 46–69 years group ranged from 28% to 85%. Though there is much heterogeneity among the studies, the findings concur with the general opinion that CA and other noncarious lesions increase with age.

Gender specification was mentioned but had not been specifically assessed. Only two studies had reported higher prevalence in males.^{22,24} One study did not find significant difference between the sexes.²⁶ Others did not report genderwise data.

Toothbrushing Data

Twelve out of the 24 studies had reported on the use of toothbrush with or without a dentifrice. The type of brush, the frequency of brushing, technique of brushing, and the frequency of brush change were also noted.^{8–11,13,14,19,20,23,24,26,27}

Six studies clearly state that brushing two or more times a day was significantly associated with CA.^{8–10,14,20,29} Five studies did not report significant difference,^{11,13,19,23,26} while the others had no data. The odds ratio of twice a day brushing was derived at 1.8 (Bernhardt et al.)–4.2 (Que et al.), compared to single daily use of toothbrush. Not surprisingly, studies reported a positive correlation between cervical lesions and good oral hygiene.^{10,29}

The type of toothbrush was mentioned in four studies.^{9,19,20,26} All studies report that brushing with hard toothbrush was associated with higher lesion prevalence compared to medium and soft toothbrushes. The participants who reported using a high force for brushing were also associated with such lesions, though adequate information is scant in this aspect.

Technique of toothbrushing was reported in nine studies.^{8–10,14,19,20,22,24,28} Overall, horizontal, circular, and mixed (horizontal–vertical and horizontal–circular) brushing techniques were associated with higher lesion prevalence compared to roll-type and vertical brushing. Three studies did not find significant differences in relation to brushing technique.^{8,19,24} Que et al. found the odds ratio at 1.59 for horizontal vs vertical brushing.¹⁰

A North American study found that brushing the facial surfaces first and lower arch first seemed to have a greater prevalence of lesions.²⁰ Comparing age groups, the significance of technique appeared to be lower in elderly people.

The few studies that mention the use of toothpaste report that they do not significantly affect the prevalence of abrasion independent of the brush type or brushing technique.^{11,14,25} Almost all the studies agree that vigorous brushing is a factor in development of CA.

Tooth-related Data

Ten studies specified the teeth most affected in abrasion.^{6–8,10,18,19,23,25,28,29} Generally, posterior teeth, maxillary teeth,

and premolars seem to be usually affected by CA. Premolars especially are the most affected teeth. Seven studies report that premolars are affected in almost all participants. Furthermore, first premolars and lower premolars are the maximum affected. Regarding the side of the arches, there are conflicting reports. Studies do not find a significant difference between the right and left sides. Most of the studies had not mentioned the handedness of the participants; therefore, it is not possible to make a cogent finding in this aspect. Most of the studies did not assess the extent of wear by standardized methods. Among the studies that did so, the tooth wear index (TWI) by Smith and Knight was preferred.³⁰

To summarize, the results indicated adequate prevalence data from studies across countries, with a wide range from 17% to 80%. Ages ranged from schoolchildren (12 years) to the elderly (69 years), with good evidence of age-related increase in abrasive lesions, while gender data are inadequate. Toothbrushing data were clear on the significant effects of brushing frequency and vigorous method on prevalence of abrasive lesions. Maxillary teeth and premolars seemed to be more vulnerable to dental abrasion.

DISCUSSION

Noncarious cervical lesions are one of the most common dental issues that affect a large section of the population. They include abrasion, abfraction, and erosion. Abrasion is due to the action of mechanical processes not related to physiological activities like mastication. It is mostly due to injudicious use of toothbrush and dentifrices. It is seen as a sharp wedge-shaped defect in the exposed root surface of the tooth. Abfraction is a type of lesion that is said to arise from flexural stresses to the tooth that can result from biomechanical loading factors. Erosion is due to chemical action not related to dental caries.^{1,2}

There are many theories of development of NCCLs. The abfraction theory (Lee and Eakle) suggests that biomechanical forces due to high occlusal loading cause flexure and tensile stress concentrations at the cervical region. This results in microcracks between hydroxyapatite crystals. The abrasion theory suggests that soft tissue loss above the cemento-enamel junction (gingival recession) causes exposure of cemental surface. This surface is susceptible to wear due to toothbrushing with abrasives. This accompanied by the aforementioned factors, which results in abrasive cervical defects.³

There is a lot of confusion regarding the terminology among researchers over the world. Many researchers accept abfraction as not more than a theoretical concept. Others postulate that all NCCLs are abfractions and not due to abrasive action. Abrasion may be confusing to distinguish from cervical erosion if history and other factors are similar. There may be a higher incidence of cervical erosion in people consuming acidic drinks and simple carbohydrates.^{4,5}

Grippio et al. postulated a multifactorial illustration of NCCLs and categorized CA as both endogenous and exogenous defects due to friction. Endogenous causes were mastication and tongue activity, while exogenous causes were dental hygiene, habits, occupation, and presence of dental appliances. The author earlier (1991) first defined the term abfraction from “ab fractio” meaning to break away. They also proposed replacing the term erosion with the more appropriate “biocorrosion.”^{1,2}

A critical review by Bartlett and Shah in 2006 regarded abfraction as hypothetical and experimental, and opined that there is no conclusive evidence to backup the abfraction theory.

Therefore essentially, the overwhelming proportion of NCCLs would appear to be abrasions.⁵

Abrasion has been reported by many authors to be mainly due to toothbrushing using a dentifrice. The dentifrice is regarded by some researchers to be important compared to using plain toothbrush, which does not seem to cause abrasion on its own. However, there are multiple factors involved in its pathogenesis, including salivary characteristics (pH, buffers, calcium–phosphate levels, and flow rate), tooth position, periodontal factors, type/composition of toothbrush, and toothpaste, etc. Use of drugs and occupational factors may also have to be accounted.^{6–13}

A review by Wood et al. concluded that cervical lesions were multifactorial in etiology and proportional to age and were more common on the facial surfaces of teeth. The shape of the lesion does not correlate with etiology, and significantly, the long-term benefit of treatment is unclear.³

Heasman et al. did a meta-analysis of the effect of toothbrushing (excluding toothpastes) on development of cervical lesions. They did not find conclusive evidence of toothbrushing due to conflicting results obtained by various studies. Furthermore, longitudinal studies were lacking in the analysis. They postulated that the frequency, method, and the hardness of bristles may be associated with more cervical lesions. Direct causative link is yet to be established.⁴

Litonjua et al. reported on the discrepancies in the prevalence data of NCCLs due to lack of standardization, resulting in confusion and subsequent misdiagnosis of these lesions over the world. Attrition, abrasion, and erosion can simultaneously occur and act sequentially, synergistically, or additively. Treatment planning is dependent upon the etiology and pathogenesis of each individual lesion. Another article by the authors advised that the single-etiology terms like attrition and erosion may be replaced by the term NCCL since there is more and more evidence of multifactorial etiology of cervical lesions.^{31,32}

An *in vitro* study by Bizhang et al. reported an unexpected finding that use of soft toothbrushes with dentifrice had higher number of dentinal loss compared to medium or hard brushes. The reason presumably was that soft brushes were more homogeneous and flexible with larger surface area resulting in greater dispersion of toothpaste on the dentinal surfaces. However, being an *in vitro* study, the various factors involved in the oral environment need to be considered in order to obtain a conclusive finding.³³

Limitations of the Current Literature and Protocols— Future Trends

The present review concurs with the prevalent consensus that the etiology of CA is multifactorial; the occurrence of other cervical lesions simultaneously cannot be ruled out. The confusion in terminology and diagnosis confounds the proper analysis of purely abrasive lesions. There cannot be a completely foolproof method to segregate CAs from any of the NCCL studies. Moreover, studies that focus on CA alone are very rare and suffer from the same diagnostic issues. Furthermore, the prevalence ranges varied considerably within and across populations.

There was no consensus on the type of measurement indices that are to be followed. This resulted in a complete lack of quantifiable information as to the extent of the lesions. Therefore, there is need for a standardized tool to measure the extent of the CA lesions. A simple index of measurement is also necessary for uniformity of data compiled throughout the world. Such a reliable protocol can help in formulation of treatment plans.

Treatment Modalities

The objective of management of CA and other NCCLs is to arrest lesion progress, to strengthen the tooth to withstand functional stresses, to mitigate dentine hypersensitivity, to reduce likelihood of pulpal involvement, and also to enhance esthetics and prevent further retention of plaque and associated factors. In all restorations, the most important clinical complications were secondary caries, fracture and wear, marginal discoloration, and color mismatch, etc. NCCLs rarely occur without soft tissue lesions including gingival recession and periodontal disease, and therefore, it is imperative to sustain soft tissue health as part of a holistic management. The abfraction theory of flexural stress might also need to be considered in intransigent cases.³⁴

Cervical abrasion is usually treated by surface preparation and restoration, with a suitable adhesive or micromechanical bond-based material. Additional retentive mechanisms like cavo-surface beveling have been discussed in many studies (systematic review by Schroeder et al.). Overall, many researchers are of the opinion that there is no conclusive evidence to suggest that beveling is critical to the success of the restorations. However, it does seem to have a positive effect in the retention of such restorations.³⁵

Various studies had evaluated different materials and restorative techniques over the years. In the Brazilian study, the 2-year retention rate of composite cements for CA was 78.8%. The authors noted that variable 3-year retention rates ranging from 50% to 100% was reported by many studies. Resin-modified glass ionomer restorations (RMGICs) had a retention rate of 100%. This would indicate that RMGIC was a better alternative to composites, though both materials are acceptable to restore dental abrasion.^{36–45}

CONCLUSION

Cervical abrasion has been established to be due to the vigorous use of toothbrush with or without an accompanying dentifrice. The prevalence varies and there is need to devise a standardized protocol for diagnosis. There is a significant correlation between prevalence and increasing age. There is no significant gender difference. Higher frequency and use of harder brush bristles were associated with higher prevalence of wear. Posterior and maxillary dentition is most affected by abrasion.

Cervical abrasion should be considered along with other NCCLs as a holistic approach. Soft tissue pathology like gingival recession and attachment loss should also be managed appropriately for the long-term success of treatment. There is a need to devise a standard index that is followed by all clinicians that should be simple and reliable. Future trends point to the development of reliable instruments and indices for clinical assessment and consequent formulation of appropriate treatment plans.

ETHICS STATEMENT

This systematic review is free from ethical concerns.

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