

Basic Study

Reliability of Sawai's classification for dental cervical abrasions: A pilot study

Madhuri A Sawai, Anika Daing, Fazala Adeel, Sakshi Chawla

Madhuri A Sawai, Anika Daing, Department of Periodontology, Faculty of Dentistry, Jamia Millia Islamia University, New Delhi 110025, India

Fazala Adeel, Sakshi Chawla, Jamia Millia Islamia University, New Delhi 110025, India

Author contributions: Sawai M contributed to the conception and design of the study; Sawai M, Adeel F and Chawla S contributed to the acquisition and analysis of data; Daing A contributed in the interpretation of the data; Sawai M wrote the paper; all authors made critical revisions related to the manuscript and approved the final version of the article to be published.

Institutional review board statement: As this study did not involve any diagnostic or treatment procedure on the patient, it did not require any institutional ethical clearance.

Informed consent statement: This study involved the use of photographs of patients' dentition only. Patients who voluntarily agreed to allow their dental photographs to be taken were included in the study. Their informed consent was obtained.

Conflict-of-interest statement: All the authors declare that there is no conflict of interest.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Manuscript source: Unsolicited manuscript

Correspondence to: Madhuri A Sawai, BDS, MDS, Associate Professor, Department of Periodontology, Faculty of Dentistry, Jamia Millia Islamia University, Jamia Nagar, New Delhi 110025, India. msawai@jmi.ac.in
Telephone: +99-1-1484802

Received: May 17, 2017

Peer-review started: May 23, 2017

First decision: July 3, 2017

Revised: November 11, 2017

Accepted: November 22, 2017

Article in press: November 22, 2017

Published online: December 16, 2017

Abstract

AIM

To test the reliability of the Sawai's classification for dental cervical abrasions.

METHODS

Intraoral photographs of 70 teeth from 23 patients with tooth abrasions were taken by the first examiner MS. The teeth were marked and the photos were maintained in a soft copy sequentially. Two other examiners FA and SC were trained in the use of the classification and any clarifications needed were provided at the beginning of the study. Each examiner was then given the soft copy of the complied photographs and was asked to classify the dental cervical abrasion according to their understanding of the Sawai's classification. They were given sheets to write their responses for every marked tooth. All the examiners were blinded to each other's observations which were then tested for inter-rater agreement among the three examiners.

RESULTS

The 70 teeth with tooth abrasions from 23 patients were examined by 3 investigators (MS, FA and SC) to test the reliability of the Sawai's classification system for tooth abrasion. Each examiner marked their responses in separate sheets which were blinded to each other. The kappa statistics were performed for inter-rater agreement among the three examiners. The level of agreement was evaluated according to the six-level nomenclature given by Landis and Koch. ICC and 95%CI between two examiners, *i.e.*, the inter-rater agreement among

1st examiner (MS) and 2nd examiner (FA) was 0.89. The inter-rater agreement among 1st examiner (MS) and 3rd examiner (SC) was 0.89. And the inter-rater agreement among 2nd examiner (FA) and 3rd examiner (SC) was 0.83. All the three comparisons show an almost perfect agreement between them.

CONCLUSION

There is an almost perfect agreement between multiple observers for classifying dental cervical abrasions using Sawai's classification. Hence, this classification is reliable.

Key words: Tooth abrasion; Classification; Diagnosis; Tooth wear; Dental education; Diagnostic techniques and procedures

© **The Author(s) 2017.** Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: Currently, an ideal index for tooth abrasion is lacking. The available indices are either too time consuming or complicated. Hence, an easy and least time-consuming classification was proposed. The present study evaluates the reliability of the Sawai's classification. In this study, out of three observers, two were students of dentistry (undergoing internship). The study shows that there was almost perfect agreement amongst the observers in classifying the tooth abrasions. Also, it was noted that the classification was easy to understand and use and least time consuming. So the authors suggest that this classification can be effectively used in daily dental practice.

Sawai MA, Daing A, Adeel F, Chawla S. Reliability of Sawai's classification for dental cervical abrasions: A pilot study. *World J Clin Cases* 2017; 5(12): 407-411 Available from: URL: <http://www.wjgnet.com/2307-8960/full/v5/i12/407.htm> DOI: <http://dx.doi.org/10.12998/wjcc.v5.i12.407>

INTRODUCTION

Tooth wear is a modern day problem. It produces varying symptoms ranging from discomfort, pain and also may lead to loss of tooth vitality. As dentists, we need to diagnose and monitor tooth loss and provide adequate treatment to our patients. Though, a lot of emphasis has been given towards treatment aspect of cervical abrasions, much research is required to develop a comprehensive method to diagnose and classify cervical abrasions. Different indices have been given in the past to diagnose and grade the cervical abrasions. For example: Eccles index for dental erosion of non-industrial origin^[1], Smith and Knight's Tooth Wear Index^[2] and Erosion Index by Lussi^[3]. Bardsley *et al*^[4] pioneered a new, simplified version of tooth wear index (TWI) and Khan *et al*^[5] reported cervical lesions of different morphological types. Across the world, qualitative and quantitative methods

were used to measure cervical abrasion. Although these grading methods are available, they still lack objective measurements. Some methods rely on clinical descriptions and others on physical measurements. There is a lack of uniformity and hence comparison of data is difficult. An ideal index is hence needed to scientifically diagnose the disease. A classification system is necessary in order to provide a framework to scientifically study the etiology, pathogenesis and treatment of diseases in an orderly fashion. In addition, such systems give clinicians a way to organize the health care needs of their patients^[6]. The already available classification systems for dental cervical abrasion have limitations as some of them are descriptive and others are time consuming. A simple classification system was proposed by Sawai in 2014^[7].

The present study was conducted to test the reliability of Sawai's classification system^[7] for Dental Cervical Abrasions.

MATERIALS AND METHODS

Individuals showing at least one dental cervical abrasion were recruited for the study to check the reliability of this new classification. The patients were recruited from the Out-Patient Department of Department of Periodontology, Faculty of Dentistry, Jamia Millia Islamia, New Delhi, India and signed a written informed consent in accordance with Helsinki declaration of 1975 as revised in 2000.

Inclusion criteria including: (1) the presence of dental cervical abrasion on one or more teeth; and (2) completion of cause-related therapy when necessary. Exclusion criteria were patients who did not want to participate voluntarily.

Assessment of agreement

The subjects were recruited by the first examiner (MS) and photographs of the teeth with dental cervical abrasion were taken and teeth were marked. The photographs were sequenced and maintained in a soft copy. The other two examiners (FA and SC) were trained on the use of this classification system. All clarifications were provided before the start of the study. Each examiner was then given the soft copy of the compiled sequence of photographs and a sheet to write their responses. The examiners classified the tooth wear defect according to the Sawai's classification^[7].

Each examiner used sufficient time to classify every defect. All the three examiners were blinded to the evaluation of each other. The results were then analyzed statistically to test the reliability of the classification.

Statistical analysis

Variables were reported as mean \pm standard deviation (SD) for continuous variables or frequency and percentage for discrete variables unless otherwise specified. Kappa statistics were performed for 70 observations to analyze inter-rater agreement amongst the three examiners.

Table 1 MS photography based evaluation and FA photography based evaluation Crosstab

		FA photography based evaluation								Total	Measure of agreement, χ value
		Class A			Class B			Class C			
		Type I	Type II	Type III	Type I	Type II	Type III	Type I	Type II		
MS Photography based evaluation	Class A Type I	12	0	0	0	0	0	0	0	12	0.899
	Class A Type II	1	10	0	0	1	0	0	1	13	
	Class A Type III	0	0	4	0	0	0	0	0	4	
	Class B Type I	0	0	0	2	0	0	0	0	2	
	Class B Type II	0	0	0	0	9	0	0	0	9	
	Class B Type III	0	0	0	0	0	7	0	0	7	
	Class C Type II	0	0	0	0	0	2	6	0	8	
Class C Type III	0	0	0	0	0	1	0	14	15		
Total		13	10	4	2	10	10	6	15	70	

Table 2 MS photography based evaluation and SC photography Crosstab

		SC photography								Total	Measure of agreement, χ value
		Class A			Class B			Class C			
		Type I	Type II	Type III	Type I	Type II	Type III	Type I	Type II		
MS Photography based evaluation	Class A Type I	12	0	0	0	0	0	0	0	12	0.899
	Class A Type II	0	11	0	0	0	0	2	0	13	
	Class A Type III	0	0	3	0	0	0	0	1	4	
	Class B Type I	0	0	0	2	0	0	0	0	2	
	Class B Type II	0	0	0	0	8	0	1	0	9	
	Class B Type III	0	0	0	0	0	6	1	0	7	
	Class C Type II	1	0	0	0	0	0	7	0	8	
Class C Type III	0	0	0	0	0	0	0	15	15		
Total		13	11	3	2	8	6	11	16	70	

SPSS version 17 (SPSS, Inc., Chicago, IL, United States) was used for data analysis.

The level of agreement was evaluated according to the six-level nomenclature given by Landis and Koch^[8]: (1) Poor agreement: 0.00; (2) Slight agreement: 0.00-0.20; (3) Fair agreement: 0.21-0.40; (4) Moderate agreement: 0.41-0.60; (5) Substantial agreement: 0.61-0.80; and (6) Almost perfect agreement: 0.81-1.00.

RESULTS

A total 70 observations from 23 patients were examined by 3 investigators (MS, FA and SC) to test the reliability of the Sawai's classification^[7] system for tooth abrasion. The kappa statistics were performed for inter-rater agreement among the three examiners. ICC and 95%CI between two examiners, *i.e.*, the inter-rater agreement among 1st examiner (MS) and 2nd examiner (FA) was 0.89 (Table 1). The inter-rater agreement among 1st examiner (MS) and 3rd examiner (SC) was 0.89 (Table 2). And the inter-rater agreement among 2nd examiner (FA) and 3rd examiner (SC) was 0.83 (Table 3). All three comparisons show an almost perfect agreement amongst the three observers.

DISCUSSION

In dentistry, classifications are widely used to categorize defects or diseases based on their etiology, diagnosis,

treatment and prognosis. A "Classification" is defined as "systematic arrangements in groups or categories according to established criteria^[9]."

There are many classifications available for tooth wear. The earliest known index is by Broca^[10], 1879 for tooth attrition. It was followed by index given by Restarski *et al*^[11] in 1945 which evaluated the severity of erosive destruction using the 6 point grading system. But concerns were raised regarding its reproducibility.

The commonly known Eccles's index^[1] was given in 1979 initially classified the lesions into early, small and advanced types. It was refined and expanded in 1982 with more descriptive criteria; grading both severity and site erosion due to non-industrial causes. It is considered as one of the cardinal indices from which others have evolved^[4].

Later, Xhonga and Valdimanis^[12] divided erosions into four levels by measurement with a periodontal probe: none, minor, moderate and severe. They further differentiated the types of erosion by morphological descriptions, such as wedge, saucer, groove and atypical. However, they did not address the problem of inter- or intra-examiner variability.

Other index like Smith and Knight's Tooth Wear Index (TWI)^[2] was given in 1984 which was a comprehensive system and was more clinically relevant. It produced results from intra- and inter-rater reproducibility within an acceptable range. It could be used on study models and photographs also. However, it was very time consuming

Table 3 FA photography based evaluation and SC photography Cross tabulation

		SC photography									Total	Measure of agreement, χ value
		Class A			Class B			Class C				
		Type I	Type II	Type III	Type I	Type II	Type III	Type I	Type II			
MS Photography based evaluation	Class A Type I	12	0	0	0	0	0	1	0	13	0.832	
	Class A Type II	0	9	0	0	0	0	1	0	10		
	Class A Type III	0	0	3	0	0	0	0	1	4		
	Class B Type I	0	0	0	2	0	0	0	0	2		
	Class B Type II	0	1	0	0	8	0	1	0	10		
	Class B Type III	1	0	0	0	0	6	2	1	10		
	Class C Type II	0	0	0	0	0	0	6	0	6		
Class C Type III	0	1	0	0	0	0	0	14	15			
Total		13	11	3	2	8	6	11	16	70		

and always required computer assistance as the amount of data generated was very high.

Linkosalo and Markkanen^[13] used a quantitative, four-scale grading system for severity relating to involvement of dentine. This index was modified by Lussi *et al.*^[31]. Later, Bardsley *et al.*^[41] carried out epidemiological studies on adolescents in North West England using a new, simplified version of TWI. It collected data from 40 surfaces from every subject. However, despite calibration and training, there were difficulties in diagnosing dentine exposure in epidemiological field.

Larsen *et al.*^[14] recommended a new clinical index. It was based on clinical examination, photographs and study casts. Each tooth surface was scored, with six grades of erosion severity modelled using Smith and Knight's TWI; however its criteria is complicated and time consuming.

Thus, there was a need of new classification system for tooth wear which was proposed by Sawai^[7] in 2014. The present study evaluated the sensitivity of using this classification system by three observers.

An ideal classification should have following characteristics according to the criteria given by Murphy^[15] in 1997: (1) Naturalness; (2) Usefulness; (3) Simplicity; (4) Exhaustiveness; (5) Disjointness; and (6) Constructability.

When this proposed classification is tested for these qualities of an "Ideal Index", it is seen that this system is simple, exhaustive, useful and clear in its classes. The distinction is based on objective criteria to avoid any confusion. It seems to be very simple for practical application as there are few subclasses. The observers reported no difficulty in using this classification system. This study conducted here tests the reliability of the use of this index, whether it can effectively communicate the findings to other colleagues, whether it creates confusion among different clinicians regarding difference in opinions in diagnosis. As the results of this study show that there was almost perfect agreement amongst the observers, it can be concluded that this proposed classification system by Sawai satisfies majority of the criteria, which are considered essential for a good classification system. This system can be used for studying dentitions from study casts and photographs

as well.

The authors want to highlight that there were no observations of type IV subclass category in the present study. Hence, it is emphasized that this subclass cannot be documented using photographs or study models as one cannot identify an open pulp chamber in a photograph or study cast. However, this drawback can be defeated if this classification is used in clinical study as it is easy to identify an exposed pulp chamber.

To conclude, the Sawai's classification system is simple and practical to use in daily dental practice. The results of the study show that this classification is sensitive and reliable. The authors' recommend further clinical studies to assess the validity of this proposed classification system.

COMMENTS

Background

The authors, as dentists, always diagnose and monitor any particular oral disease. They use various indices to determine the severity and progression of a disease. For this, the authors use classifications or indices which are universally applied. Currently there is no ideal index for classification of tooth abrasion. A simple classification was proposed in 2014. This study evaluates the reliability of this index for use in practice.

Research frontiers

The currently available indices for tooth abrasion are time consuming. There is no uniformity regarding their grading. Hence there is an absolute need for a classification which is reliable for use in practice.

Innovations and breakthroughs

The available classifications for tooth abrasion lack uniformity and are either qualitative or quantitative in nature. This study proves that the classification used was easy to understand as dentistry students classify the tooth abrasions effectively. The classification is able to identify the position of the abrasion defect on the tooth surface and grade the severity as well.

Applications

The classification is reliable and can be used in daily dental practice.

Peer-review

The manuscript is interesting and with clinical relevance. It requires minor improvement in methodology. However, the conclusion that it can be used to classify cervical abrasions reliably is very important in dental clinics. Yet, it is important that the limitations regarding exposed pulp chamber are established.

ACKNOWLEDGMENTS

The authors deeply acknowledge the support of Prof. Dr. Ashu Bhardwaj and Ms. Jinisha Shukla in helping us complete this study.

REFERENCES

- 1 **Eccles JD.** Dental erosion of nonindustrial origin. A clinical survey and classification. *J Prosthet Dent* 1979; **42**: 649-653 [PMID: 292776 DOI: 10.1016/0022-3913(79)90196-3]
- 2 **Smith BG, Knight JK.** An index for measuring the wear of teeth. *Br Dent J* 1984; **156**: 435-438 [PMID: 6590081 DOI: 10.1038/sj.bdj.4805394]
- 3 **Lussi A, Schaffner M, Hotz P, Suter P.** Dental erosion in a population of Swiss adults. *Community Dent Oral Epidemiol* 1991; **19**: 286-290 [PMID: 1742995 DOI: 10.1111/j.1600-0528.1991.tb00169.x]
- 4 **Bardsley PF, Taylor S, Milosevic A.** Epidemiological studies of tooth wear and dental erosion in 14-year-old children in North West England. Part 1: The relationship with water fluoridation and social deprivation. *Br Dent J* 2004; **197**: 413-416; discussion 399 [PMID: 15475904 DOI: 10.1038/sj.bdj.4811722]
- 5 **Khan F, Young WG, Shahabi S, Daley TJ.** Dental cervical lesions associated with occlusal erosion and attrition. *Aust Dent J* 1999; **44**: 176-186 [PMID: 10592562 DOI: 10.1111/j.1834-7819.1999.tb00219.x]
- 6 **Mahajan A, Kashyap D, Kumar A, Mahajan P.** Reliability study of Mahajan's classification of gingival recession: A pioneer clinical study. *J Indian Soc Periodontol* 2014; **18**: 38-42 [PMID: 24744542 DOI: 10.4103/0972-124X.128198]
- 7 **Sawai MA.** An easy classification for dental cervical abrasions. *Dent Hypotheses* 2014; **5**: 142-145 [DOI: 10.4103/2155-8213.140589]
- 8 **Landis JR, Koch GG.** The measurement of observer agreement for categorical data. *Biometrics* 1977; **33**: 159-174 [PMID: 843571 DOI: 10.2307/2529310]
- 9 **Merriam-Webster.** Merriam-Webster online dictionary, copyright by Merriam-Webster Incorporated. [accessed 2016 Sep 26]. Available from: URL: <http://www.merriamwebster.com/dictionary/classification>
- 10 **Broca P.** Instructions relatives a l'étude anthropologique dusystème dentaire. *Bull Soc Anthropol Paris* 1879; **2**: 128-163 [DOI: 10.3406/bmsap.1879.5212]
- 11 **Restarski JS, Gortner RA, McCay CM.** Effect of acid beverages containing fluorides upon the teeth of rats and puppies. *J Am Dent Assoc* 1945; **32**: 668-675[doi:10.14219/jada.archive.1945.0108]
- 12 **Xhonga FA, Valdmanis S.** Geographic comparisons of the incidence of dental erosion: a two centre study. *J Oral Rehabil* 1983; **10**: 269-277 [PMID: 6575167 DOI: 10.1111/j.1365-2842.1983.tb00121.x]
- 13 **Linkosalo E, Markkanen H.** Dental erosions in relation to lactovegetarian diet. *Scand J Dent Res* 1985; **93**: 436-441 [PMID: 3864217]
- 14 **Larsen IB, Westergaard J, Stoltze K, Larsen AI, Gyntelberg F, Holmstrup P.** A clinical index for evaluating and monitoring dental erosion. *Community Dent Oral Epidemiol* 2000; **28**: 211-217 [PMID: 10830648 DOI: 10.1034/j.1600-0528.2000.280307.x]
- 15 **Murphy EA.** The Logic of Medicine. 2nd ed. Baltimore: The Johns Hopkins University Press, 1997: 119-136

P- Reviewer: Ferreira MM, Mattos BSC, Vieyra JP
S- Editor: Kong JX **L- Editor:** A **E- Editor:** Lu YJ





Published by **Baishideng Publishing Group Inc**
7901 Stoneridge Drive, Suite 501, Pleasanton, CA 94588, USA
Telephone: +1-925-223-8242
Fax: +1-925-223-8243
E-mail: bpgoffice@wjgnet.com
Help Desk: <http://www.f6publishing.com/helpdesk>
<http://www.wjgnet.com>

