

# A new cavity classification LOV/DD

Oleksandr Bulbuk<sup>1</sup>, Olena Bulbuk<sup>1</sup>, and Mykola Rozhko<sup>1</sup>

<sup>1</sup>Ivano-Frankivsk National Medical University

April 28, 2020

## Abstract

**Background** : Previous research have established – in the problem solving of diagnosis and treatment of hard tissues defects, a significant role belongs to the choice of tactics treatment tooth destruction. This work aims to study the diagnosis problems and cavity classification, what will facilitate objectification of diagnostic and therapeutic approaches in the dental treatment of patients with this disease.

**Methods** : For differential estimation of defects in teeth and for a precise assessment of the strength of the composition "tooth-restoration", we conducted a mechanic-mathematical modeling of contact interaction of restoration with tooth tissues. We also conducted anthropometric studies cavities all kinds and different groups of teeth.

**Results**: The first division of the cavities we have conducted in depth lesions: depth of destruction (DD). The next division we conducted on several parameters: **Location of defects, Occlusion load, Volume of defects (LOV)**. As a result of the study, was proposed the cavity classification LOV/DD, is offered the method choice algorithm of treatment hard tissues defects, which is based on classification LOV/DD, and can serve as a selection criterion in the treatment of such pathologies.

**Conclusion**: The proposed classification fills the obvious gap in academic representations of hard tissue defects, suggests the prospect of reaching a consensus on differentiated diagnostic and therapeutic approaches in the treatment of patients with this disease.

**Keywords**: cavity classification, diagnostics, restoration, algorithm of treatment.

## Problem statement and analysis of the recent research

Since the complications arising after various types of restoration are often caused by mistakes made by doctors at the stage of choosing a treatment method, the problem of choosing a method for treating hard tissue defects (cavities) requires a thorough study and development of new approaches in accordance with the principles of evidence-based medicine.1-3

When choosing the method of restoring the damaged crown of the tooth and making the diagnosis, one can consider the index of destruction of occlusal surface of tooth (IDOST) proposed by Milikievich for Class I and II carious lesions. To date, the determination of the degree of the destruction of the occlusal surface of the tooth is one of the most important factors in choosing a treatment method (fillings, onlays or crowns). This index is used today in the post-Soviet countries for the diagnosis and choice of a method for treating cavities.4 The global dental community relies on other indicators: "intercuspal distance", SI/STA.5

At the current stage of dentistry development, the dynamic growth of new knowledge, technologies and materials has significantly changed the methods of treating cavities.6

Based on the meta-analysis of literature, it was concluded that complications arising after various types of restorations are often associated with mistakes made by doctors at the stage of choosing a treatment method. Thus, the problem of choosing a method for treating cavities requires a thorough study and development of new approaches in accordance with the principles of evidence-based medicine.

**The objective of the study** – develop anatomical and functional classification cavities, as a basis for the application of differentiated diagnostic and therapeutic approaches in dental treatment.

## Methods

For differential assessment of the extent of cavities and precise estimation of the strength of the composition “tooth-restoration”, we conducted mechanical and mathematical modeling of contact interaction of restoration with dental tissues. We conducted anthropometric studies using methodology proposed by us. Anthropometric study of all types of cavities of different groups of teeth was carried out as well.7-8

## Results of the research and their discussion

We relied on the well-known prototypes of SI/STA classification proposed by Mount GJ and Hume WR (1998), and modified by Lasfargues JJ et al. (2000).6,9 On the basis of conducted experimental researches,10 own scientific hypotheses, meta-analysis of scientific literature, clinical experience, we have developed the cavity classification.

The first division was made according to the depth of destruction (DD):

- 0 – the cavity is not determined (demineralization, discolorite, changes in the anatomical shape of the tooth).;
- 1 – defeat of enamel and initial defeat of dentin, cavity depth within the outer 1/3 dentin;
- 2 – moderate defeat of dentin, depth of cavity in the middle third of dentin;
- 3 – deep dentin damage, depth of the cavity within the circle of the pulp dentin,
- 4 – teeth after endodontic treatment.

The next division we conducted on several parameters: location of defects (L), occlusion load (O), volume of cavity (V). All the cavities were divided into 4 groups (LOV) (Fig. 1):

*Group 1:*

- Cavities in the area of natural pits and fissures;
- Cavities with one and two-sided defects on incisors and fangs up to  $\frac{1}{2}$  of the length of the cutting edge with the preserved vestibular surface and the optimum amount of dentin on it;
- Cavities cervical area of all groups of teeth and free operational access to them. *Group 2 :*
- Cavities on molars and premolars of type O, with a preserved wall not less than 20% of the diameter of the crown of the tooth;
- Cavities on molars and premolars of the type OM (OD) and MOD without damage to the supporting humps and the thickness of the retained walls of not less than 20% of the diameter of the crown of the tooth;
- Cavities on incisors and fangs with a lesion of the vestibular surface to one third.

*Group 3:*

- Cavities type O in premolars and molars with a wall thickness of less than 20% of the diameter of the crown of the tooth;
- Cavities type OM (OD), MOD with a defeat of one supporting cusp in molars;
- Cavities type OM (OD), MOD in premolars and molars with preservation of wall thicknesses less than 20% of the diameter of the crown of the tooth;
- Cavities on incisors with a lesion of 1/3 to  $\frac{1}{2}$  length of the cutting edge;
- Cavities on incisors and fangs with lesion of the vestibular tooth surface up to 1/2 of the crown width;
- horizontal tooth defeat to 1/3 crown height;

*Group 4:*

- Cavities on premolars of type OM (OD), MOD with a lesion of one cusp;

- Cavities of molars of type OM (OD), MOD with lesions of two or more cusps;
- Cavities on incisors with a lesion of the cutting edge more than  $\frac{1}{2}$  its width;
- Cavities on fangs with a lesion of more than  $\frac{1}{2}$  crown width;
- horizontal tooth defeat at  $\frac{1}{2}$  and more crown height.

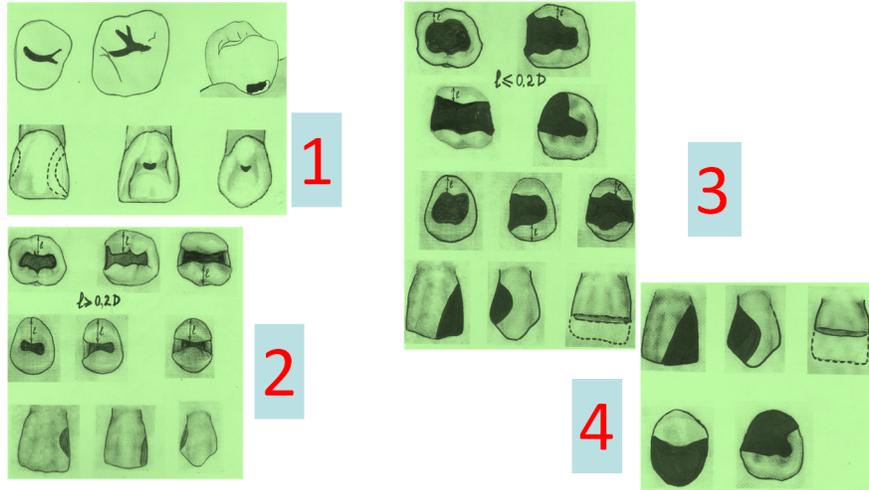


Figure 1: Couldn't find a caption, edit here to supply one.

**Figure 1.** Classification LOV/DD

We called our classification LOV/DD. After removal of the affected tissues, we measured using a micrometer in the front group of teeth of the width of the preserved vestibular surface, and in the lateral group of teeth, the thickness of the preserved wall. Based on these measurements, we performed the diagnosis using LOV/DD (Fig. 2 ).

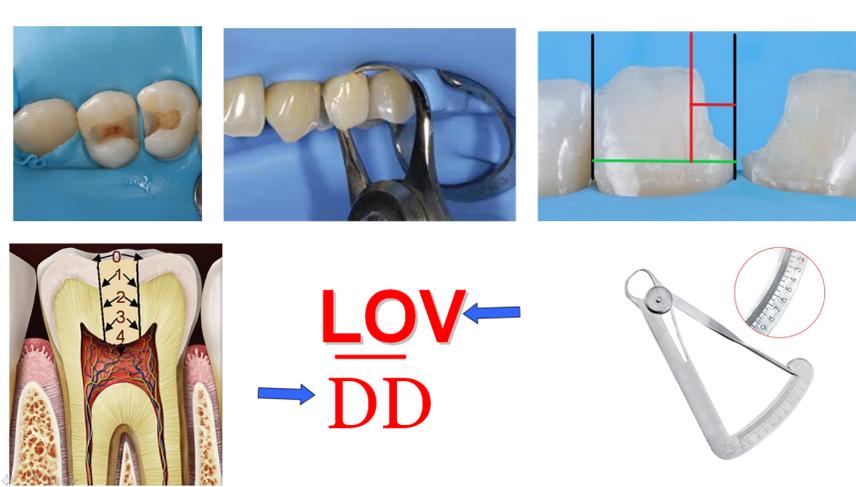


Figure 2: Couldn't find a caption, edit here to supply one.

**Figure 2.** Classification LOV/DD (measurements)

We propose to write it in the form of a fraction, where the numerator indicates the location of defects - LOV, and the denominator indicates the depth of decay - DD. For example: 1/0, 1/1, 1/2, 1/3, 1/4, 2/0, etc. For all types of cavities localized in the cervical margin of a tooth, we used the classification being previously described by us, where the numerator indicated the level of the cervical location of the cavity. To describe the depth of the location of the cavity margin line towards the gingival level, we used the index, the value of which was equal to the distance (expressed as an integer in millimeters) from the level of the epithelial attachment to the deepest point of the cavity margin line. If the bottom of the cavity was located supragingivally, we put the “+” sign in front of the index; if the bottom of the cavity was located subgingivally, we put the “-” sign in front of the index; if the bottom of the cavity was located at the level of the epithelial attachment, we used the “ index.11

If the cavity had marginal decay of two or more sides - we chose the deepest cavity for our classification. For example: 2+1 /3, 30/4 etc.

According to our research, we proposed an algorithm for choosing a method dental treatment, based on the classification we proposed (Table 1).

**Table 1. Algorithm choice of dental treatment**

Type of treatment	Systematization LOV/DD
Direct restoration	Cavities 1/0, 1/1, 1/2, 1/3, 1/4; Cavities 2/0, 2/1, 2/2, 2/3, 2/4; Cavities 3/0, 3/1, 3/2
Indirect restoration	Cavities 3/3, 3/4 Cavities 4/1, 4/2 Cavities 4/0*
Crowns	Cavities 4/3, 4/4**

\*The tactics of treating such patients with cavities of 4/0 depend on the etiology and depth of the change in the color of the tooth. Currently, such teeth are treated by external or internal bleaching or by less conventional methods: indirect restoration and artificial crowns.

\*\*The tactics of treating such patients with cavities of 4/4: use of a fiber post is recommended.

In the available medical literature, we did not find any works devoted to the questions of clear cavity classification. At the present stage of the development of dentistry, the dynamic growth of new knowledge, technologies and materials significantly changed the methods of treating defects of dental hard tissues.12 In clinical cases where the cavity is located subgingivally, the “Cervical Margin Relocation” (CMR) can be used. During the period of dentistry development, various CMR techniques have been developed and studied gaining popularity among dental practitioners; however, there is no clear classification of gingival cavities.3,13-16

The importance of dental restoration using fiber posts is being discussed as well. After endodontic treatment of teeth, it is recommended to use a fiber post, as there is a greater loss of dental tissue, i.e. the decisive factor in choosing the method of treatment is the amount of lost hard tissue. 3,17-20

In the SI/STA classification system, there is no clear distinction between isolated carious cavities, located on one tooth surface, and combined lesions that involve several surfaces. The disadvantage of this classification is the characteristics of mainly chewing teeth, without involving the anterior ones.3,15

The choice between direct and indirect restoration is complicated by the fact that it does not depend on the objective factors. It depends on the dentist’s knowledge, habits, preferences and stereotypes concerning the treatment of such pathologies; the patient’s consent, financial capabilities and other factors that have nothing to do with the methods of evidence-based medicine, i.d. the absence of a cavity classification formed a methodological gap in treatment of this pathology.

## Conclusions

In our opinion, the proposed classification filled the obvious gap in academic ideas of cavities, suggested the prospect of reaching a consensus on differentiated diagnostic and therapeutic approaches in treatment of patients with this disease. The algorithm we developed for choosing a method for treating cavities based on the classification we proposed can serve as a criterion for choosing the treatment of this pathology.

## References

1. Smithson J, Newsome P, Reaney D, Owen S. Direct or indirect restorations? *Int Dent.* 2011;1(1):70-80.
2. Liebenberg W. Return to the resin-modified glassionomer cement sandwich technique. *J Calif Dent Assoc.* 2005;(71):743-7.
3. Nikolaev AI. Sistemnyiy podhod k diagnostike i kompleksnomu lecheniyu karioznyih i prisheechnyih nekarioznyih porazheniy tverdyyh tkaney zubov : kliniko-laboratornoe issledovanie [avtoreferat]. Smolensk: 2012.37 s.
4. Abolmasov NG, Abolmasov NN, Serdyukov MS. *Ortopedicheskaya stomatologiya.* M. : MEDpress-inform; 2018. 556 s.
5. Zarow MD, D'arcangelo C, Paolone G, Paniz G, Felipe L. *EndoProsthodontics – Guidelines for the clinical practice.* Chicago: Quintessence Int; 2016.
6. Mount GJ, Hume WR. A new cavity classification. *Aust Dent J.* 1998 Jun;43(3):153-9.
7. Bulbuk OI, Hrynishak EB, Bulbuk OV, vynakhidnyky; Ivano-Frankivskyi natsionalnyi medychnyi universytet, patentovlasnyk. Sposib vyznachennia ob'emu defektiv tverdyykh tkanyn zubiv. Patent Ukrainy na korysnu model 51592. 2010 lyp. 26.
8. Bulbuk Olena, Bulbuk Olexandr Improvement of diagnostic process in lesions of the coronal part of front teeth. The 12th YSA PhD Symposium at the Medical University of Vienna Vienna 9-10 June (2016):108-109
9. Lasfargues JJ, Kaleka R, Louis JJ. Le concept SISTA. Un nouveau guide thrapeutique en cariologie. *Real Clin.* 2000;11:103–122.
10. Bulbuk OV, Rozhko MM. Optimization of diagnostic process in assessing the extent of dental hard tissue defects after endodontic treatment. *Galician Medical Journal.* 2016;23(4):07-09.
11. Bulbuk O, Rozhko M., Bulbuk O. Classification of defects hard tissue located in the gingival part of any tooth. *The Pharma Innovation Journal.* 2017;6(6):33-35.
12. Carvalho MA, Lazari PC, Gresnigt M, Del Bel Cury AA, Magne P. Current options concerning the endodontically-treated teeth restoration with the adhesive approach. *Braz Oral Res.* 2018 Oct 18;32(suppl 1):e74. doi: 10.1590/1807-3107bor-2018.vol32.0074.
13. Ferrari M, Koken S, Grandini S, Ferrari Cagidiaco E, Joda T, Discepoli N. Influence of cervical margin relocation (CMR) on periodontal health: 12-month results of a controlled trial. *J Dent.* 2018 Feb;69:70-76. doi:10.1016/j.jdent.2017.10.008.
14. Magne P, Spreafico R. Deep margin elevation: a paradigm shift, *Am. J. Esthet. Dent.* 2012;2:86–96.
15. Rocca GT, Rizcalla NI, Krejci I, Dietschi D. Concepts and evidence-based procedures for bonded inlays and onlays. Part II. Guide lines from cavity's preparation to final restoration, *Int. J. Esthet. Dent.* 2015;3:370–392.
16. Zaruba M, Gohring TN, Wegehaupt FJ, Attin T. Influence of a proximal margin elevation technique on marginal adaptation of ceramic inlays. *Acta Odontol. Scand.* 2013;71:317–324.
17. Paolone G, Saracinelli M, Devoto W, Putignano A. Esthetic direct restorations in endodontically treated anterior teeth. *Eur J Esthet Dent.* 2013;8(1):44-67
18. D'Arcangelo C., Zarow M., De Angelis F., et al. Five-year retrospective clinical study of indirect composite restorations luted with a light-cured composite in posterior teeth. *Clinical Oral Investigations.* 2014;18(2):615–624. doi: 10.1007/s00784-013-1001-8.
19. Sande FH, Collares K, , Cenci MS, Demarco FF, Opdam N. Restoration survival: revisiting patients' risk factors through a systematic literature review. *Oper Dent.* 2016;41(S7):S7-S26. <https://doi.org/10.2341/15-120-LIT>
20. Wilson N, Lynch CD, Brunton PA, Hickel R, Meyer-Lueckel H, Gurgan S et al. Criteria for the replacement of restorations: Academy of Operative Dentistry European Section. *Oper Dent.* 2016;41

S7:S48-57. <https://doi.org/10.2341/15-058-O>