

Original Research Article

Morphological and morphometric characteristics of labial-cervical-vertical groove in upper central incisor

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Abstract

Introduction: The labial-cervical-vertical groove (LCVG) is a developmental dental anomaly that may be present in the maxillary central incisors (UCI) which can affect periodontal health, facilitate the occurrence cervical decay, and compromise the aesthetics of the gingival contour. A LCVG can present different magnitudes and, when severe, it can impact the prognosis of the affected tooth. **Objective:** The objective of this study was to investigate the prevalence, extent, and depth of labial-cervical-vertical groove (LCVG) in maxillary central incisors (UCI) from the Human Tooth Bank of Rio de Janeiro State University Dental School, aiming to provide a better understanding of this anomaly and thus to contribute to an accurate differential diagnosis and appropriate dental planning. **Material and methods:** Ninety-seven dental elements, belonging to the Human Tooth Bank of Rio de Janeiro State University Dental School, were inspected, for presence of LCVG. For analysis of this morphological alteration, the following measurements were registered in millimeters: the total length (measured from the coronal to the apical limits of the defect); its extension in the crown (measured from the defect's coronal limit to the cementum enamel junction (CEJ)); its extension in the root (measured from the defect's apical limit to the CEJ) and depth (measurement of the groove's invagination toward the root canal) of

LCVG in each tooth. **Results:** The prevalence of LCVG in our sample was 7.21%. The average measures observed for the LCVG were: 6.43 (± 1.81) mm of total of length, 2.86 (± 1.68) mm of extension in the root; 3.57 (± 0.98) mm of extension in the crown; and <1 to 1mm of depth. **Conclusion:** These findings contribute with knowledge on of the detail, of extent and depth of LCVG in UCI, providing the clinician with information that can favor diagnosis and maintenance of teeth with this anomaly.

Introduction

The labial-cervical-vertical groove (LCVG) is a developmental dental anomaly that may be present in the maxillary central incisors (UCI) with an estimated prevalence ranging from 0.14 to 6.5% of the population [3, 11, 13, 15]. This groove starts at the labial cervical enamel region and extends to the radicular surface with a variable severity. The etiology of this malformation is not well defined and seems to be similar enamel hypoplasia where the function of ameloblasts is compromised by trauma in primary teeth, nutritional issues, genetic or idiopathic causes [9]. It may also be related to a possible involution of enamel epithelium and Hertwig sheath during odontogenesis [8].

The LCVG is a kind of dental morphology change which can affect the health of supporting tissue. It is associated to increased plaque accumulation and periodontal pocket formation with bone loss, initially located. The presence of this groove on the labial aspect of the UCI also affects the aesthetics of the gingival contour and facilitate the occurrence of cavities in the cervical region of the dental crown [3, 13]. The magnitude of the defect can vary from a shallow groove to a complete lack of calcified tissue sealing, allowing communication between the pulp and periodontium [2]. Thus, the prognosis of a tooth with LCVG depends on the severity of the periodontal problem, the access to defect and the groove type, whether it is shallow or deep / short or long [16].

Special attention should be given to this anomaly since it may difficult diagnosis and treatment of periodontal disease. As well as is difficult to rehabilitate patients in esthetic and prosthetic aspects. Clinicians must be prepared to make a differential diagnosis between the LCVG and fractures lines by investigating trauma history. In addition, LCVG can be the cause of persistent pain after endodontic treatment, once there can be lack of hard tissue seal and increased challenge for plaque control in the affected area [14].

The objective of this study was to investigate LCVG extent and depth in UCI, extracted from human subjects, aiming to provide a better understanding of this anomaly and thus to contribute to an accurate differential diagnosis and appropriate dental planning.

Material and methods

This *in vitro* observational descriptive study was conducted at the School of Dentistry of Rio de Janeiro State University (UERJ), after approval by the Ethics in Research Committee of the University Hospital Pedro Ernesto (HUPE) (number: 857 135). All UCI, available on the Human Tooth Bank of Rio de Janeiro State University Dental School, were inspected for sample selection. Teeth with restoration or carious lesion on the buccal aspect were excluded from the sample. After exclusion criteria was applied, total sample size was ninety-seven UCI.

The inspection of the sample for presence of LCVG, and measurements were performed by a single examiner, whose reliability and calibration were assessed via triplicate measurements with *kappa* value of 0.8. The identification of a longitudinal depression when a running a probe over the crown or root surface from mesial to distal (adapted method by Brin e Ben-Bassat [3]) was recorded as presence of LCVG. For analysis of LCVG length and depth, a Williams probe Williams (Hu-Friedy® PCP15, Chicago, EUA) was used to register in millimeters the following measurements: the total length (measured from the coronal to the apical limits of the defect); its extension in the crown (measured from the defect's coronal limit to the cementum enamel junction (CEJ)); its extension in the root (measured from the defect's apical limit to the CEJ) and depth (measurement of the groove's invagination toward the root canal) of LCVG in each tooth.

The prevalence of LCVG was calculated as well as the mean extension and depth of the LCVG. The

statistical analysis was performed with SPSS 20.0 software. The Kolmogorov Smirnov Z normality test was applied to verify the distribution of the data. Normally distributed data were displayed as mean and standard deviation.

Results

Among the ninety-seven UCI examined, the LCVG prevalence was 7.21%, represented by three right UCI and four left UCI had LCVG, accounting or a total of seven UCI with the anomaly (figures 1 and 2).

The mean total extension of LCVG was $6.43(\pm 1.81)$ mm, with a mean extension of $3.57(\pm 0.98)$ mm in the crown and $2.86(\pm 1.68)$ mm in the root. The depth of LCVG varied from <1 to 1mm (table I).



Figure 1 - Vestibular view



Figure 2 - Proximal view

Table I - Labial-cervical-vertical groove measures

Teeth (n=7)	Total extension (mm)	Extension in the crown (mm)	Extension in the root (mm)	Depth (mm)
Tooth 1	8	4	4	1
Tooth 2	7	4	3	1
Tooth 3	9	4	5	1
Tooth 4	7	3	4	<1
Tooth 5	4	2	2	1
Tooth 6	5	3	2	<1
Tooth 7	5	5	0	<1
Mean	6,43 ($\pm 1,81$)	3,57 ($\pm 0,98$)	2,86 ($\pm 1,68$)	*

* not calculated

Discussion

The LCVG prevalence in this study was 7.2%, which is significantly higher than the one found by Kogon [11] of 0.14%, however it is not too contrasting to the following reports of clinical studies: 6,5% by Brin e Ben-Bassat [3], 4,5% by Mass *et al.* [13], 5,3% by Shpack *et al.* [15] and 5% in Di Domenico *et al.* [7]. It is worth mentioning that the findings of Mass *et al.* [13] and Shpack *et al.* [15] refer to LCVG prevalence in all four Maxillary Incisor. Regarding the study of Mass *et al.* [13], it is possible to infer that the prevalence of LCVG in UCI was 3.6%, however the same cannot be done for the study of Shpack *et al.* [15]. Only Kogon [11] assessed extracted teeth and even though his sample as larger, a lower LCVG prevalence was found.

Brin e Ben-Bassat [3] believe that genetic and ethnic factors might influence the LCVG prevalence in UCI. Considering that to our knowledge no other study has investigated the LCVG prevalence in Brazilian subjects and that the UCI is the tooth most frequently affected by this anomaly [15], the present paper provides initial information.

The extension of LCVG was on average $3.57(\pm 0.98)$ mm at the crown; $2.86(\pm 1.68)$ mm at the root and $6.43(\pm 1.81)$ mm for the total length, including crown and root. There are few studies

that address detailed morphometry, in millimeters, of this anomaly. Some of this, describe the groove in lateral incisor, on the palatal radicular face [4-6, 17]. Brin e Ben-Bassat [3] classified the depth of the LCVG in UCI as shallow or deep but did not describe the criteria for such classification and neither quantify in millimeters how this anomaly varied within the sample. Mass *et al.* [13] examined the longitudinal extent of LCVG, classifying it in mild, moderate or severe, where a LCVG with a supragingival extension greater than 2 mm and continuing to the subgingival region was considered severe. In that study, the most frequent kind of LCVG was the mild one, where a shallow subgingival groove could only be felt during probing. Shpack *et al.* [15] also used as severity reference the longitudinal extent of LCVG. A subgingival depression with no supragingival extension was considered as mild, which was most frequently observed kind of LCVG in sample assessed, however with no statistical significance. The mean severity found by the authors was $1.81 (\pm 0.48)$.

Mass *et al.* [13] also evaluated the depth of the groove at three different points of the buccal surface of the upper incisors, finding statistically significant difference between incisors presenting the defect (1.55 ± 0.90 mm) and the ones without the defect (1.18 ± 0.75 mm) only when the central region was compared. The papers of Brin e Ben-Bassat [3], Di Domenico *et al.* [7], Mass *et al.* [13] and Shpack *et al.* [15] refer to clinical studies involving erupted teeth and intrasulcular probing and therefore the full extent of root defect could not be evaluated. Thus, the laboratorial data obtained in the present study cannot be perfectly compared to these other reports but contribute to the perception that LCVG root extension may jeopardize the periodontal support for elements affected by this anomaly.

Some studies describe periodontal changes associated to the presence of LCVG where the periodontal pocket probing depth exceeded 5 mm. Di Domenico *et al.* [7] in a cross-sectional study, with two hundred and fifty-one patients show that presence of radicular grooves increases the possibility of developing gingival inflammation by acting as a plaque retentive factor. Shah *et al.* [14] published a case report where the periodontal bone loss was directly related to LCVG in the UCI and pocket depth recorded in the area was of 11 mm on the mesial and 8 mm on the buccal aspect, while the tooth was vital and without mobility or history of trauma. Srinivas e Pradeep [16] also reported a case where the teeth #11 and #21

had probing depth at the buccal aspect of 7 and 5mm, respectively, with no vertical root fracture and preserved vitality in both teeth. Kerezoudis *et al.* [10] presented the case of a patient with severe pain and swelling in the vestibular region of UCI, initially suggestive of a periodontal abscess. There was no history of trauma, periodontal probing at tooth #21 reached the apex, although the record was not described, and the tooth was not vital. During the clinical examination, it was observed that both UCI had a groove in the cervical area and that bone destruction involving tooth #21 was directly related to the LCVG. Although the LCVG in tooth #11 had not led to endodontic and periodontal involvement, the images showed in this paper reveal its resemblance to the LCVG on tooth #21. Kozlovsky *et al.* [12] have published case reports of periodontal bone in UCI directly related to LCVG, with pocket probing depth of 10mm at the mesiobuccal area. These studies emphasize the importance of differential diagnosis between LCVG and cracks or fractures, as well as vitality test to verify the need for combined endodontic and periodontal treatment. Brin e Ben-Bassat [3] also emphasize the risk of misdiagnosis regarding the LCVG, which can lead to unnecessary invasive procedures illustrated by the two case reports showed in his article, where the teeth with LCVG had received indication for restoration on the cervical area and orthodontic extrusion for treatment of supposed cavity and root resorption, respectively, before the correct treatment indication of proper hygiene of the area.

Therefore, we call the attention of clinicians and dental specialist to carefully examine the clinical crown and subgingival region adjacent to LCVG by periodontal probing to identify as early as possible the occurrence of periodontal changes and rule out dental fracture; indications of invasive unnecessary procedures or compromised the esthetic reconstruction.

The findings of this study provide further knowledge of detail, extension and depth of LCVG in UCI also contributing to correct diagnosis and maintenance of teeth with this anomaly.

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