

Labial-cervical-vertical groove in maxillary permanent incisors—Prevalence, severity, and affected soft tissue

Eliyahu Mass, DMD¹/Keren Aharoni, DMD²/
Alexander D. Vardimon, DMD³

Objectives: To investigate the prevalence and severity of a labial-cervical-vertical groove (LCVG) in maxillary permanent incisors and its effect on the associated gingival tissue.

Methods: A total of 600 adolescents (293 boys and 307 girls, mean age 13.6 ± 1.99 years) were randomly selected and examined for the presence of LCVG. The deformity was classified as mild, moderate, or severe according to predetermined criteria. Gingival coverage at the groove site was defined as normal, partial, and irregular. **Results:** LCVG was found in 27 adolescents (4.5%). It was unilateral in 24 (89%) and bilateral in 3 (11%). The ratio of central to lateral incisors was 29:1. No sexual dimorphism or side prevalence were found. Mild LCVG was found in 22 incisors, moderate LCVG in 7 incisors, and severe LCVG in one incisor. Moderate LCVG was 5 to 6 times more susceptible to partial or irregular coverage of the gingival margin than mild LCVG. The gingival sulcus in teeth with LCVG demonstrated a significant ($P = .001$) increase in depth compared to non-LCVG teeth (1.55 ± 0.90 mm vs 1.18 ± 0.75 mm). **Conclusions:** An LCVG is a deformity confined predominantly to a single permanent maxillary central incisor. Its prevalence is not connected with gender. Most LCVGs are mild and often difficult to detect. However, the greater the severity, the more gingival irregularity is associated. This and the increase in sulcus depth in LCVG incisors are adverse predispositions for periodontal sequelae, calling for cautious oral hygiene maintenance. (*Quintessence Int* 2005;36:281–286)

Key words: congenital deformity, dental deformity, enamel development, gingival contour, gingival margin, labial-cervical-vertical groove, maxillary incisor, periodontal sulcus, tooth development

Diverse morphological tooth deformities are found in various shapes, textures, and prevalence. They can be sporadic or syndromes, nutritional, environmental, genetic, and ethnic related. Most of these tooth-born (ie, patient born with the deformation) deforma-

tions (eg, shovel-shaped incisors, tuberculum Carabelli, variations in number and shape of cusps, dens invaginatus, taurodontism) have been extensively investigated.^{1–10}

Labial-cervical-vertical groove (LCVG), which starts on the cervical enamel and extends to the radicular surface, has also been described as a notch.^{11–17} It is assumed that this malformation is a developmental anomaly in which an infolding of the enamel organ and Hertwig's epithelial root sheath create a groove on the labial surface of permanent maxillary incisors.¹¹ LCVG runs vertically from the crown surface to the root, starting at the enamel on the crown cervix and extends apically, crossing the cemento-enamel junction and resembling a short furrow. This furrow

¹Department of Pediatric Dentistry, Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv, Israel.

²Private practice, Tel Aviv, Israel.

³Department of Orthodontics, Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv, Israel.

Reprint requests: Dr E. Mass, Department of Pediatric Dentistry, Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv, 69978, Israel. Fax: 972-3-6409250. E-mail: elimas@post.tau.ac.il



Fig 1 Unilateral mild labial-cervical-vertebral groove, characterized by a subgingival shallow groove below the gingival margin with a gingival contour type partial coverage (ie, gingiva partially covers the groove with mild change in contour).

gradually grows deeper in the apical direction and may, occasionally, run throughout the root surface.¹⁵ A similar trait has been described on the palatal aspect of maxillary incisors.^{11,12,18,19} The etiology of the malformation may be similar to enamel hypoplasia, caused by impaired function of ameloblasts during tooth development.^{19,20} Causative factors for this malfunction may be due to trauma, disease, and nutritional issues (eg, rickets), or can be genetic or idiopathic.

Anatomic factors, such as cervical enamel projections, enamel pearls, and radicular grooves, may be associated with advanced localized periodontal destruction. Kozlovsky et al¹³ describe a 25-year-old female in which a periodontal lesion with vertical bone loss was directly related to the labial groove on a maxillary central incisor. Brin and Ben-Bassat¹⁴ define the groove as a "labial notch" on the enamel of central incisors. A prevalence of 6.5% was found in a sample of 1,880 children, with no gender preference. Kovacs¹⁸ describes the anomaly in the junction line between enamel and cementum on maxillary central incisors as "fossacoronoradicular," in the same category as "syndesmocoronoradicular" on maxillary lateral incisors. The junction is often divided into two unequal parts and is hollow at that place which is nearly always present in the crown, very often in the root, and can also continue on the latter

up to the apex. Fifteen such teeth (3%) were found in a collection of 500 dry maxillary incisors. This feature was often found, but was less pronounced, on the other teeth.¹⁸

The presence of LCVG may exacerbate some clinical aberrations, such as esthetic deficiency of the gingival marginal contour, accumulation of plaque and, consequently, gingival pocket with bone loss, as well as failure in endodontic and periodontal treatments.^{21–23} This type of dental deformity has been scarcely investigated and reported in the dental literature. Hence, the purpose of this study was to examine the prevalence of LCVG in maxillary permanent incisors in terms of specific tooth (central vs lateral incisor), side (unilateral vs bilateral, left vs right) and gender, and to characterize LCVG in terms of size (severity) and the related gingival tissue (contour and sulcus depth).

METHOD AND MATERIALS

The study group consisted of 600 children and adolescents (293 boys and 307 girls), 12 to 17 years of age, (mean 13.6 ± 1.99 years) treated in the Departments of Orthodontics and Pediatric Dentistry of the School of Dental Medicine, Tel Aviv University. All participants in the study were examined in a dental chair, using a periodontal probe (Wise Perio probe, Premier), by one investigator. The periodontal probe was used to determine LCVG presence, its severity, and depth of the gingival sulcus. A total of 2,392 central and lateral maxillary incisors were examined.

LCVG severity

Severity of LCVG was ranked in three stages: (1) a mild subgingival shallow groove below the marginal gingiva that can be felt only by probing (Fig 1); (2) a moderate groove that can be detected with the eyes, extending subgingivally as in (1), and additionally supragingivally on the labial crown surface, not more than 2 mm from the marginal gingiva in the incisal direction (Fig 2); and (3) a severe defect extending supragingivally more than 2 mm from the marginal gingiva on the labial crown surface and further subgingivally (Fig 3).



Fig 2 (above) Bilateral moderate labial-cervical-vertical groove, characterized by a groove that extends supragingivally less than 2 mm from the gingival margin with a gingival contour type irregular coverage (ie, the gingiva covers the groove with severe change in contour).

Fig 3 (right) Unilateral severe labial-cervical-vertical groove, characterized by a groove that extends supragingivally more than 2 mm from the gingival margin with irregular gingival contour.



Gingival contour

When an LCVG was present, the gingival contour was described in three categories: normal coverage, ie, the gingiva covers the groove with no change in the regular shape of the gingival margin; partial coverage, ie, the gingiva partially covers the groove with mild change in the contour (Fig 1); and irregular coverage, ie, the gingiva covers the groove with a severe change in the contour (Figs 2 and 3).

Depth of subgingival sulcus

Sulcus depth was measured on the mesial, distal, and middle parts of the labial tooth surface. In teeth with the groove, the subgingival depth was also measured in the groove.

Fisher's exact test was used to examine the differences of categorical variables with one free variable between LCVG and non-LCVG teeth. Student *t*-test was used in continuous variables to compare the means of the two groups.

RESULTS

Prevalence

A total of 30 LCVGs were found in 27 children (3 children with bilateral groove) in 14 girls and 13 boys. This means a prevalence of 4.5% for a unilateral or bilateral LCVG (Table 1). Only one lateral incisor was found with a LCVG. Therefore, all further analyses were referred to central and lateral incisors as one entity. No difference was found between occurrence on the left (15 teeth) and the right (15 teeth) side.

LCVG severity

The 30 LCVG were divided into 22 mild (73.3%), 7 moderate (23.3%) LCVG, and 1 severe case (3.3%) (Table 2). There was no difference in severity of the grooves between the left and right sides ($P = 0.897$).

Table 1 Prevalence of unilateral or bilateral LCVG in permanent maxillary incisors of 600 children and adolescents

| | Girls (%) | Boys (%) | Total (%) |
|-------------------------------|-----------|-----------|-----------|
| Subjects | 307 (100) | 293 (100) | 600 (100) |
| Right central incisor | 6 (2.0) | 6 (2.0) | 12 (1.8) |
| Left central incisor | 5 (1.6) | 6 (2.0) | 11 (1.8) |
| Right lateral incisor | —* | — | — |
| Left lateral incisor | 1 (0.3) | — | 1 (0.2) |
| Subjects with unilateral LCVG | 12 (3.9) | 12 (4.1) | 24 (4.0) |
| Subjects with bilateral LCVG | 2 (0.7) | 1 (0.3) | 3 (0.5) |
| Subjects with LCVG | 14 (4.6) | 13 (4.4) | 27 (4.5) |
| Teeth with LCVG | 16 (5.2) | 14 (4.8) | 30 (5.0) |

*LCVG (labial-cervical-vertical groove) not found.

Table 3 Depth of the MLGS in maxillary incisors with and without LCVG

| | With LCVG | Without LCVG |
|-------------|-------------|--------------|
| MLGS ≤ 1 mm | 17 (63%) | 505 (88.3%) |
| MLGS ≥ 1 mm | 10 (37.0%) | 68 (11.7%) |
| Mean (mm) | 1.55 ± 0.90 | 1.18 ± 0.75 |
| Total | 27 | 573 |

LCVG = labial-cervical-vertical groove; MLGS = mid-labial gingival sulcus.

Gingival contour

Gingival contour of the 22 mild LCVG cases was normal in 18 instances (81.8%), that is, the LCVG was completely covered subgingivally and could be detected only with a periodontal probe beneath the marginal gingiva. In 3 subjects (13.6%) the gingival contour partially covered the deformity (Fig 1), and in one case (4.5%), a severe irregular shape in the gingival margin was found (Fig 2, Table 2). The 7 moderate and one severe grooves could clearly be detected without probing, since the LCVG extended coronally from the gingival margin. In 5 patients (62.5%) the gingival contour demonstrated a partial coverage (Fig 1), and in 3 an irregular coverage (37.5%) (Figs 2 and 3; Tables 1 and 2).

Depth of subgingival sulcus

Fisher's exact test was used to compare the depth of the gingival sulcus at three points on

Table 2 Distribution of gingival contour according to LCVG severity in maxillary incisors with LCVG (n = 30)

| Gingival coverage | Severity of LCVG (%) | | |
|-------------------|----------------------|----------|---------|
| | Mild | Moderate | Severe |
| Normal | 18 (81.8) | —* | — |
| Partial | 3 (13.6) | 5 (71.4) | — |
| Irregular | 1 (4.5) | 2 (28.6) | 1 (100) |
| Total | 22 (73.3) | 7 (23.3) | 1 (3.3) |

*LCVG (labial-cervical-vertical groove) not found.

the labial side of all incisors between children with and without LCVG. There were no differences in the mesiolabial ($P = .168$) and distolabial measurements ($P = .437$). However, the mid-labial gingival sulcus was highly significantly different ($P = .001$) between children with (1.55 ± 0.90 mm) and without (1.18 ± 0.75 mm) LCVG (Table 3). Nevertheless, the increase in sulcus depth (>1 mm) was found in 37% of the LCVG subjects (Table 3).

DISCUSSION

Changes in tooth size, number, and morphology have been widely discussed in the literature.¹⁻¹⁰ Some tooth abnormalities are frequent and some sporadic, some are related to genetic influences and some are caused by systemic developmental aberrations. Little attention has been given to the LCVG deformity. An important goal in dentistry is early prevention of disease of the oral cavity and teeth. As LCVG deformity could have future implications that may be expressed as a local gingival disease,¹³ caries and possible esthetic problems, it is important to record LCVG presence and severity in the routine dental examination and to raise awareness in patients and their caregivers.

In the present study, the prevalence of 4.5% of LCVG in maxillary central incisors

was similar to the frequency of 6.5% found by Brin and Ben-Bassat¹⁴ in their study of 1,880 children. In addition, there was no preference related to gender or side of the mouth. Bilaterally LCVG was found in 3 children and on one lateral incisor in 1 child. This indicates that, although less frequent, LCVG may show on more than one maxillary incisor.

The question of whether LCVG is a predisposed condition for a local periodontal disease was addressed in this study. The data suggested a possible cause and effect relationship. First, a direct relation was found between LCVG severity and gingival contour. LCVGs with moderate grade of severity were found to be 5 times more susceptible to partial coverage of the gingival margin and 6 times more prone to irregular gingival coverage than LCVG with a mild grade of severity. That is, the greater the deformity of the LCVGs the more aberration of the gingival coverage was presented. Second, the gingival sulcus at the site of the LCVG defect demonstrated a significant increase in depth (31%) compared to patients without LCVG. This mean depth is still in the normal range, however, the examined population was of adolescents with a mean age of 13.6 ± 1.99 years, which suggests that with increasing age LCVG incisors may become more inclined to develop periodontal sequelae, as has been shown by Kozlovsky et al.¹³ However, 63% of the LCVG incisors demonstrated a normal sulcus depth of less than 1 mm, implying that only one-third of the LCVG deformities are susceptible in developing a periodontal sequelae and two-thirds are likely to maintain a healthy periodontium. Nevertheless, no participant, or their parents, complained or was even aware of the presence of the deformity. It is strongly recommended that whenever LCVG is detected, the dentist should alert the patient to this deformity so that cautious oral hygiene can be implemented. Careful management is of special importance as gingival recession is age-dependent.²⁴

REFERENCES

- Rosenzweig KA, Mass E, Smith P. The Samaritan dentition [in French]. *Bull Group Int Rech Sc Stomat* 1969;12:95–106.
- Jien SS. The Chinese dentition. II. Shovel incisors, Carabelli's cusps, groove patterns, cusp numbers, and abnormalities in morphology of the permanent teeth. *Taiwan Yi Xue Hui Za Zhi* 1970;69:264–271.
- Portin P, Alvesalo L. The inheritance of shovel shape in maxillary central incisors. *Am J Phys Anthropol* 1974;41:59–62.
- Blanco R, Chakraborty R. The genetics of shovel shape in maxillary central incisors in man. *Am J Phys Anthropol* 1976;44:233–236.
- Saunders SR, Mayhall JT. Developmental patterns of human dental morphological traits. *Arch Oral Biol* 1982;27:45–49.
- Sharma JC. Dental morphology and odontometry of the Tibetan immigrants. *Am J Phys Anthropol* 1983;61:495–505.
- Varrel J, Alvesalo L. Taurodontism in 47XXY males: An effect of the extra X chromosome on root development. *J Dent Res* 1988;67:501–502.
- Backman B, Wahlin YB. Variations in number and morphology of permanent teeth in 7-year-old Swedish children. *Int J Paediatr Dent* 2001;11:11–17.
- Terezhalmay GT, Riley CK, Moore WS. Clinical images in oral medicine and maxillofacial radiology. Taurodontism. *Quintessence Int* 2001;32:254–255.
- Constant DA, Grine FE. A review of taurodontism with new data on indigenous southern African populations. *Arch Oral Biol* 2001;46:1021–1029.
- Lee KW, Lee EC, Poon KY. Palato-gingival grooves in maxillary incisors. A possible predisposing factor to localised periodontal disease. *Br Dent J* 1968;124:14–18.
- Gaspersic D. Palatal grooves on the upper incisors and buccal grooves on the dental neck of the upper central incisors [in Croatian]. *Zobozdrav Vestn* 1986;41:95–99.
- Kozlovsky A, Tal H, Yechezkiely N, Mozes O. Facial radicular groove in a maxillary central incisor. A case report. *J Periodontol* 1988;59:615–617.
- Brin I, Ben-Bassat Y. Appearance of a labial notch in maxillary incisors: A population survey. *Am J Phys Anthropol* 1989;80:25–29.
- Goon WW, Carpenter WM, Brace NM, Ahlfeld RJ. Complex facial radicular groove in a maxillary lateral incisor. *J Endod* 1991;17:244–248.
- Seow WK. Clinical diagnosis of enamel defects: Pitfalls and practical guidelines. *Int Dent J* 1997;47:173–182.
- Ben-Bassat Y, Brin I. The labiogingival notch: An anatomical variation of clinical importance. *J Am Dent Assoc* 2001;132:919–921.

18. Kovacs I. A systemic description of dental roots. In: Dahlberg AA (ed): *Dental Morphology and Evolution*. 1st ed. Chicago: University of Chicago Press; 1971:113.
19. Everett FG, Kramer GM. The disto-lingual groove in the maxillary lateral incisor: A periodontal hazard. *J Periodontol* 1972;43:352-361.
20. August DS. The radicular lingual groove: An overlooked differential diagnosis. *J Am Dent Assoc* 1978;96:1037-1039.
21. Simon JH, Glick DH, Frank AL. Predictable endodontic and periodontic failures as a result of radicular anomalies. *Oral Surg Oral Med Oral Pathol* 1971; 31:823-826.
22. Peikoff MD, Trott JR. An endodontic failure caused by an unusual anatomical anatomy. *J Endod* 1977;3:356-359.
23. Peikoff MD, Perry JB, Chapnick LA. Endodontic failure attributable to a complex radicular lingual groove. *J Endod* 1985;11:573-577.
24. Ship JA, Beck JD. Ten-year longitudinal study of periodontal attachment loss in healthy adults. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996;81: 281-290.

Copyright of Quintessence International is the property of Quintessence Publishing Company Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.