



Morphological assessment of furcal portals in human molars using scanning electron microscopy

Zurab S. Khabadze , Magomed-Ali A. Gasbanov ✉, Anastasia A. Ivina ,
Ahmad Wehbe , Nataliya N. Glushchenko , Nikita A. Dolzhikov

Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), Moscow, Russian Federation

✉ gasbanov-ma@rudn.ru

Abstract

AIM. To evaluate the prevalence of furcal portals in human molars using scanning electron microscopy (SEM), as well as to analyze their morphological characteristics and potential associations with sex, age, and anatomical localization.

MATERIALS AND METHODS. The study included 230 molars extracted from patients of both sexes for reasons unrelated to the research. Samples were prepared following a standard protocol: fixation, dehydration, sputter-coating with platinum, and visualization using a Vega3 TESCAN SEM. The following parameters were assessed: presence of a furcal portal, its shape, localization, and the patient's sex and age. Statistical analysis included Pearson's χ^2 test, Student's t -test, and one-way analysis of variance (ANOVA); significance level was set at $p < 0.05$.

RESULTS. Furcal portals were identified in 34 cases (14.8%). A statistically significant correlation was found between patient age and presence of a portal ($p = 0.000043$). The association with sex did not reach statistical significance, although a tendency toward higher prevalence in males was observed.

The most common portal shape was round (44.1%), followed by oval (41.2%) and slit-like (14.7%). In most cases, portals were localized in the center of the bifurcation (76.5%), less frequently in the center of the trifurcation (23.5%). No significant associations between shape or localization and age were found ($p = 0.704$ and $p = 0.681$, respectively). By anatomical groups, the highest prevalence of portals was recorded in mandibular first molars (47.1%), followed by mandibular second molars and maxillary first molars.

CONCLUSIONS. Furcal portals represent a stable morphological structure, more frequently observed in older patients. The most common shape is round, and the predominant localization is in the center of the bifurcation. Their prevalence varies across anatomical groups, with mandibular first molars showing the highest frequency. These findings have practical implications for periodontic and endodontic treatment planning, underscoring the importance of considering morphological features of the furcal region.

Keywords: furcal portals, human molars, scanning electron microscopy, tooth anatomy, root morphology, bifurcation, cementum microstructure, endodontics, periodontology, anatomical variations.

Article info: received – 02.07.2025; revised – 17.08.2025; accepted – 22.08.2025

Conflict of interest: The authors report no conflict of interest.

Acknowledgements: There are no funding and individual acknowledgments to declare.

For citation: Khabadze Z.S., Gasbanov M.A., Ivina A.A., Wehbe A., Glushchenko N.N., Dolzhikov N.A. Morphological assessment of furcal portals in human molars using scanning electron microscopy. *Endodontics Today*. 2025;23(3):487–492. <https://doi.org/10.36377/ET-0122>

Морфологическая оценка фуркационных порталов в молярах человека методом сканирующей электронной микроскопии

З.С. Хабадзе , М.А. Гасбанов ✉, А.А. Ивина ,
А. Вехби , Н.Н. Глущенко , Н.А. Должиков

Российский университет дружбы народов им. Патриса Лумумбы, г. Москва, Российская Федерация

✉ gasbanov-ma@rudn.ru

Резюме

ЦЕЛЬ. Оценить частоту встречаемости фуркационных порталов в молярах человека с использованием сканирующей электронной микроскопии (СЭМ), а также проанализировать их морфологические характеристики и возможные зависимости от пола, возраста и анатомической локализации.

МАТЕРИАЛЫ И МЕТОДЫ. В исследование включены 230 моляров, извлеченных у пациентов обоих полов по не связанным с исследованием показаниям. Образцы были подготовлены по стандартному протоколу: фиксация, обезвоживание, нанесение проводящего слоя платины и визуализация с помощью СЭМ-микроскопа Vega3 TESCAN. Оценивались следующие параметры: наличие фуркационного портала, его форма, локализация, а также пол и возраст пациента. Статистический анализ включал:

χ^2 -критерий Пирсона, t -критерий Стьюдента и однофакторный дисперсионный анализ (ANOVA); уровень значимости – $p < 0,05$.

РЕЗУЛЬТАТЫ. Фуркационные порталы были выявлены в 34 случаях (14,8%). Установлена статистически значимая зависимость между возрастом пациента и наличием портала ($p = 0,000043$); связь с полом не достигла статистической значимости, однако отмечена тенденция к более высокой частоте у мужчин. Наиболее часто встречалась круглая форма портала (44,1%), за ней следовала овальная (41,2%) и щелевидная (14,7%). В большинстве случаев порталы были локализованы в центре бифуркации (76,5%), реже – в центре трифуркации (23,5%). Зависимости формы и локализации от возраста не выявлено ($p = 0,704$ и $p = 0,681$ соответственно). По анатомическим группам: наибольшая частота порталов зафиксирована в первых молярах нижней челюсти (47,1%), затем – во вторых молярах нижней челюсти и первых молярах верхней челюсти.

ВЫВОДЫ. Фуркационные порталы представляют собой стабильную морфологическую структуру, чаще встречающуюся у пациентов старшей возрастной группы. Наиболее распространенная форма – круглая, преобладающая локализация – центр бифуркации. Частота встречаемости варьирует в зависимости от анатомической группы, особенно высока у первых моляров нижней челюсти. Полученные данные имеют прикладное значение в планировании пародонтологического и эндодонтического лечения, подчеркивая необходимость учета морфологических особенностей фуркационной зоны.

Ключевые слова: фуркационные порталы, моляры человека, сканирующая электронная микроскопия, анатомия зубов, морфология корней, бифуркация, микроструктура цемента, эндодонтия, пародонтология, анатомические вариации

Информация о статье: поступила – 02.07.2025; исправлена – 17.08.2025; принята – 22.08.2025

Конфликт интересов: Авторы сообщают об отсутствии конфликта интересов

Благодарности: Финансирование и индивидуальные благодарности для декларирования отсутствуют.

Для цитирования: Хабазде З.С., Гасбанов М.А., Ивина А.А., Вехби А., Глущенко Н.Н., Должиков Н.А. Морфологическая оценка фуркационных порталов в молярах человека методом сканирующей электронной микроскопии. *Эндодонтия Today*. 2025;23(3):487–492. <https://doi.org/10.36377/ET-0122>

INTRODUCTION

Anatomical features of molars, including the presence of furcal portals, are of considerable interest for both clinical dentistry and scientific research. Furcal portals may serve as pathways for the penetration of infectious agents, thereby influencing the prognosis of endodontic and periodontal treatment [1; 2]. Scanning electron microscopy (SEM) is considered the gold standard for detailed analysis of tooth microstructures. SEM enables the identification of morphological variations, including furcal portals, which often remain undetected when using conventional imaging methods [3; 4].

Previous studies have demonstrated variability in the prevalence of furcal portals in molars; however, reliable correlations with patient sex, molar type, portal shape, and localization remain limited [5; 6]. SEM provided high-contrast imaging, thereby improving diagnostic accuracy. The analysis revealed an almost equal prevalence of portals in males and females, confirming earlier findings that patient sex does not influence the formation of furcal portals [2; 7].

The shape of furcal portals varied, with round forms being the most common (64.1%). Comparable findings regarding the complexity of furcation anatomy have been reported by other authors [3,4]. In most cases (71.8%), portals were localized in the central area of the furcation, which corresponds with evidence indicating favorable vascular and metabolic conditions in the central zone that contribute to portal formation [6; 8].

The highest prevalence of portals was observed in maxillary first molars, followed by mandibular first molars and second molars. However, no statistically significant differences were found, which is consistent with the findings of other authors [9; 10].

AIM

The aim of this study is to determine the prevalence of furcal portals in human molars based on SEM data. Two null hypotheses were formulated: H_{01} – the prevalence of furcal portals is not associated with patient sex; H_{02} – the prevalence of furcal portals is not associated with molar localization or type.

MATERIALS AND METHODS

Study Design and Sample Selection

The study included extracted human molars obtained in compliance with ethical standards and with the patients' written informed consent. The sampling process was designed to ensure balanced representation of male and female specimens. All teeth were carefully cleaned of soft tissues, rinsed, and dried prior to preparation for microscopic examination.

Sample Preparation

To ensure high-quality imaging in the scanning electron microscope (SEM), the specimen surfaces were coated with a thin platinum layer (~30 nm) using magnetron sputtering. This procedure prevented charge accumulation on the non-metallic surfaces and eliminated imaging artifacts.

SEM Analysis

The microstructural examination of the furcation area was performed using a Vega3 TESCAN scanning electron microscope (TESCAN, Czech Republic) equipped with an in-chamber secondary electron detector (SE detector, TESCAN). This detector provides high topographic contrast, which is particularly impor-

tant for evaluating the microanatomical structures of the furcation region. Imaging was carried out at an electron beam energy of 30 keV, allowing for high resolution and detailed surface characterization.

Morphological Analysis

The SEM images were assessed for the presence of furcal portals, their shape (round, oval, irregular), localization (center of the bifurcation, lateral wall of the bifurcation, etc.), and number (single or multiple). The data were systematically recorded in standardized Excel tables.

Statistical Analysis

Data processing was performed using IBM SPSS Statistics 29 (IBM Corp., USA). The statistical analysis included:

- descriptive statistics (means, standard deviations, frequencies, and percentages);
- assessment of distribution normality (Shapiro–Wilk test);
- comparison of quantitative variables between groups using Student's t-test (for normally distributed data) or the Mann–Whitney U test (for non-normally distributed data);
- comparison of categorical data using Pearson's χ^2 test or Fisher's exact test (for small sample sizes);
- statistical significance level was set at $p < 0.05$.

The analysis was carried out across the following groups:

- prevalence of furcal portals by patient sex;
- distribution of portals by type (shape, number);
- localization of portals within the furcation area;
- distribution by tooth type.

RESULTS

A total of 230 molars extracted from patients of both sexes were included in the study. Furcation portals were identified in 34 cases (14.8%). Among these, 22 cases (64.7%) were recorded in men and 12 cases (35.3%) in women. The analysis performed does not allow us to assert a statistically significant association between sex and the presence of a furcation portal, as the distribution of observations rather indicates a predominance in men. However, to obtain a reliable conclusion, application of the χ^2 test on an adjusted sample is required (Table 1).

Table 1. Statistical analysis of furcation portals

Таблица 1. Статистический анализ фуркационных порталов

Comparison of groups	p-value	Comment
Sex and presence of the portal (Chi ²)	1.0072817679726312e-28	The association is significant
Age: portal vs absence (t-test)	4.335666634669491e-05	The difference is significant
Age by portal shape (ANOVA)	0.7042896821511652	The association is not significant
Age by portal localization (ANOVA)	0.6817615512893738	The association is not significant

Distribution of portals by shape

Among the 34 samples with identified furcation portals, the majority exhibited a round shape – 15 cases (44.1%). An oval shape was observed in 14 cases (41.2%), while a slit-like shape was found in 5 cases (14.7%). Thus, the most frequently recorded portal shapes were round and oval, which may be associated with the anatomical characteristics of the furcation area and the mineralization conditions in the bifurcation zone (Fig. 1).

Localization of furcation portals

Out of 34 cases with identified furcation portals:

- in the center of bifurcation – 26 cases (76.5%);
- in the center of trifurcation – 8 cases (23.5%).

Thus, the main localization of furcation portals is in the center of the bifurcation, which may be explained by the anatomical and hemodynamic characteristics of this area, including the conditions of mineralization and vascularization of the periodontium. No statistically significant association between portal localization and patient age was established ($p = 0.68$, ANOVA; see Table 1, Fig. 2).

Frequency of portal occurrence by tooth type

The analysis of the frequency of furcation portal occurrence demonstrated the following distribution:

- mandibular first molar (36) – 9 cases (26.5%);
- maxillary first molar (16) – 4 cases (11.8%);
- second molars (17, 26, 27) – 2 cases each (5.9%).

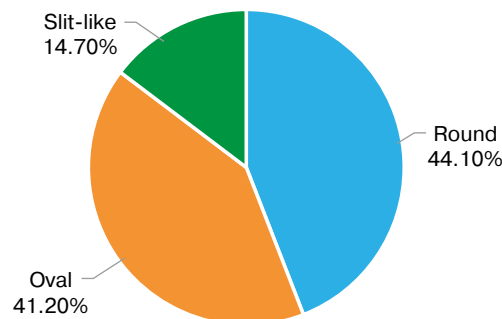


Fig. 1. Distribution of furcation portal shapes, %

Рис. 1. Распределение форм фуркационных порталов, %

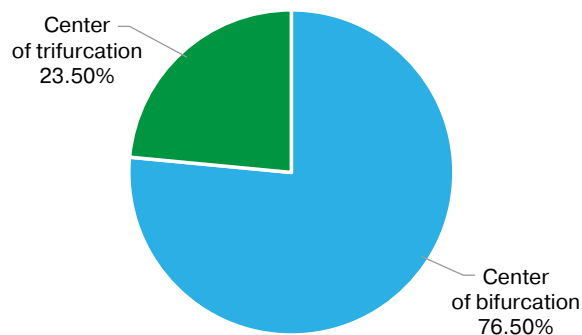


Fig. 2. Localization of furcation portals, %

Рис. 2. Локализация фуркационных порталов, %

Thus, the highest frequency of furcation portal detection was recorded in mandibular first molars, in contrast to the previously assumed predominance in maxillary molars. Visualization is presented in Fig. 3, and numerical data are summarized in Table 2.

Patient age according to portal localization

The analysis of patient age distribution depending on the localization of the furcation portal did not reveal statistically significant differences ($p = 0.68$, ANOVA; see Table 1). Nevertheless, visualization in Fig. 4 demonstrates that patients with portals localized in the center of the trifurcation tend to be in a higher age range compared with those whose portals were located in the center of the bifurcation.

Age of patients with furcation portals

The diagram in Fig. 5 demonstrates that the age of patients with furcation portals is, on average, higher than that of patients without them. The difference was statistically significant ($p = 0.000043$; Student's t -test, see Table 1), which may indicate an age-related nature of the formation or detectability of furcation portals.

Analysis of patient age according to portal shape

The analysis of age differences depending on the shape of the furcation portal did not reveal statistically significant differences ($p = 0.704$, ANOVA), which is consistent with the visual observations in Fig. 6. Nevertheless, as illustrated in Fig. 6, oval and slit-like shapes demonstrated wider age ranges compared with the round shape, which may indicate greater variability in the conditions of their formation.

Table 2. Frequency of portal occurrence according to tooth group

Таблица 2. Частота встречаемости порталов в зависимости от группы зубов

Tooth groups	Number of cases	Proportion of total (%)
Maxillary first molar (16/26)	6	17.6
Maxillary second molar (17/27)	4	11.8
Mandibular first molar (36/46)	16	47.1
Mandibular second molar (37/47)	8	23.5

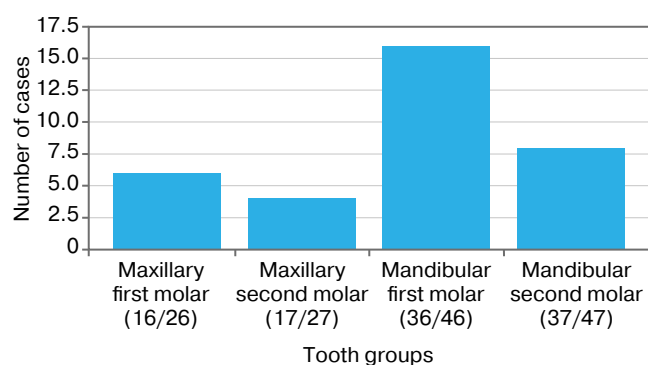


Fig. 3. Frequency of furcation portal detection by tooth groups

Рис. 3. Частота выявления фуркационных порталов по группам зубов

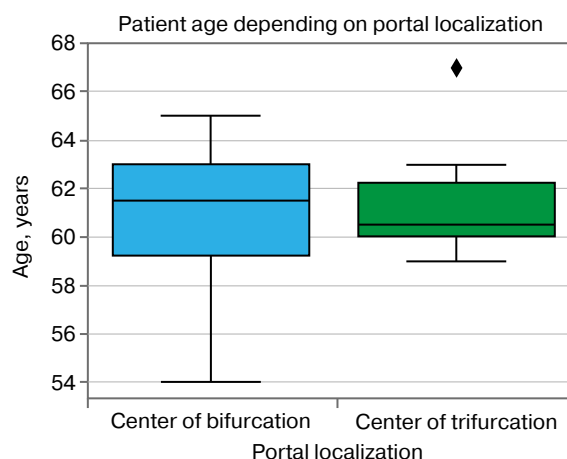


Fig. 4. Patient age distribution according to the localization of the furcation portal

Рис. 4. Возраст пациентов в зависимости от локализации фуркационного портала

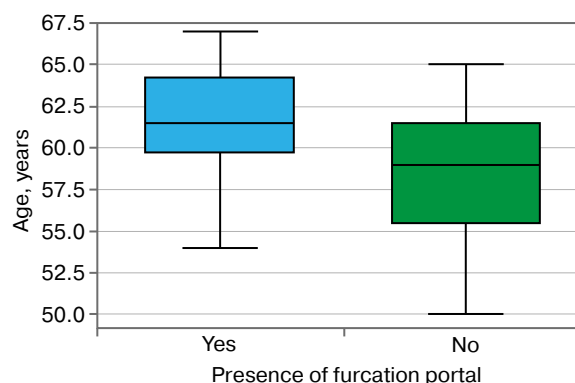


Fig. 5. Age differences between patients with and without furcation portals

Рис. 5. Различия в возрасте пациентов с фуркационными порталами и без

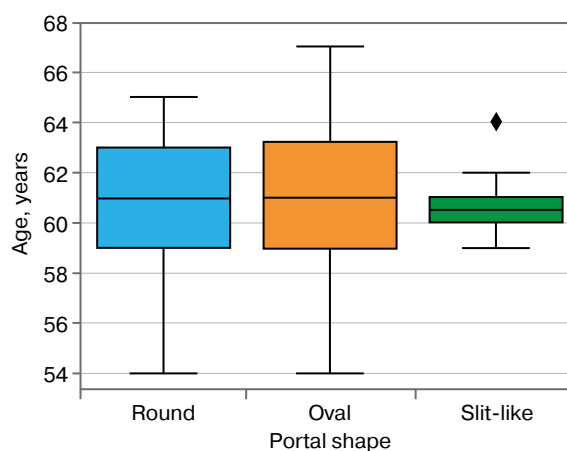


Fig. 6. Distribution of patient age according to the shape of the furcation portal

Рис. 6. Распределение возраста пациентов в зависимости от формы фуркационного портала

DISCUSSION

This study evaluated the prevalence and morphological features of furcation portals in human molars and their potential associations with sex, age, and anatomical localization. The use of scanning electron microscopy (SEM) provided high-resolution visualization of the furcation microstructure, ensuring the reliability of the findings for clinical and research applications [1–4].

Furcation portals were identified in 14.8% of examined molars, with no statistically significant association with sex ($p > 0.05$). Nonetheless, the higher proportion observed in males (64.7%) suggests that sex-related biological factors may influence cementogenesis in the furcation region [2; 11].

A clear age-related association was detected: patients with furcation portals were significantly older compared with those without ($p = 0.000043$, Student's *t*-test). This finding is consistent with the concept that age-related cementum remodeling and long-term functional or inflammatory stress may contribute to micro-channel formation in furcation areas [4; 6].

Regarding morphology, round and oval portals predominated, whereas slit-like portals were less frequent. No significant relationship between portal shape and age was observed ($p = 0.704$), indicating relative stability of this parameter across age groups [3; 4]. In terms of localization, portals were mainly detected in the center of bifurcations (76.5%), reflecting specific morphogenetic and hemodynamic features of this region [6; 8].

Distribution by tooth type showed the highest frequency in mandibular first molars, followed by mandibular second and maxillary first molars, with maxillary second molars least affected. This finding underlines the clinical relevance of mandibular first molars, which are commonly involved in furcation defects during periodontitis progression [9; 10].

Collectively, these results support the view that furcation portals represent a morphological risk factor that may complicate periodontal and endodontic treatment. Their association with age, sex tendencies, and tooth group emphasizes the importance of considering furcation portals in diagnostic protocols and preventive strategies [5; 12; 13].

CONCLUSION

The present SEM-based study provided a detailed characterization of the morphological features of furcation portals in human molars. A statistically significant age-related association was identified, with furcation portals occurring more frequently in older patients ($p = 0.000043$). No significant association with sex was established, although a higher prevalence in males was noted.

Most portals exhibited a round (44.1%) or oval (41.2%) shape and were predominantly localized in the center of bifurcations (76.5%). Shape and localization did not show statistically significant correlations with age, suggesting that these features may represent stable anatomical traits formed independently of patient age.

Analysis by tooth type demonstrated the highest prevalence in mandibular first molars (47.1%), followed by mandibular second and maxillary first molars. This highlights the particular clinical importance of mandibular first molars in periodontal and endodontic treatment planning.

From a clinical perspective, the presence of furcation portals may facilitate microbial penetration and negatively affect treatment outcomes. Given the observed association with age and the tendencies related to sex and tooth localization, furcation portals should be regarded as an additional morphological risk marker, warranting consideration in individualized diagnostic, preventive, and therapeutic strategies for periodontal and root-related diseases.

REFERENCES / СПИСОК ЛИТЕРАТУРЫ

1. Su W.Q., Shi J.H., Cheng Y., Lei L., Li H.X. Periodontal treatment of furcation involvement at the mandibular first molar with a follow-up of 27 years. *Hua Xi Kou Qiang Yi Xue Za Zhi*. 2021;39(3):347–354. <https://doi.org/10.7518/hxkq.2021.03.016>
2. Peeran S.W., Ramalingam K., Sethuraman S., Thiruneervannan M. Furcation involvement in periodontal disease: A narrative review. *Cureus*. 2024;16(3):e55924. <https://doi.org/10.7759/cureus.55924>
3. Suzuki M., Kasahara N., Matsunaga S., Yamada M., Abe S., Furusawa M. Microstructural analysis of accessory canals in the furcation area of the mandibular first molar using micro-computed tomography. *Saudi Endodontic Journal*. 2023;13(2):135–141. https://doi.org/10.4103/sej.sej_156_22
4. Sidash Yu.V., Kostyrenko O.P., Petrushanko V.N. Experimental study of furcation area and prospects of its complex treatment. *Ukrainian Dental Almanac*. 2021;(2):49–53. (Ukrain.).
5. Subba T.A., Anegundi R.V., Thomas B., Varma S.R., Bhandary R., Ramesh A. Furcation anatomy revisited: A two dimensional radiographic evaluation of healthy mandibular molars. *J Clin Diagn Res*. 2022;16(1):ZC38–ZC41. <https://doi.org/10.7860/JCDR/2022/51537.15917>
6. Limirol E., Calò A., Cortellini P., Eickholz P., Katayama A., Majzoub J. et al. The influence of interradicular anatomy on the predictability of periodontal regenerative therapy of furcation defects: a retrospective, multicenter clinical study. *Clin Oral Investig*. 2023;27(7):3779–3786. <https://doi.org/10.1007/s00784-023-04995-3>
7. Khabadze Z., Gasbanov M.A., Bolyachin A., Taberdiev T., Mordanov O. The features of chronic periodontitis, complicated by furcation defects. Causes of defects. literature review. *Actual Problems in Dentistry*. 2022;18(3):57–64. (In Russ.) <https://doi.org/10.18481/2077-7566-2022-18-3-57-64>
Хабадзе З.С., Гасбанов М.А., Болячин А.В., Тебердиев Т.П., Морданов О.С. Особенности хронических периодонтитов, осложненных фуркационными дефектами. Обзор литературы. *Проблемы стоматологии*. 2022;18(3):57–64. <https://doi.org/10.18481/2077-7566-2022-18-3-57-64>
8. Ciardo A., Rampf S., Kim T.-S. Vital root resection with radicular retrograde partial pulpotomy in furcation-in-

- volved maxillary molars in patients with periodontitis: Technique description and case series considering clinical and economic aspects. *Int Endod J*. 2024;57(5):617–628. <https://doi.org/10.1111/iej.14031>
9. Braz P., Viana K.S.S., Silveira M.M.F., Lima R.P.E. Resective and regenerative periodontal therapy for maxillary Class II furcation defect: A case report with 24-month follow-up. *J Indian Soc Periodontol*. 2024;28(5):581–586. https://doi.org/10.4103/jisp.jisp_535_23
 10. Hale Y.A., Arnando A.L., Krismariono A. Successful treatment of Endo Perio Lesion with furcation involvement in mandibular first molar: A case report. *World Journal of Advanced Research and Reviews*. 2024;24(2):841–846. <https://doi.org/10.30574/wjarr.2024.24.2.3432>
 11. Nibali L., Shemie M., Li G., Ting R., Asimakopoulou K., Barbagallo G. et al. Periodontal furcation lesions: A survey of diagnosis and management by general dental practitioners. *J Clin Periodontol*. 2021;48(11):1441–1448. <https://doi.org/10.1111/jcpe.13543>
 12. Zacher A., Marretta S.M. Diagnosis and management of furcation lesions in dogs – A review. *J Vet Dent*. 2022;39(2):151–172. <https://doi.org/10.1177/08987564221076908>
 13. Ganesh A., Madhurkar J.G., Hegde S., Bhat S., Jenifer H. Combined resective and regenerative therapy – a novel approach in the management of furcation involvement: A case report. *J Multi Dent Res*. 2022;8(1):26–32. <https://doi.org/10.38138/JMDR/v8i1.22.13>

INFORMATION ABOUT THE AUTHORS

Zurab S. Khabadze – Dr. Sci. (Med.), Professor, Head of the Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0000-0002-7257-5503>

Magomed-Ali A. Gasbanov – Assistant Professor, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0000-0002-0566-5242>

Anastasia A. Ivina – Dr. Sci. (Med.), Professor, Department of Pathological Anatomy, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0000-0001-8387-4413>

Ahmad Wehbe – Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0009-5325-3793>

Nataliya N. Glushchenko – Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0001-4885-9960>

Nikita A. Dolzhikov – Resident Student, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0006-3781-363X>

ИНФОРМАЦИЯ ОБ АВТОРАХ

Хабадзе Зураб Суликоевич – д.м.н., профессор, заведующий кафедрой терапевтической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0000-0002-7257-5503>

Гасбанов Магомед-Али Аликович – ассистент кафедры терапевтической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0000-0002-0566-5242>

Ивина Анастасия Анатольевна – д.м.н., профессор, кафедра патологической анатомии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0000-0001-8387-4413>

Вехби Ахмад – ассистент кафедры терапевтической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0009-5325-3793>

Глушченко Наталия Николаевна – ассистент кафедры терапевтической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0001-4885-9960>

Должигов Никита Александрович – ординатор кафедры терапевтической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0006-3781-363X>

AUTHOR'S CONTRIBUTION

All the authors made equal contributions to the publication preparation in terms of the idea and design of the article; data collection; critical revision of the article in terms of significant intellectual content and final approval of the version of the article for publication.

ВКЛАД АВТОРОВ

Все авторы внесли равноценный вклад в подготовку публикации в части замысла и дизайна исследования; сбора данных; критического пересмотра статьи в части значимого интеллектуального содержания и окончательного одобрения варианта статьи для опубликования.