folia medica

Folia Medica 65(6):1005-1010
DOI: 10.3897/folmed.65.e100418

Case Report

Treatment of an Apical Cyst with Platelet Concentrate – a Case Report

Janet Kirilova[1], Dimitar Kirov[2], Dimitar Yovchev[3], Elitsa Deliverska[4]

[1] *Department of Conservative Dentistry, Faculty of Dental Medicine, Medical University of Sofia, Sofia, Bulgaria*

[2] *Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University of Sofia, Sofia, Bulgaria*

[3] *Department of Imaging and Oral Diagnostics, Faculty of Dental Medicine, Medical University of Sofia, Sofia, Bulgaria*

[4] *Department of Dental, Oral, and Maxillofacial Surgery, Faculty of Dental Medicine, Medical University of Sofia, Sofia, Bulgaria*

Corresponding author: Janet Kirilova, Department of Conservative Dentistry, Faculty of Dental Medicine, Medical University of Sofia, 1 St Georgi Sofyiski St., 1431 Sofia, Bulgaria; Email: janetkirilova@gmail.com; Tel.:+359 888 343 397

Received: 11 Jan 2023 ♦ **Accepted:** 22 Feb 2023 ♦ **Published:** 31 Dec 2023

Citation: Kirilova J, Kirov D, Yovchev D, Deliverska E. Treatment of an apical cyst with platelet concentrate – a case report. Folia Med (Plovdiv) 2023;65(6):1005-1010. doi: 10.3897/folmed.65.e100418.

Abstract

Apical cysts are typically caused by dental pulp disease and are difficult to treat. In the majority of cases, surgical intervention is required. The rate of success after apical osteotomy varies between 60% and 91%. The introduction of platelet concentrates in treating chronic apical periodontitis is a promising direction for achieving quick and secure results. This article examines the healing of a sizable apical cyst after conservative surgical intervention and the application of platelet concentrate.

We present the case of a patient with a large apical cyst (0.799 cm^3) of teeth 24 and 25 which was treated in this study. The precise endodontic treatment was performed with regenerative components such as gaseous ozone and EDTA irrigation. Apical osteotomy was performed, followed by inserting advanced platelet-rich fibrin plus (A-PRF+) into the surgical wound.

Nine months after treatment, the bones of teeth 24 and 25 were fully healed without any changes to the sinus and nine months after surgically removing the radicular cyst, rapid and complete tissue repair was demonstrated.

Keywords

A-PRF+, apical cyst, bone regeneration, endodontic treatment, ozone gaseous, regenerative therapy

INTRODUCTION

Apical cysts are usually the result of a dental pulp disease and are known to be difficult to treat. They are the most severe complication of a progressive apical infection. The outcome of their conservative treatment is uncertain. In most cases, surgical intervention is required.[1] Surgery is associated with discomfort, edema, and pain in such cases, and patients tend to avoid it. Moreover, the success rate following an apical osteotomy ranges between 60% and 91%[2], which Wang et al.[3] claim can be improved with an orthograde filling. Clinical cases of radicular cysts associated with severe complications, such as spontaneous jaw fracture, have been described in the literature.[4] Tooth loss is also a likely outcome.

The introduction of platelet concentrates in treating chronic apical periodontitis is a promising direction for achieving quick and secure results.[5] Moreover, different generations of platelet concentrates are available, such as PRP, A-PRF, A-PRF+, and others.[6] The treatments of radicular cysts with platelet concentrates described in the literature mainly combine these concentrates with different types of graft materials.[7-9]

This article aims to follow the healing process of a large apical cyst which undergoes a conservative surgical treatment and placement of advanced platelet concentrate fibrin plus.

CASE REPORT

The patient, a 25-year-old man, visited us to complete the treatment of tooth 25. We found that he was in the process of receiving endodontic treatment by another dentist. The examination revealed a fissuring fistula between teeth 23 and 24 ***(Fig. 1c)****. Tooth 24 has a large composite filling. The electric pulp testing (EPT) showed values above 100 μA for both teeth 24 and 25. There was no evidence of a prior endodontic treatment of tooth 24. On the X-ray, it turned out that the bone density changes occurred not only in tooth 24 but also in tooth 25* ***(Figs 1a, 1b)****. The final diagnosis was an apical cyst in teeth 24 and 25.*

Figs 2a, 2b *show the examination of the fistula. We found that it was not associated with apical cysts but with marginal periodontitis. Teeth 24 and 25 were without previous endodontic treatment. In* ***Fig. 2c****, teeth 24 and 25 are visible from the occlusal surface of the teeth at the initial examination.*

Core beam computed tomography (CBCT) evaluation

To examine pathological apical lesions and postoperative apical defects, the observers used Digital Imaging and Communications in Medicine files and Planmeca Romexis Viewer (v. 6.1.0.997) visualization software. The outlines of the apical defect were marked manually as polygons in the axial section (axial Z) using the 'free region grow' tool available in Planmeca Romexis Viewer (v. 6.1.0.997). Next, the lesion outline was marked. The polygon in the axial section precisely covered the entire lesion border (coronal and sagittal).[10] *The 'Create Region' option automatically calculated the defect volume in cubic centimeters. The CBCT study found an apical cyst with a large size of 0.799 cm³ and gaps within it* ***(Figs 1a, 1b)****. According to the PAI system, the cyst was classified with a size of 5, i.e., more than 8 mm.*

Endodontic treatment

The endodontic treatment included determination of the working length using the apex locator Raypex 6 (VDW GmbH. Germany), root canal treatment (two for tooth 24 and 2 for tooth 25) with nickel-titanium files from WaveOne Gold files (Maillefer Instruments, Ballaigues, Switzerland) with reciprocal movement. The irrigation protocol included 2% sodium hypochlorite, 17% ethylenediaminetetraacetic acid (EDTA), 2% chlorhexidine solution (PPH Cercamed, Poland), and the saline solution used for intermediate irrigation

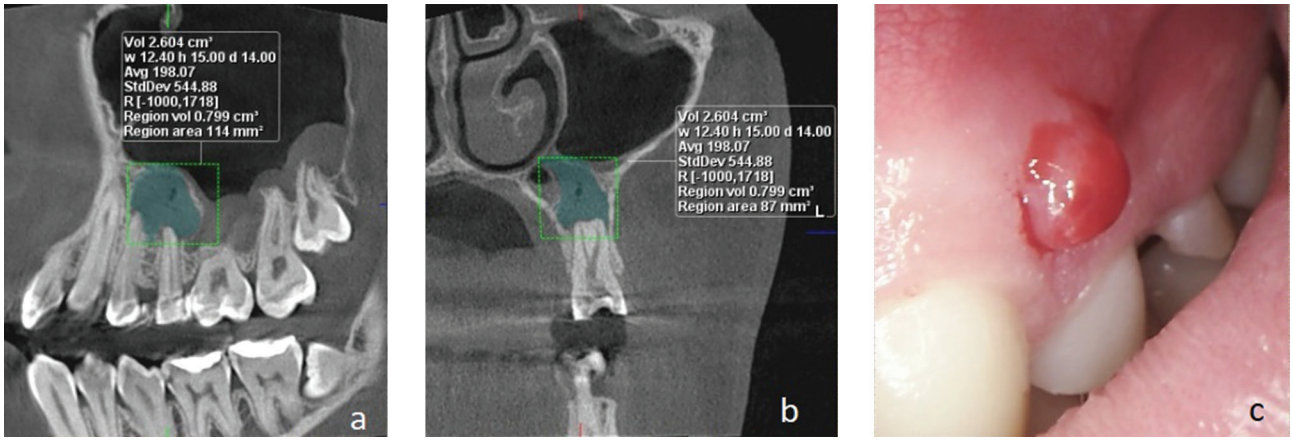

Figure 1. CBCT evaluation of teeth 24 and 25 before treatment. Size 0.799 cm³: (**a**) Coronal section; (**b**) Sagittal section; (**c**) Intraoral view of a fistula between teeth 23 and 24.

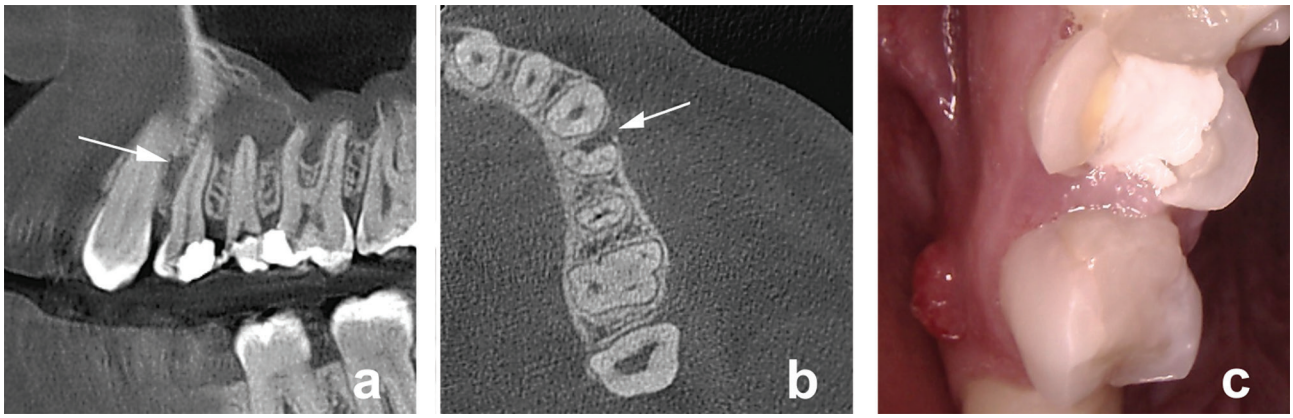

Figure 2. CBCT evaluation of teeth 24 and 25 before treatment. (**a**) Sagittal section; (**b**) Axial section; white arrow indicates fistula tract connected with marginal periodontitis; (**c**) Intraoral view of teeth 24 and 25 before treatment.

between active solutions. For additional effects on microbes in the root canal system, gaseous ozone was used for 48 sec per root canal, not exceeding the maximum permissible dose of 96 sec per visit. An ozone generator Prozone (TIP TOP TIPS Sarl, Switzerland) was used with an endo-tip for direct root canal disinfection. Gaseous ozone was applied through a 2% chlorhexidine solution to remove the Enterococcus faecalis from the root canals.

The endodontic treatment of both teeth was performed consecutively, tooth by tooth, and not simultaneously, to track better the symptoms of the treated teeth. Obturation of root canals was performed with epoxy sealer AH Plus Jet (Dentsplay, DeTrey Gmbh, Konstanz, Germany) and Thermafil Obturators (Maillefer Instruments, Ballaigues, Switzerland). A final restoration of glass-ionomer cement was placed (GC Fuji LC II, GC Corporation Tokyo, Japan).

According to the surgeon's capabilities, surgical intervention was appointed four weeks after the endodontic treatment of teeth 24 and 25.

Surgical treatment

The patient underwent an apical osteotomy. Under local anesthesia, a trapezoidal mucoperiosteal flap was formed from tooth 23 to tooth 26 with two diverging vertical incisions. The bone lesion was visualized and further revealed using bone files. The roots of teeth 24 and 25 were resected by about 3 mm at approximately 12°. Apical granulomatous tissues were removed carefully. After good hemostasis and lavage with saline, the surgical wound was prepared for A-PRF+ placement. A sample of the patient's blood was taken by venipuncture (20 mL). The blood sample was then centrifuged according to the Shounkroun protocol – A-PRF+ (low relative centrifugal forces – 208 g; centrifugation protocol – 1300 rpm for 14 min; Duo centrifuge/Process for PRF, Nice, France). Two fibrin membranes were made. With the one filled, the formed defect without pressure protects the sinus cavity. The other membrane was used to cover the wound surface, and the mucoperiosteal flap (Glycolon 5/0 DS 18-Resorba Medical GmbH, Nümberg Germany) was applied and sewn over it. Finally, the patient was prescribed antibiotic treatment. The sutures were removed seven days after the operation. The area was smooth after an operating period, with minor pain and no edema. After surgery, the patient was prescribed antibiotic treatment for seven days with augmentin 1000 mg per 12 hours for seven days and a probiotic. In addition, painkillers should be prescribed if necessary.

The diagnosis of the radicular cyst was histopathologically confirmed.

RESULTS

The CBCT study performed at three and six months after the surgery found a significant reduction in the radicular cyst **(Fig. 3)**. Three months after the surgical treatment, the bone structure above teeth 24 and 25 was restored, except for a volume of 0.064 cm^3 **(Figs 3-a3, b3)**.

Six months after surgery, a careful CBCT investigation found that the lesion was preserved only above tooth 25, while we found no lesion above tooth 24. The bone structure above the teeth was completely restored except for a minimum volume of 0.008 cm^3 above tooth 25. There were minor changes in the sinus **(Figs 3-a6, b6)**.

The CBCT test was repeated after another three months, nine months after surgery, and 11 months from the start of treatment **(Fig. 4)**. There was a complete healing of the bone of affected teeth 24 and 25 without changes in the sinus.

DISCUSSION

Healing of surgical wounds and after tissue damage involves the following phases: inflammation, proliferation, and formation of new tissue. Platelets form a coagulum for the initial hemostasis immediately after tissue damage or the surgical wound is created. Subsequently, this coagulum is replaced by a fibrin clot. Once platelets are activated, they release natural molecules – various growth factors that can stimulate cell growth, proliferation, differentiation, and healing of tissues.[11]

Choukroun et al. established a protocol to produce A-PRF+, which contains platelets, leukocytes, and growth factors in a healthy fibrin matrix.[11] Leukocytes are essential in the healing process – they protect against external pathogens and attract stem cells from the blood.[12] Growth factors are critical in tissue maturation and the affected tissue's remodeling. In practice, the placement of A-PRF+ in the surgical wound is tissue engineering.[13] The results of our traced case of treatment of radicular cyst confirm a rapid and almost complete recovery of the affected bone tissue by the sixth month postoperatively and entirely at nine months.

In the protocol applied by Choukroun, the centrifugation force is low – it decreases to 208 g and 60 g.[14] Another difference is that tubes (A-P tubes Zhejiang Gongdong Medical Technology Co., Ltd., 318020, Guangzhou, China) without anticoagulants are used, eliminating the possibility of an antigen-antibody reaction. The resulting fibrin matrix has a more porous structure and increased inter-fibrinous spaces (thus cell migration is facilitated), and platelet distribution is even, significantly increasing their number. In addition, there are leukocyte cells in the plasma. Clinical studies confirm the importance of cell distribution for vascularization and tissue regeneration processes.[14] At longer centrifugation times (mode A-PRF+), growth factors significantly increased TGF-β1, VEGF, EGF, and IGF-1.[13] Excellent biocompatibility and cellular activity are reported in an in vitro study.[15] In addition, up to a 300% increase in the synthesis of collagen of the first type is found, which is a critical factor in healing wounds and remodeling them.

The A-PRF+ protocol aims to achieve a better composition for the healing cascade: slow-release cytokines, natural fibrin, monocytes, granulocytes, and plasma proteins with the long-term release of autologous bone morphogenetic protein.[14]

Folia Medica

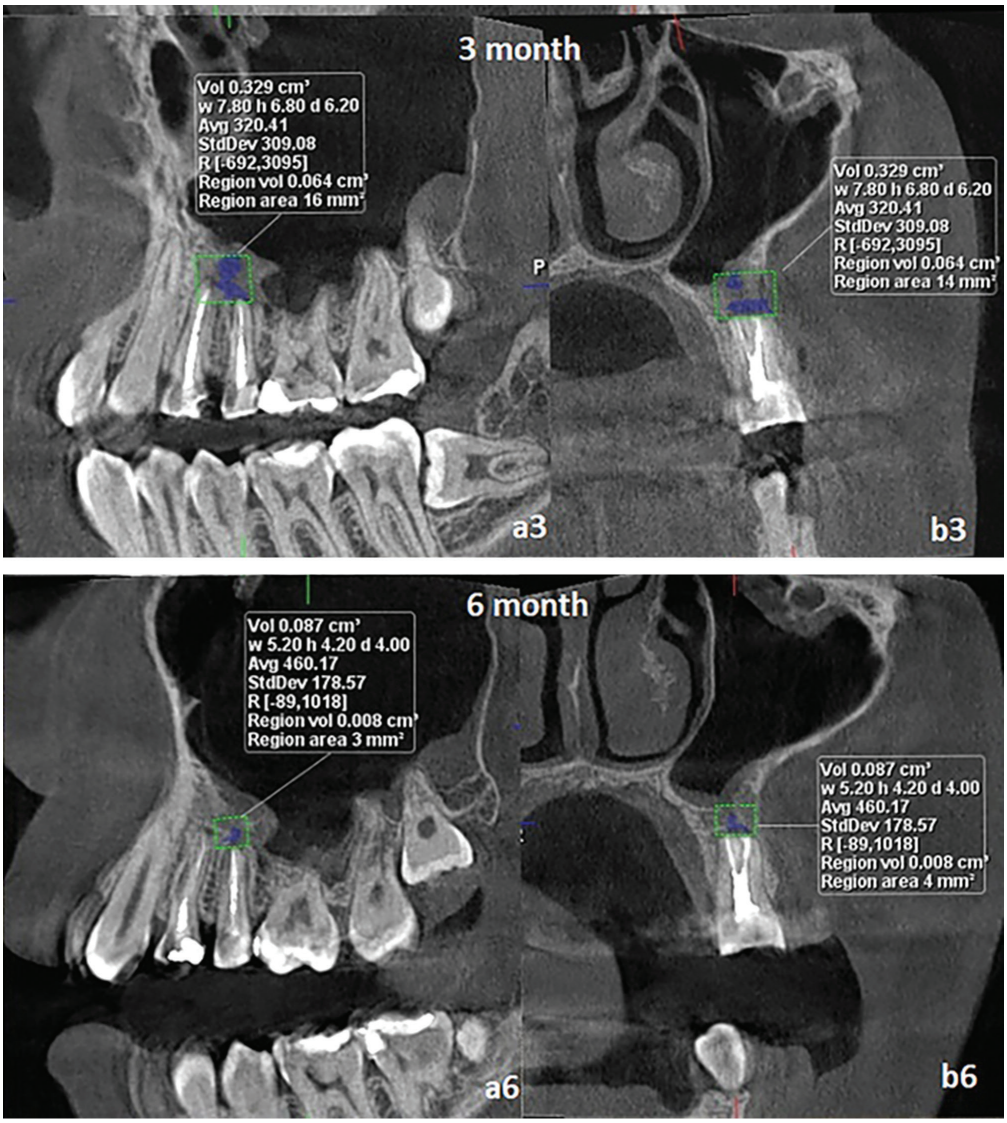

Figure 3. CBCT evaluation of teeth 24 and 25 three and six months after surgical treatment: (**a3, a6**) coronal section; (**b3, b6**) sagittal section.

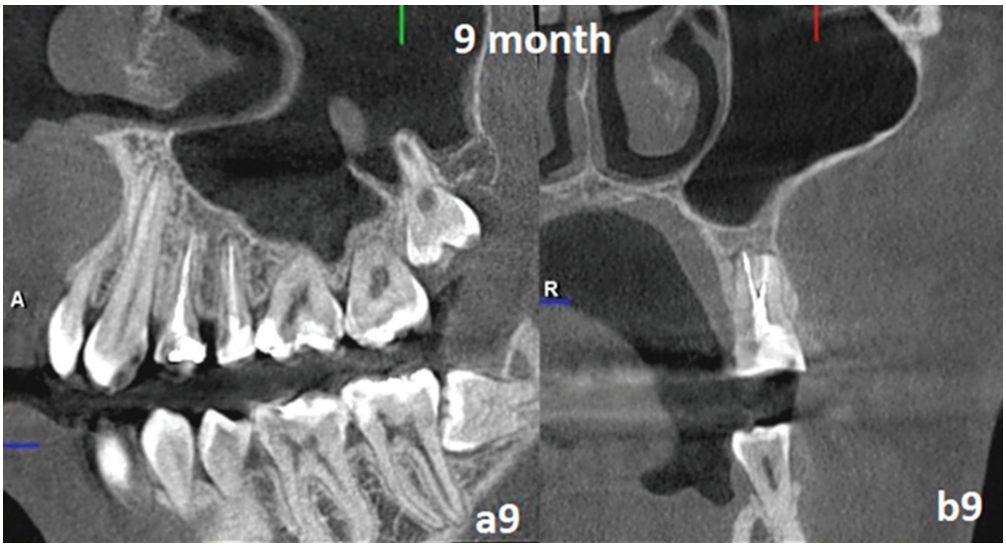

Figure 4. CBCT evaluation of teeth 24 and 25 nine months after surgical treatment: (**a9**) coronal section; (**b9**) sagittal section.

Essential for the result obtained is the method in which the endodontic treatment is conducted. A lavage with 17% EDTA was included in the treatment protocol. It has been shown that the treatment of dentin with EDTA solution leads to the emission of growth factor TGB-β and improves cell morphology, migration, adhesion, and differentiation of cells. Separation of growth factor TGB-β stimulates stem cell activation.[16] In addition, treating root canals with gaseous ozone has been shown to destroy pathogenic microorganisms in the tooth's root canal system. Furthermore, its passage through a chlorhexidine solution reliably reduces the *Enterococcus faecalis* in the tooth's canals. Gaseous ozone itself also leads to an increase in the expression of growth factors in the treated tissues.[17]

The results we obtained are similar to those of Zhao et al. on the treatment terms of healing a radicular cyst but without additional placement of bone grafts.[9] In the present paper, the exact size of the initial radicular cyst was established by CBCT examination and demonstrated in dynamics. Again, CBCT examination improved the complete tissue repair nine months after surgery. In addition, with the endodontic treatment protocol, lavages with a 17% EDTA solution and ozonation of the root canal space are included.

The use of A-PRF+ in dentistry is tissue engineering. In this way, the treatment periods are significantly shortened. Rapid healing is also observed in treating chronic periapical lesions, periodontal diseases, and others.[18,19] The present case of treatment of apical cysts confirms the excellent healing process using platelet concentrate.

CONCLUSIONS

After removing the radicular cyst, rapid and complete tissue repair was demonstrated nine months after surgical treatment. Precise endodontic treatment was performed with a regenerative component such as gaseous ozone and EDTA irrigation. After apical surgery, advanced platelet-rich fibrin (A-PRF+) was introduced to obtain rapid and complete regenerative repair of the affected tissues.

Acknowledgements

The present study was supported by grant No. D-116/24.6.2020 from the Council of Medical Science at the Medical University in Sofia, Bulgaria.

REFERENCES

1. Karamifar K, Tondari A, Saghiri MA. Endodontic periapical lesion: an overview on the etiology, diagnosis and current treatment modalities. Eur Endod J 2020; 5(2):54–67.
2. Mead C, Javidan-Nejad S, Mego ME, et al. Levels of evidence for the outcome of endodontic surgery. J Endod 2005; 31:19–24.
3. Wang N, Knight K, Dao T, et al. Treatment outcome in endodontics – the Toronto Study. Phases I and II: apical surgery. J Endod 2004; 30:751–61.
4. Xiao X, Dai JW, Li Z, et al. Pathological fracture of the mandible caused by radicular cyst: A case report and literature review. Medicine 2018; 97:e13529.
5. Choukroun J, Ghanaati S. Reduction of relative centrifugation force within injectable platelet-rich-fibrin (PRF) concentrates advances patients' own inflammatory cells, platelets and growth factors: the first introduction to the low speed centrifugation concept. Eur J Trauma Emerg Surg 2018; 44:87–95.
6. Miron RJ, Zucchelli G, Pikos MA, et al. Use of platelet-rich fibrin in regenerative dentistry: A systematic review. Clin Oral Investig 2017; 21:1913–27.
7. Vidhale G, Jain D, Jain S, et al. Management of radicular cyst using platelet-rich fibrin and iliac bone graft – a case report. J Clin Diagn Res 2015; 9:ZD34–6.
8. Dhote VS, Thosar NR, Baliga SM, et al. Surgical management of large radicular cyst associated with mandibular deciduous molar using platelet-rich fibrin augmentation: a rare case report. Contemp Clin Dent 2017; 8:647–9.
9. Zhao JH, Tsai CH, Chang YC. Management of radicular cysts using platelet-rich fibrin and bioactive glass: a report of two cases. J Formos Med Assoc 2014; 113:470–6.
10. Karteva T, Manchorova-Veleva N, Karteva E, et al. Application of manual and automatic segmentation methods for volumetric measurements of osteolytic periapical lesions. Rentgenol Radiol 2019; 19(4):287–93.
11. Cieslik-Bielecka A, Choukroun J, Odin G, et al. L-PRP/L-PRF in esthetic plastic surgery, regenerative medicine of the skin, and chronic wounds. Curr Pharm Biotechnol 2012; 13:1266–77.
12. Ponte A, Marais S, Gallay N, et al. The in vitro migration capacity of human bone marrow mesenchymal stem cells: Comparison of chemokine and growth factor chemotactic activities. Stem Cells 2007; 25:1737–45.
13. Ghanaati S, Booms P, Orlowska A, et al. Advanced platelet-rich fibrin: A new concept for cell-based tissue engineering by means of inflammatory cells. J Oral Implantol 2014; 40:679–89.
14. Ghanaati S, Al-Maawi S, Herrera-Vizcaino C, et al. A proof of the low speed centrifugation concept in rodents: new perspectives for in vivo research. Tissue Eng Part C Methods 2018; 24:659–70.
15. El Bagdadi K, Kubesch A, Yu X, et al. Reduction of relative centrifugal forces increases growth factor release within solid platelet-rich-fibrin (PRF)-based matrices: A proof of concept of LSCC (low-speed centrifugation concept). Eur J Trauma Emerg Surg 2019; 45:467–79.
16. Gallar KM, Wildbiller M, Buchalla W, et al. EDTA conditioning of dentine promotes adhesion, migration and differentiation of dental pulp stem cells. Int Endod J 2016; 49:581–90.
17. Grocholewicz K, Matkowska-Cichocka G, Makowiecki P, et al. Effect of nano-hydroxyapatite and ozone on approximal initial caries: a randomized clinical trial. Sci Rep 2020; 7:11192.
18. Kirilova J, Kirov D, Yovchev D, et al. Endodontic and surgical treatment of chronic apical periodontitis: a randomized clinical study. Biotechnol Biotechnol Equip 2022; 36(1):737–44.
19. Deliverska E, Kirilova J. Long-term outcome of endo-surgical treatment of chronic apical periodontitis – case reports. Medinform 2022; 9(3);1612–7.

Лечение апикальной кисты концентратом тромбоцитов – клинический случай

Жанет Кирилова[1], Димитр Киров[2], Димитр Йовчев[3], Елица Деливерска[4]

[1] *Кафедра консервативной стоматологии, Факультет дентальной медицины, Медицинский университет – София, София, Болгария*
[2] *Кафедра протетической дентальной медицины, Факультет дентальной медицины, Медицинский университет – София, София, Болгария*
[3] *Кафедра рентгенологической и оральной диагностики, Факультет дентальной медицины, Медицинский университет – София, София, Болгария*
[4] *Кафедра дентальной, оральной и челюстно-лицевой хирургии, Факультет дентальной медицины, Медицинский университет – София, София, Болгария*

Адрес для корреспонденции: Жанет Кирилова, Кафедра консервативной стоматологии, Факультет дентальной медицины, Медицинский университет – София, ул. „Георги Софийски“ № 1, 1431 София, Болгария; Email: janetkirilova@gmail.com; тел.:+359 888 343 397

Дата получения: 11 января 2023 ♦ **Дата приемки:** 22 февраля 2023 ♦ **Дата публикации:** 31 декабря 2023

Образец цитирования: Kirilova J, Kirov D, Yovchev D, Deliverska E. Treatment of an apical cyst with platelet concentrate – a case report. Folia Med (Plovdiv) 2023;65(6):1005-1010. doi: 10.3897/folmed.65.e100418.

Резюме

Апикальные кисты обычно вызваны заболеванием пульпы зуба и плохо поддаются лечению. В большинстве случаев требуется хирургическое вмешательство. Вероятность успеха после апикальной остеотомии варьируется от 60% до 91%. Внедрение концентратов тромбоцитов в лечение хронического апикального периодонтита является перспективным направлением для достижения быстрых и надёжных результатов. В статье рассмотрено заживление апикальной кисты больших размеров после консервативного хирургического вмешательства и применения концентрата тромбоцитов.

Мы представляем случай пациента с крупной апикальной кистой (0.799 см^3) 24 и 25 зубов, который прошёл лечение в рамках нашего исследованиия. Тщательное эндодонтическое лечение проводилось с использованием регенеративных компонентов, таких как газообразный озон и ирригация EDTA. Была выполнена апикальная остеотомия с последующим введением в операционную рану расширенного фибрина, богатого тромбоцитами (A-PRF+).

Через девять месяцев после лечения кости 24 и 25 зубов полностью срослись без каких-либо изменений в пазухах, а через девять месяцев после хирургического удаления радикулярной кисты было продемонстрировано быстрое и полное восстановление тканей.

Ключевые слова

A-PRF+, апикальная киста, костная регенерация, эндодонтическое лечение, газообразный озон, регенеративная терапия