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**APICAL PERIODONTITIS:  
DIAGNOSTICS, CLINICAL  
MANIFESTATIONS, TREATMENT**

Minsk BSMU 2015

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ

1-я КАФЕДРА ТЕРАПЕВТИЧЕСКОЙ СТОМАТОЛОГИИ

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**АПИКАЛЬНЫЙ ПЕРИОДОНТИТ:  
ДИАГНОСТИКА, КЛИНИЧЕСКИЕ ПРОЯВЛЕНИЯ,  
ЛЕЧЕНИЕ**

**APICAL PERIODONTITIS:  
DIAGNOSTICS, CLINICAL MANIFESTATIONS,  
TREATMENT**

Учебно-методическое пособие



Минск БГМУ 2015

Репозитории БГМУ

УДК 616.314.17-008.1-07-08(811.111)-054.6(075.8)

ББК 56.6 (81.2 Англ-923)

К14

Рекомендовано Научно-методическим советом университета в качестве  
учебно-методического пособия 20.05.2015 г., протокол № 9

Р е ц е н з е н т ы: канд. мед. наук, доц. Н. М. Полонейчик; канд. мед. наук, доц.  
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РЕПОЗИТОРИИ

**Казеко, Л. А.**

**К14** Апикальный периодонтит : диагностика, клинические проявления, лечение = Apical periodontitis : diagnostics, clinical manifestations, treatment : учеб.-метод. пособие / Л. А. Казеко, Ю. В. Модринская, К. В. Севрукевич. – Минск : БГМУ, 2015. – 16 с.

**ISBN 978-985-567-250-1.**

Рассматриваются вопросы диагностики, клинических проявлений и основных принципов лечения апикального периодонтита. Материал базируется на имеющихся в отечественной и зарубежной литературе современных представлениях по данной проблеме.

Предназначено для студентов 3-го курса медицинского факультета иностранных учащихся, обучающихся на английском языке.

**УДК 616.314.17-008.1-07-08(811.111)-054.6(075.8)**

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**ISBN 978-985-567-250-1**  
2015

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## DIAGNOSTICS

*Diagnosis* is defined as utilization of scientific knowledge for identifying a diseased process and for differentiating it from other disease processes. It is the procedure of accepting a patient, recognizing that he/she has a problem, determining the cause of problem and developing a treatment plan, which would solve the problem. Although diagnostic testing of some common complaints may produce classic results, sometimes tests may produce wrong results, which need to be carefully interpreted by a clinician.

### *Examination procedures required to make an endodontic diagnosis:*

- Medical/dental history (past/recent treatment, drugs).
- Chief complaint (if any, how long, symptoms, duration of pain, location, onset, stimuli, relief, referred, medications).
- Clinical exam (facial symmetry, sinus tract, soft tissue, periodontal status (probing test, tooth mobility tests), caries, restorations (defective, newly placed?).
- Clinical testing:
  - pulp tests (cold, electric pulp test, heat);
  - periapical tests (percussion, palpation, tooth biting test);
- Radiographic analysis (new periapicals (at least 2), bitewing, cone beam-computed tomography).
- Additional tests (transillumination, selective anesthesia, test cavity).

## X-RAY EXAMINATION

Radiographic analysis is necessary for the final diagnosis. In the case of asymptomatic apical periodontitis the patients don't have any complaints. The disease is often detected only due to X-ray examination.

X-ray examination is used:

- To identify hidden cavities:  
*on the contact surfaces of teeth;*

*under artificial crowns;*  
*identification of other inaccessible for inspection foci, which contribute to the development of pulp inflammation (periodontal pocket, etc..).*

- To determine:  
*the depth of caries;*  
*the proximity of the cavity bottom to the pulp;*  
*the proximity of the filling material to the pulp, etc.*
- For differential diagnosis of:  
*caries;*  
*pulpitis;*  
*apical periodontitis.*
- In case of teeth or jaws injury, *which can lead to the pulp inflammation.*

Types of X-ray:

- Film.
- Digital.

Digital imaging uses standard radiology technique with film to record the image, and then subjects the finished image to digital processing to produce the final result. *Digital radiography* has the following advantages: the amount of information available from these radiographs is greater than from radiographs that have not been digitized; the storage of radiographs and quality of image is better; photographs of radiographs can be produced. But the radiation dose to the patient while using digital radiography is the same as that used for conventional radiographs.

Types of X-ray:

- **Extraoral:**  
Orthopantomography (fig. 1).



Fig. 1. Orthopantomography

- **Intraoral:**

- Bisecting angle technique (isometric) (fig. 2);

- Paralleling technique (fig. 3);

- Bitewing radiography (fig. 4);

- Occlusal radiography (fig. 5).

In **bisecting angle technique** the X-ray beam is directed perpendicular to an imaginary plane which bisects the angle formed by recording plane of X-ray film and the long axis of the tooth. This technique can be performed without the use of film holders, it is quick and comfortable for the patient when rubber dam is in place. But it also has certain disadvantages such as incidences of cone cutting, image distortion, superimposition of anatomical structures and difficulty to reproduce the periapical films.

In **paralleling technique** the X-ray film is placed parallel to the long axis of the tooth to be exposed and the X-ray beam is directed perpendicular to the film. This technique has advantages such as better accuracy of image; reduced dose of radiation; reproducibility; better images of bone margins, interproximal regions and maxillary molar region. Paralleling technique has also certain disadvantages: e. g. it is difficult to use in patients with shallow vault; gag reflex, when rubber dam is in place; extremely long roots; uncooperative patients; tori.



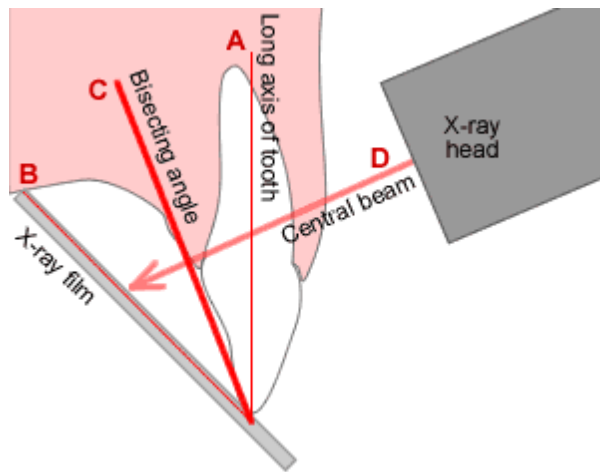


Fig. 2. Bisecting angle technique

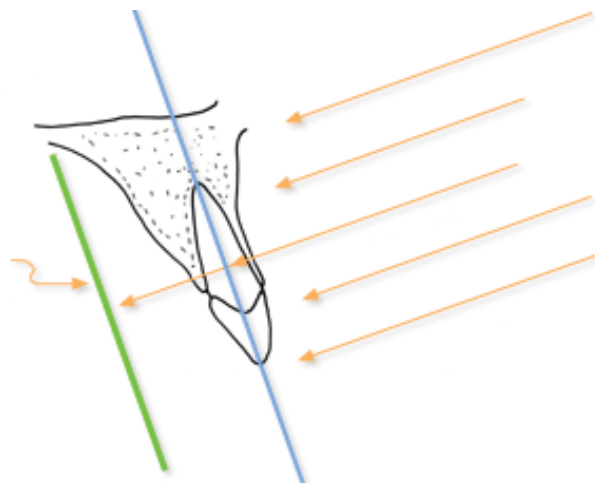


Fig. 3. Paralleling technique

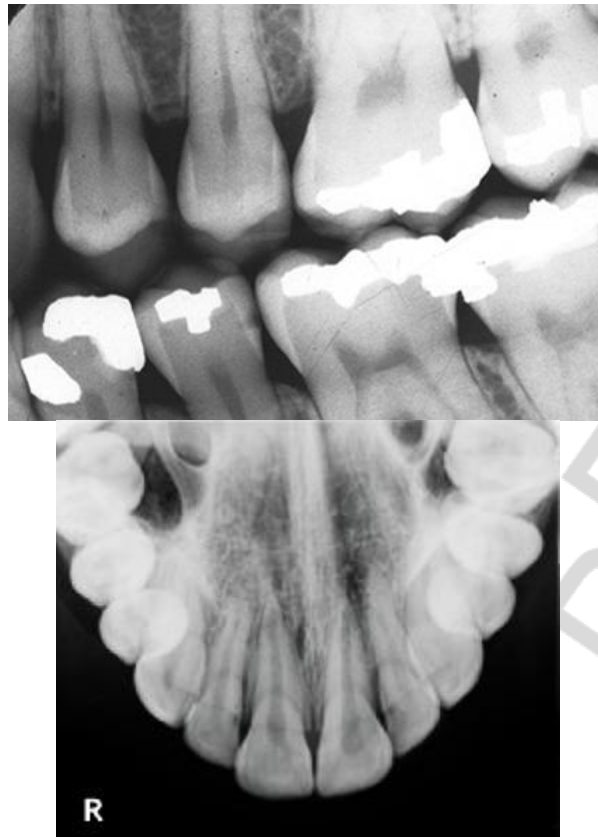


Fig. 4. Bitewing radiography radiography

Fig. 5. Occlusal

**Bitewing radiographs** include the crowns of maxillary and mandibular teeth and alveolar crest in the same film. These are reliable methods for estimation of the proximal tooth surfaces before they are detected clinically, because these areas are usually not readily assessed visually or tactilely. It is particularly important to detect incipient lesions at the contact points. In bitewing films, we can also notice height of alveolar crest, cervical margins of the restoration, lamina dura and pulp cavity.

**Bitewing radiographs** are divided into two types:

1. **Horizontal bitewing films.** In this technique, the beam is aligned between the teeth parallel to occlusal plane.

2. **Vertical bitewing film.** In this technique, the film is oriented vertically so as to record more of root area. It is done in cases of extensive bone loss.

**Bitewing radiographie** helps detecting interproximal caries; evaluating periodontal conditions and secondary caries under restorations; assessing alveolar bone crest and changes in bone height by comparing it with adjacent teeth. However, bitewing radiographs don't help in detecting any changes in

apical periodontium. This technique is seldom used for diagnostic of apical periodontitis.

Computed Tomography (CT) in Endodontics (fig. 6):

- Anatomy of root canals.
- Periapical lesions.
- Root canal relationship with other anatomical structures.
- Identification of errors and complications of endodontic treatment.

CT — the gold standard in the determination of additional root canals!

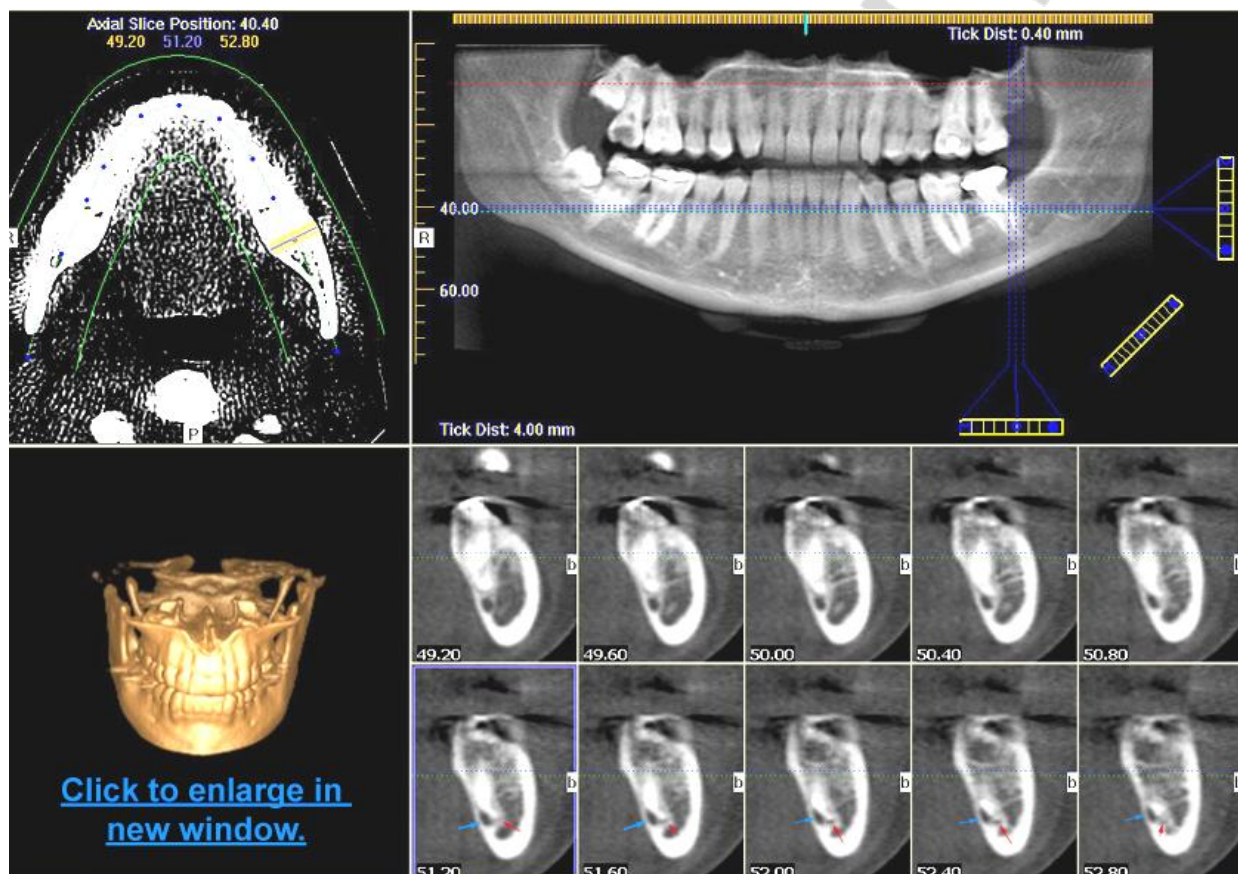


Fig. 6. Cone Beam Computed Tomography (CBCT)

## RADIOGRAPHIC IMAGE OF PERIAPICAL INFLAMMATORY PROCESSES

X-ray examination is carried out in several projections. It allows:

- evaluate anatomical and pathological changes in the pulp and periapical tissues,

- roughly estimate the length of the root canal;
- determine the radius of curvature of the root canal;
- assess the quality of the previous endodontic treatment.

Periapical inflammatory processes that causes changes in the periapical bone, mainly bone loss, which will appear as periapical radiolucencies in radiograph.

Changes of bone texture are the earliest radiographic signs of apical periodontitis. However, these changes may be difficult to assess, and a widening of the periodontal ligament space in the periapical region is usually considered as the most reliable initial sign.

Radiographically, a periapical granuloma or periapical cyst are seen as a round or oval radiolucency that extends away from the apical portion of the root of the tooth.

A definite diagnosis of periapical granuloma or cyst can be made of only after microscopic examination of biopsy material.

A fistula should, therefore, always be traced with a radiopaque object for instance, a gutta-percha point, to determine the tooth of origin radiographically.

Thus, endodontic diagnosis is based on patient complaints, medical history, clinical examination, radiographic examination and clinical test data.

The diagnosis is formulated on the basis of the classification, as a rule, adopted in the system of health care institutions.

#### International classification ICD-10

K04 Diseases of pulp and periapical tissues

K04.4 Acute apical periodontitis of pulpal origin

Acute apical periodontitis NOS

K04.5 Chronic apical periodontitis

Apical granuloma

K04.6 Periapical abscess with sinus

Includes: dental abscess with sinus

dentoalveolar abscess with sinus

periodontal abscess of pulpal origin

K04.60 Sinus to maxillary antrum

K04.61 Sinus to nasal cavity

K04.62 Sinus to oral cavity

K04.63 Sinus to skin

K04.69 Periapical abscess with sinus unspecified

K04.7 Periapical abscess without sinus

Dental abscess without sinus

Dentoalveolar abscess without sinus

Periodontal abscess pulpal origin without sinus

Periapical abscess with no reference to sinus

K04.8 Radicular cyst

**ACUTE APICAL PERIODONTITIS OF PULPAL ORIGIN K04.4 (ICD-10)**

Acute periapical periodontitis, also termed acute apical periodontitis, acute periradicular periodontitis, or symptomatic periapical periodontitis.

Apical periodontitis begins with an acute inflammation of the periapical tissues.

Etiology: occlusal trauma, egress of bacteria from infected pulps, toxins from necrotic pulps, chemicals, irrigants or excessive instrumentation in root canal therapy.

Clinical signs: pain, no pulp sensitivity, painful percussion, feeling of «grown up» tooth, and the tooth is tender on biting.

#### Acute apical periodontitis

- Constant aching pain, sharp pain on biting.
- Pain is localized, patient accurately indicates the causative tooth.
- Probing the bottom of tooth cavity is painless.
- Percussion is sharply painful.
- Hyperemia and swelling of transitional fold.
- Palpation in the projection of the root apex is painful.
- There are no reactions to temperature irritants.
- Threshold values of amperage after electric pulp testing are more than 100  $\mu$ A.

#### Acute purulent apical periodontitis:

- Constant tearing pain, severe pain on biting, feeling the «grown up» tooth.
- The patient accurately indicates the causal tooth.
- Percussion is very painful.
- Changes in the oral mucosa in the region of causal tooth can present; hyperemia and swelling of the transitional fold.

X-ray picture: widening of the periodontal space, lack of bone resorption in the periapical region (fig. 7).



Fig. 7. Radiographic appearance of acute apical periodontitis: widening of the periodontal space in the second upper bicuspid (Adapt. from [www.cram.com](http://www.cram.com))

The combination of the clinical signs with the destruction of the bone tissue at the apex indicates exacerbation of chronic apical periodontitis.

Treatment: it depends on the final diagnosis; it may range from occlusal adjustment to root canal therapy or extraction. The basic principles: elimination of the pathologic stimulus (remove inflamed pulp), the outflow of exudates, normalization of occlusion.

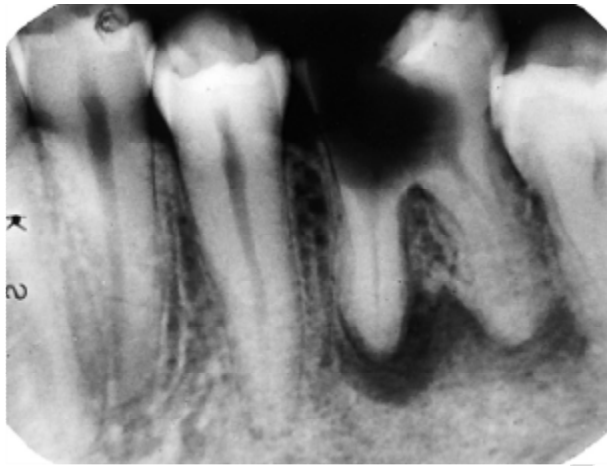
#### CHRONIC APICAL PERIODONTITIS K04.5 (ICD-10)

Chronic periapical periodontitis, also termed chronic apical periodontitis, chronic periradicular periodontitis, or asymptomatic periapical periodontitis. It is a chronic inflammation of the periodontium.

Etiology: Chronic apical periodontitis occurs as a result of pulp necrosis.

Signs and symptoms: affected teeth do not respond to pulp sensitivity tests. Tenderness to biting is usually mild; however some tenderness may be noted to palpation over the root apex. Radiographic appearance is varied, ranging from minimal widening of the periodontal ligament space to a large area of destruction of periapical tissues (fig. 8).

- Possibly, asymptomatic course of the disease.
- There are no complaints on pain from all kinds of stimuli.
- There is no reaction on temperature stimuli.
- Using of endodontic instrument in the root canal is painless.
- Changes in the oral mucosa in the region of causal tooth can present (swelling, fistula).
  - Threshold values of amperage after electric pulp testing are more than 100 uA.
  - On X-ray there is expansion of periodontal gap or destructive changes in the root apex.



*Fig. 8.* Periapical granuloma along root of carious molar (adapt. from <http://www.pathologyoutlines.com>)

### Radiology of inflammatory dental granuloma:

- radiolucent apical/periapical lesion, usually indistinguishable from periapical cyst;
- radiolucent lesions can range from small, barely perceptible lesions to lytic lesions  $>2$  cm in diameter and any lesion can be circumscribed or somewhat ill-defined;
- affected teeth typically reveal loss of the apical lamina dura;
- root resorption is not uncommon;
- intraosseous fibrous scars are possible, especially when both cortical plates have been lost; this can give the appearance of a radiographic persistent radiolucent lesion.

Radiographically detectable lesions at the apical/periapex or lateral region in the setting of a root canal treated tooth may have failed to resolve for several reasons:

- residual cyst formation;
- persistent pulpal infection;
- extraradicular infection (usually localized periapical actinomycotic colonization);
- accumulation of endogenous debris (e. g., cholesterol crystals);
- periapical foreign material;
- associated periodontal disease;
- penetration of the adjacent maxillary sinus;



- fibrous scar formation.

All soft tissue removed during periapical surgical procedures should be submitted for histopathologic examination as unexpected findings are not rare, including neoplasms.

Treatment: root canal therapy, apex resection, hemisection or extraction.

### PERIAPICAL ABSCESS WITH SINUS K04.6 (ICD-10)

Sinus (fistula) is a typical sign of this form of disease.

The fistulous tract is the communication between periodontal abscess and oral or facial skin surface.

The fistulous tract is produced by acute inflammation or exacerbation of chronic apical periodontitis. It can also be formed without prior clinical manifestations.

After opening the abscess, fistula may temporarily close and epithelialization can occur.

However, in the case of re-accumulation of fluid in the periapical tissues the fistula is reopened. This condition can be asymptomatic and go undetected by the patient.

When the fistula closes a small scar may remain on the skin or mucosa.

In a chronic apical abscess, the abscess has formed a communication through which it discharges. Such communications may be through an intraoral sinus (fig. 9) or, less commonly, extraorally. Alternatively the discharge may be along the periodontal ligament; such cases resemble a periodontal pocket. Usually these communications or tracts heal spontaneously following root canal therapy or extraction.

Symptoms: affected teeth do not respond to pulp sensitivity tests. Tenderness to biting is usually mild; however some tenderness may be noted

to palpation over the root apex. Radiographic appearance is varied, ranging from minimal widening of the periodontal ligament space to a large area of destruction of periapical tissues (fig. 10).

Treatment: root canal therapy, apex resection, hemisection or extraction.



*Fig. 9.* Pre-operative photograph showing three intra-oral sinuses (adapt. from R. Gupta, V. Prakash, 2013)



*Fig. 10.* Radiograph showing gutta percha cones placed through the opening of the sinuses (adapt. from R. Gupta, V. Prakash, 2013)

**PERIAPICAL ABSCESS WITHOUT SINUS K04.7 (ICD-10)**

Exudate and neutrophils accumulate in the area of acute inflammation. These and other cells secrete proteolytic enzymes. This leads to the disintegration of tissues. Pus and abscess are formed; they increase tissue pressure in the affected area.

Inflammatory mediators released during suppuration promote bone resorption in the direction of least resistance.

The patient experiences severe pain when the pus breaks through the bone and the periosteum is peeled. Then pus breaks through the periosteum and submucosal or subcutaneous abscess is formed. At this stage, the tissue pressure is reduced. Pain is reduced, but severe swelling of soft tissue is preserved. Breakthrough of mucosa occurs and pus comes out. The most common abscess breaks in the vestibule of the mouth.

An acute apical abscess is a severe inflammatory response to microorganisms or their irritants that have leached out into the periradicular tissues.

Signs and symptoms: It varies from moderate discomfort or swelling to systemic involvement, such as elevated temperature and malaise. Involved teeth are usually tender to both palpation and percussion. Radiographic changes are variable depending on the amount of periradicular destruction, which already has present; however, usually there is a well-defined radiolucent area, as in many situations an acute apical abscess is an acute exacerbation of a chronic situation.

Treatment: initial treatment of an acute apical abscess involves removal of the cause as soon as possible. Drainage should be applied either by opening the tooth or making an incision into a related swelling. An antibiotic may be prescribed, depending on the patient's condition. Once the acute symptoms have subsided, then root canal therapy or extraction may be performed.

## ENDODONTIC TREATMENT

Endodontic treatment — a complex of measures aimed at preserving the tooth. Treatment is chosen individually for each patient, depending on:

- disease course (acute, chronic);
- the degree of destruction in the periapical tissues;
- features of the anatomical structure of the root;
- functional and aesthetic value of the tooth;
- general condition of the patient and concomitant diseases;
- the patient's age;
- technical and doctor's manual skills.

Indications for antibiotic therapy:

- temperature elevation;
- abscess at the bottom of the oral cavity;
- perimandibular abscess;
- the opened tooth cannot be machined;
- surgical drainage cannot be established;
- purulent inflammation which is close to the trigeminal nerve.

Basic principles of the emergency:

- eliminate the source of pain;
- ensure drainage of fluid (if available);
- normalize occlusion;
- appoint analgesics.

Stages of emergency aid:

- diagnostics;
- anesthesia;
- isolation of the tooth;
- removal of tooth decay or fillings, creating a good access to the pulp cavity;

- the establishment of the working length;
- instrumentation of the root canal (with constant irrigation);
- irrigation and drying of the root canal;
- temporary filling (copious exudates — a tooth is left opened).

Filling of the root canal is the main manipulation in pathology in endodontic. Sometimes combined with surgery:

- incision and drainage (exacerbation and extension to the periosteal and soft tissues);
- apical surgery (resection of the root apex);
- extraction of a root, hemisection.

Evaluation of the effectiveness of treatment. Assess clinical and radiological signs directly after treatment and in the late periods after treatment.

*Directly after treatment:*

- lack of patient complains;
- no signs of inflammation;
- on the radiograph root canals are sealed to the apex.

*In the late periods after treatment:*

- the absence of any symptoms in the patient;
- in the field of tooth no signs of inflammation and a fistula;
- radiologically periapical tissue is normal, if there were no radiological signs of the disease before treatment;
- radiographic signs of recovery of the bone destruction, if it was observed before treatment.

## REFERENCES

1. *Cohen's pathways of the pulp* / eds. : K. M. Hargreaves, S. Cohen, L. H. Berman. 10<sup>th</sup> ed. Elsevier, 2011. 986 p.
2. *Endodontics : principle and practice* / eds. : M. Torabinejad, R. E. Walton. 4<sup>th</sup> ed. Elsevier, 2008. 598 p.
3. *Endodontics* / eds. : S. Cohen, R. C. Burns. 8<sup>th</sup> ed. New York : Elsevier, 2002. 1021 p.
4. *Endodontics* / eds. : C. J. R. Stock, R. T. Walker. Elsevier, 2014. 388 p.
5. *Problem solving in endodontics : prevention, identification and management* / eds. : J. L. Gutmann, P. E. Lovdahl. 5<sup>th</sup> ed. Elsevier, 2010. 482 p.

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Ответственная за выпуск Л. А. Казеко  
Переводчики: К. В. Севрукевич, Ю. В. Модринская  
Компьютерная верстка Н. М. Федорцовой

Подписано в печать 21.05.15. Формат 60×84/16. Бумага писчая «Снегурочка».

Ризография. Гарнитура «Times».

Усл. печ. л. 0,93. Уч.-изд. л. 0,66. Тираж 40 экз. Заказ 364.

Издатель и полиграфическое исполнение: учреждение образования  
«Белорусский государственный медицинский университет».

Свидетельство о государственной регистрации издателя, изготовителя,  
распространителя печатных изданий № 1/187 от 18.02.2014.

Ул. Ленинградская, 6, 220006, Минск.