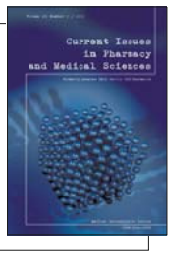
2012 © Curr. Issues Pharm. Med. Sci. Vol. 25, No. 3, Pages 325-330

Current Issues in Pharmacy and Medical Sciences

Formerly ANNALES UNIVERSITATIS MARIAE CURIE-SKLODOWSKA, SECTIO DDD, PHARMACIA
on-line: www.umlub.pl/pharmacy



Mandibular odontogenic cysts. Individual cases description and literature review

MANSUR RAHNAMA*, JOANNA SZCZERBA, ROZAN HAMWI

* The Chair and Department of Oral Surgery Medical University of Lublin, Poland

ABSTRACT

According to definition, a cyst is a unilocular or multilocular pathological cavity within bones or soft tissues, filled with liquid. The true tissue is distinct from the false one, beside the connective tissue capsule on the periphery, through the presence of epithelial liner. Oral cavity and maxillary bones, due to the presence of numerous epithelial structures of developmental nature, are the area of frequent cystic changes. The aim of the study was to present the actual state of knowledge concerning etiology, pathogenesis, morphology, treatment and methods applying to the reconstruction of bone defects after the enucleation of odontogenic cysts in the mandible as well as to introduce the description of three individual cases. In cases concerning three patients, the bone substitute material Calc-i-oss combined with PRP was applied after the surgical procedure consisting in an enucleation of the mandibular odontogenic cyst. The observation of the healing process concerning the postoperative wound was carried out after 7 days from the procedure. In two cases, the check radiograph was taken 6 months after the surgical intervention. In all cases, the proper healing of the postoperative wound was observed during the medical check-up after the procedure. The radiological image taken 6 months after the surgical intervention proved the regeneration of the bone texture. Methods of treatment concerning the bone defects after the enucleation of odontogenic cysts constitute a topic, which is still valid. The described cases of the bone defects in the mandible filled with Calc-i-oss material combined with PRP (platelet rich plasma) give good healing results.

Keywords: cyst, mandible, enucleation, bone defects

INTRODUCTION

Cysts are among the most common pathological changes which develop inside the bones of mandible and maxilla [4, 9, 10, 13, 15, 17, 19, 20, 23, 24, 26]. At first, their growth is asymptomatic, unless infection appears, and they are frequently detected during radiological examination of various indications. Their distinctive feature is a very slow growth leading to the development of different size bone cavities lined with a capsule. These cavities might attain large sizes, which results in bone distortion and migration of adjacent teeth. In case of bone cysts the secretory stratified squamous epithelium, which lines the interior of the cyst capsule, might undergo a cancerous transformation under the influence of chronic inflammatory factors or traumas. Therefore surgical treatment consisting in enucleation of bone cysts becomes the selected treatment [2, 4, 9, 12, 16, 17, 19, 23, 28].

Jens Pindborg and Ivor Kramer presented in 1971 the first commonly recognized classification of cysts, odontogenic tumours and other lesions characteristic for bones. This division was based on histological features of examined changes. In 1992 some modifications of former classification were made taking into consideration clinical symptoms as well as results of immunohistochemical and molecular research. The authors (Pindborg, Kramer and Shear) divided epithelial cysts into developmental and inflammatory cysts. The developmental odontogenic cysts included primordial (keratocyst), dentigerous as well as gingival cysts of infants (Epstein's pearls) and adults, lateral periodontal (eruption), over erupting tooth cysts and glandular odontogenic (salivary gland cysts). Considerably rare group of developmental cysts constitute nonodontogenic cysts (median anterior maxillary, median palatal, globulomaxillary and nasoalveolar). The most common group is represented by cysts of inflammatory etiology such as periapical, lateral radicular and residual cysts as well as inflammatory periodontal cysts [22]. Another classification was introduced in 2005 (Barnes and all). Then keratocyst (primordial cyst) was numbered among the tumors. Histochemical and genetic analysis allowed classifying this lesion definitely to the group of odontogenic tumors.

Corresponding author
* Chair and Department of Oral Surgery, Medical University of Lublin, 7 Karmelicka Str., 20-081 Lublin, Poland
e-mail: szemys@o2.pl

Radicular cyst develops from Malassez cells stimulated to proliferation through inflammation, which is caused by the presence of pulp rests and bacterial antigens coming from necrotic pulp. Epithelial hyperplasia might be directly stimulated by bacteria: Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis or Escherichia coli [25, 16]. Three phases of apical cyst development are distinguished:

- initiation – during which bacterial endotoxins coming from necrotic pulp cause proliferation of Malassez cells,
- formation – when the cyst is lined by proliferating odontogenic epithelium, and
- enlargement phase – with the significant role of osmosis i.e. products of epithelial and inflammatory cells lysis in a cavity providing a great number of small molecules which raise osmotic pressure [7].

Currently the division into two types of radicular cysts is proposed:

- apical true cyst – cavity is completely closed by epithelium, it constitutes 10% of all periapical lesions, and
- apical pocket cyst, the lumen of which is an extension of root canal; it can heal itself after tooth extraction or endodontic treatment [1, 25].

The group of non-epithelial cysts consists of aneurismal bone cyst and sanguineous cyst. They differ from the classic definition of a cyst because they are not surrounded by connective tissue capsule making up a dental follicle which is built with three layers: external, consisting of fibrous connective tissue, central-being a basement membrane and interior- consisting of epithelium, which depending on the type of cyst might vary. Cysts in whole or in part are covered with stratified squamous epithelium. Its nature depends on the age, degree of diversity or inflammation of the cyst. In case of new cysts the epithelium might indicate some features of inflammation and proliferate [22, 25].

At first, cysts develop without symptoms and on that stage they are frequently detected by chance during radiological examination [11]. As they grow the swelling appears in the form of a tumor on alveolar process and face deformation after that. Thinned cysts may demonstrate a crackling sound – the symptom of crepitatio – Dupuytrena's crackling. The radiological picture presents osteolitic defect with osteosclerotic sheath [11, 14]. In case of infected or very fast developing cysts, the sheath might not be visible. It is usually an oval or round unilocular lesion.

Cysts hyperplasia might lead to migration of adjacent teeth and sensation disorder. On the basis of X-ray picture the possibility of a cyst identification occurs when the lesion's diameter is bigger than or equal 2 cm [11, 14, 25]. Final diagnosis is always established during the histopathological examination. In case of epithelial cysts, the secretory stratified squamous epithelium which lines the interior of the capsule might undergo a cancerous transformation due to chronic inflammatory factors or traumas. Therefore surgical treatment consisting in enucleation of bone cysts becomes the selected treatment [2, 4, 5, 17, 28].

At the beginning of XX century Karol Partsch brought in two methods of cysts surgery: marsupialization (Partsch I) and enucleation (Partsch II). Partsch's I method (cystostomy) i.e. marsupialization method consists in transformation of the cyst cavity into the added pouch of oral cavity. Through Partsch's or Pichler's incision over the anterior surface of lacunar wall a mucoperiosteal flap is formed, exfoliates it from the base and cancels out a thinned dental lamina covering the follicle so that the arising defect loss equals the lamina's diameter. Subsequently, the same size part of the osseous wall is excised and sent to the histopathological examination. Thus formed a mucoperiosteal flap is invaginated inward the cyst cavity and supported with marginal stitches and gauze seton soaked up with antiseptic [21].

Partsch's method II i.e. cystectomy consists in one-phase removal of cysts with the complete enucleation of its follicle, which is afterward sent to the histopathological examination [21 ,22]. As a result of such procedure an intra-osseous defect is left. In case of minor cysts, the tight suture leads to filling up the cavity with blood, haematoma formation, its organization and subsequently to the long-lasting process of bone tissue formation. If the process runs successfully, it leads to regeneration and producing of a primordial bone at first and afterwards of a cancellous bone and a cortical plate in that area [6, 27]. In less successful case, a repair process follows, resulting in formation of a connective tissue, which restrains the course of proper bone tissue formation. In case of large defects the process of reparation with the formation of a fibrous connective tissue nearly always follows [6, 18].

From the beginning of the 80s of the last century, a very fast development of surgical techniques can be noticed, consisting in augumentation of bone defects which enables subsequent imlantological treatment. GBR-guided bone regeneration might be rated among the most frequently applied reconstruction procedures. The actions leading to the reconstruction of the bone tissue may be different depending on the applied surgical procedure. They are as follows:

- osteoinduction – stimulation of mesenchymal cells to differentiation into osteoblasts,
- osteogenesis – bone tissue formation due to the transfer of stem cells or progenitor cells which differentiate into osteoblasts,
- osteoinduction –formation of the framework facilitating the growth of the bone tissue,
- guided bone regeneration,
- distraction osteogenesis.

Materials used in treatment of bone defects must be biocompatible and biologically stable, they should not have toxic effect or cause allergic reactions. According to the dictionary published by American Academy of Periodontology the following types of bone grafts are defined:

- autogenous – derived from the same individual,
- isogenic – derived from genetically identical individuals,
- homogenous – derived from genetically similar individuals of the same species,
- allogenic – between genetically different individuals of the same species e.g. fresh frozen bone - FFB, fresh – dried bone allograft – FDBA, demineralized freeze – dried bone allograft – DFDBA,
- heterogenous (xenogenic) – taken in from a donor of another species e.g. animal bones, calcifying corals or calcifying algae,
- alloplastic – inert foreign bodies: metal synthetic or implants from other materials e.g. calcium phosphate, bioactive glass or polymers [18].

On the basis of Lűthkehermőlle guidelines bone substitute materials must meet the following conditions:

- they cannot be carcinogenic or transmit infection,
- they cannot evoke necrosis of tissues conditioned on cells toxicity,
- they cannot release reaction to foreign bodies,
- must have resorption and substitution ability of the existing bone in specific time,
- a synchronization of resorption or degradation range with bones reconstruction must exist
- they must stimulate regeneration of tissues,
- there cannot be differences in working when a long-term to short-term implantation are compared
- they must undergo sterilization,
- their production cannot be too expensive,
- they should be easily accessible,
- they should be easy in storage and usage.

Additional possibilities are offered by making use of PRP (platelet rich plasma), which is the source of cytokines and growth factors for the bone tissue in a formation process. The most important are: PDGF (platelet derived growth factor), TGF (transforming growth factor), EGF (epidermal growth factor), IGF (insulin-like growth factor) and VEGF (vasoendothelial growth factor). These factors, in combination with bone substitute material, bring about a significantly faster process of bone tissue regeneration [3].

CASE REPORTS

Case 1

Patient (male), 61 years old, was referred to the Chair and Department of Oral Surgery of Medical University of Lublin by his dentist due to the diagnosis based on pantomographic X-ray of a lesion within the body of mandible - on the left side – in area of 34-37 teeth (Fig. 1).

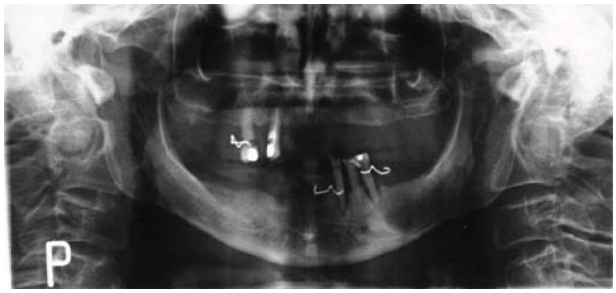


Fig. 1. Panoramic X-ray before treatment

The patient did not suffer from any systemic illnesses. He neither complained of any painful ailments nor reported feeling disorder within his face. The patient had been using an upper and lower partial denture for 6 years. He reported that about 20 years before he had got hit with the broken chipped off part of the wrench while repairing his car. As a result of this accident the patient sustained a mandibular injury in the area of lower premolar teeth on the left side.

During an extraoral examination, a small asymmetry of the face in the area of mandible on the left side was stated. The enlargement of submandibular glands on the right or left side was not stated. During an intraoral examination, a normal colour of mucosa was observed within oral vestibule as well as within proper oral cavity and posterior and anterior pillars. The proper tongue mobility without pathological fur was affirmed. The alveolar processes considerably atrophied with residual dentition. In the superior dental arch visible 15 and 13 teeth as well as 34, 33, 32 teeth in the inferior dental arch. In case of teeth 34 and 32, covered with concretion, vacillation IIIş. Within the body of mandible on the left side in area of 34-36 teeth, the painless distention of the alveolar process was stated during the palpation examination. The patient was not able to specify when the enlargement appeared. The panoramic X-ray confirmed the presence of an oval-shaped osteolytic focus with the clear osteosclerotic capsule with the diameter about 4 cm. in area of teeth 34-36, which answers a description of a cyst.

After analysis of the panoramic X–ray the patient was qualified to the extraction of teeth 32 and 34 as well as enucleation of the lesion from the bone with the simultaneous filling of the bone defect with the autogenous platelet plasma mixed with Calc-i-oss material, in order to receive the fuller and quicker effect of bone tissue reconstruction. For that reason venous blood was taken from the patient before the surgery. The procedure was carried out under local anaesthesia Ubistesinum 4%. The triangular-shaped incision of the muco-periosteal flap was performed and the flap was exfoliated. Next, the retained external plate of the alveolar process was cancelled out with the round bur. After enucleation, the lesion in the cavity was filled with the bone substitute material combined with PRP (platelet rich plasma). The flap was

mobilized and the stitches were put. The healing of the wound proceeded correctly. The stitches were removed after 7 days from the surgical procedure. The removed lesion was sent to the histopathological examination, which confirmed the initial diagnosis – Cystis radicularis. After 6 months from the procedure another panoramic X–ray was taken in order to evaluate the process of the bone structure regeneration in the postoperative area (Fig.2). The pantomographic X - ray proved the reconstruction of the bone texture on the whole postoperative area periphery. The patient did not report any ailments during the process of tissue regeneration.

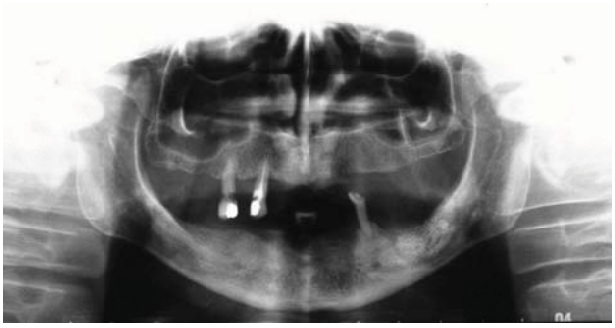


Fig. 2. Panoramic X-ray 6 months from procedure

Case 2

Patient, 59 years old, was referred to the Chair and Department of Oral Surgery of Medical University of Lublin by his dentist due to the diagnosis based on pantomographic X-ray of the two lesions within the body of mandible on the right and left side. The panoramic X-ray was taken before the planned assanation of oral cavity in order to prepare the patient for the prosthetic treatment. He did not report any general system disorders and he did not complain of any ailments within oral cavity. The external examination did not disclose any aberrance. During the internal examination the residual dentition and active fistula on the alveolar process were stated in area of 45-46 teeth. The pantomographic X-ray revealed an oval osteolytic focus about 2.5 cm in diameter with the clear osteosclerotic capsule on the right in area of 45-46 teeth and a round osteolytic focus 1 cm in diameter in area of 34-35 teeth, which might be a cyst (Fig. 3).

The patient was qualified, after the survey, physical examination and analysis of his radiogram, for the extraction of roots in teeth 13, 22, 24, 33,47 and enucleation of lesions localized within the mandible in area of teeth 45 – 46 and 34-35. The treatment began from enucleation of the lesion in area of teeth 34 – 35 and extraction of roots in tooth 33. On the second stage an enucleation of the lesion in rea of 45-46 teeth was performed as well as filling of the bone defect with the autogenous platelet-rich plasma combined with Calc-i-oss material (Fig. 4). The venous blood sample was taken before the procedure. The wounds healing in both cases proceeded correctly. The lesions removed were sent to the histopathological examination, which confirmed the initial diagnosis – Cystis radicularis. After six months from the procedure another panoramic X-ray was taken in order to evaluate the process of bone structure reconstruction in the postoperative area (Fig. 5). The X-ray proved the regeneration of bone texture in the postoperative area. The filling of the oral cavity after the cyst with the mineralized trabecula-textured tissue was stated as well as gradual osteointegration of the newly formed bone trabeculae with the enclosing bone. The patient did not report any ailments during the process of tissues healing.

Fig. 4. Copmplete enucleation of lesion

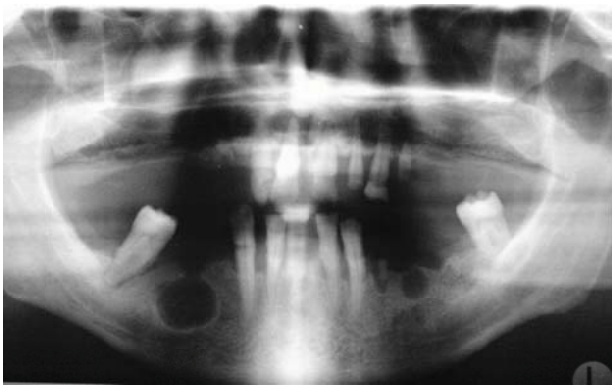


Fig. 3. Panoramic X-ray before treatment

Fig. 5. Panoramic X-ray 6 months from procedure

Case 3

Patient, 50 years old, referred to the Chair and Department of Oral Surgery of Medical University of Lublin in order to have an extraction of the remained fragments of the tooth 27 root. The patient reported the acute pain of the alveolar process in area of 27 tooth, which has been intensifying for a few days. After the survey and clinical examination the patient was scheduled for a panoramic X-ray. He did not report any systemic disorders. A radiological image proved the presence of the remained root of 27 tooth and a large osteolytic defect with the clearly marked border in area of 33-43 teeth (Fig. 6). After analysis of the radiogram the patient was qualified to the enucleation of the lesion through the extraction of teeth 31, 32, 41, 42. The lesion was completely removed and sent to the histopathological examination. The result indicated a radicular cyst. Because of the large size of the lesion the cavity in the bone was filled with Calc-i-oss material combined with PRP (platelet rich plasma), which was obtained from the pre-surgery taken venous blood (Fig. 7). The healing of the postoperative wound proceeded without complications (Fig. 8). The check X-ray taken 6 months after the procedure proved the reconstruction of bone texture in the postoperative area.

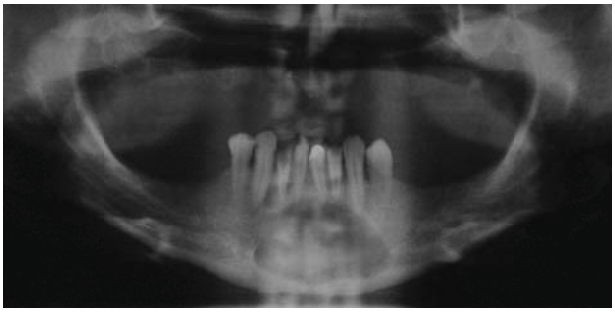


Fig. 6. Panoramic X-ray before treatment

Fig. 7. Caviti in the bone after complete enucleation of lesion

Fig. 8. Condition after procedure

CONCLUSIONS

The odontogenic cysts in the mandible and maxilla are frequent surgical problem within the facial skeleton. Their treatment consists in the complete enucleation regardless of their radicular or germinal origin. The large lesions of the cystic nature require careful surgical technique in order to avoid or minimize the risk of complications concerning adjoining teeth, teeth germs and other anatomical structures of the facial skeleton. The complete enucleation of small-size cysts do not cause any difficulties. The bone structure in these defects might be spontaneously reconstructed. However, in case of larger cysts, which cause severe bone damage, the two-stage treatment is recommended. Although this kind of treatment lasts much longer, it is advisable in case of patient with bad general condition, the aged, children and large cysts with severe damaged bone structure.

As the literature indicates, there are various methods of proceeding in case of intra-osseous defects e.g. not filling defects with any material, using bone substitute material like Bio-Oss or autogenous bone graft. The process of healing, to a large extent, depends on the general condition of the patient as well as local factors including:

- the type of the tooth near the defect,
- its position (mandible or maxilla, anterior or buccal segments and their position in relation to the tooth),
- the size of the lesion,
- the shape of the defect surface: round or oval,
- the quality of canal root filling, as well as
- the presence of the coronal bacterial microleakage and the surgical method.

In the last case the most important are: type of incision, shape of vestibular mucoperiosteal flap, state of periosteum directly over the defect, quality and working methods with the rotary instruments, the type of applied cooling, materials used for reverse roots filling, stitches and the method of flap reposition.

In available literature, there are no research works, which compare the efficacy of guided bone regeneration methods with the spontaneous healing of tissues during

the intra-osseous defect treatment. The most frequent descriptions concern the cases of successful treatment but there are no figures indicating the percentage of the complete bone reconstruction of defects. There is also difficulty in making a comparative assessment of the treatment efficacy among the particular types of applied methods of regeneration.

REFERENCES:

1. Avelar R.L. at al.: Odontogenic cysts: a clinicopathological study of 507 cases. *J Oral Sci.,* 51, 4, 2009.
2. Chabrzyk-Antosik O., Lewandowska M.: Torbiele zębopochodne w materiale Kliniki Chirurgii Szczękowo-Twarzowej Akademii Medycznej w Poznaniu. *Dent. Forum*, 30, 2004.
3. Cieślik-Bielecka A., Bielecki T., Gaździk T.S., Cieślik T.: Czynniki wzrostu zawarte w osoczu bogatopłytkowym jako autogennym materiale stymulującym procesy gojenia tkanki kostnej. *Czas. Stomat.*, 61, 7, 2006.
4. Cieślik T. Skowronek J., Adwent M.: Leczenie olbrzymich torbieli żuchwy metodą osteoplastyczną. *Czas. Stomat.*, 56, 6, 2003.
5. Dominiak M.: Porównanie zgodności rozpoznania przewlekłych zmian okołowierzchołkowych. *Dent. Med. Probl.*, 43, 2006.
6. Dominiak M., Geber-Leszczyszyn H.: Rekonstrukcja podłoża protetycznego za pomocą plastyki wyrostka zębodołowego szczęki i żuchwy. *Adv. Clin. Exp. Med.*, 14, 3, 2005.
7. Dominiak M., Łysiak K.: Naprawa i/lub regeneracja poresekcyjnych i pocystektomijnych ubytków śródkostnych wyrostka zębodołowego – ocena uwarunkowań na podstawie piśmiennictwa i doświadczeń własnych. *Dent. Med. Probl.*, 42, 2, 2005.
8. Grzesiak-Janas G., Mieczkowska A., Maciąg M. et al.: Torbiele szczęki i żuchwy w materiale Zakładu Chirurgii Stomatologicznej Instytutu Stomatologii Akademii Medycznej w Łodzi. *Mag. Stomat.*, 12, 11, 2002.
9. Kaczmarzyk T., Stypułkowska J., Zaleska-Szczurek M. et al.: Torbiele samotne-przegląd piśmiennictwa i analiza własnego materiału klinicznego. *Czas. Stomat.,* 57, 11, 2007.
10. Keszler A, Piloni M.: J. Malignant transformation in odontogenic keratocysts. *Case report. Med. Oral.*, 7, 2002.
11. Kramer I.R.H., Pindnorg J.J., Shear M., editors.: *WHO International histological classification of tumors: histological typing of odontogenic tumors. 2nd ed.* Berlin (Germany): Springer-Verlag., 1992.
12. Meningaud J.P., Oprean N., Pitak-Arnnop P., Bertrand J.C.: Odontogenic cysts: a clinical study of 695 cases. *J. Oral. Sci.*, 48, 2006.
13. Mosqueda-Taylor A., Irigoyen-Camacho M.E., Diaz-Franco M.A., Torres-Tejero M.A.: Odontogenic cysts. Analysis of 856 cases. *Medicina Oral.*, 7, 2, 2002.
14. Nair P.N.R.: Pathogenesis of apical periodontitis and the causes of endodontic failures. *Crit. Rev. Oral Biol. Med.*, 15, 2004.
15. Ochsenius G., Escobar E., Godoy L., Peñafiel C.: Odontogenic cysts: analysis of 2,944 cases in Chile. *Med Oral Patol Oral Cir Bucal.*, 12, 2007.
16. Pawlak W., Kubasiewicz-Ross P., Pałka Ł., Zarzycki R.: Torbiele kości szczęk leczone w Klinice Chirurgii Szczękowo-Twarzowej Akademii Medycznej we Wrocławiu w latach 2004-2007. *Dent. Med. Probl.*, 46, 1, 2009.
17. Piekarczyk J., Siemińska-Piekarczyk B., Samolczyk-Wanyura D. et al.: Ocena wyników leczenia oraz odległych następstw zabiegów chirurgicznych wykonywanych u dzieci z powodu torbieli szczęk. *Czas. Stomat.*, 53, 2000.
18. Puchała P., Kucharski G., Jaremczuk B., Monkos-Jaremczuk E.: Przegląd biomateriałów na podstawie piśmiennictwa. *Twój Przeg. Stomat.*, 10, 2008.
19. Rahnama M., Świątkowski W., Hajduk G. et al.: Maxillary odontogenic cysts-case reports. *Ann. UMCS Sect. DDD*, 23, 1, 2010.
20. Rahnama M., Świątkowski W., Łobacz M. et al.: Torbiele zębopochodne kości szczęk : opis przypadków. *Mag. Stomat.*, 21, 4, 2011.
21. Ratajczak M., Sowa W., Walter A.: Molekularne podstawy powstawania zębopochodnej torbieli zapalnej – przegląd piśmiennictwa. *Dent. Med. Probl.*, 47, 2009.
22. Shear M., Speight P.: Radicular cyst and residual cyst. In: *Cyst of the oral and maxillofacial regions*. Blackwell Munksgaard. Oxford., 4, 2007.
23. Smółka B., Stypułkowska J.: Ocena wyników leczenia torbieli kości szczękowych metodą dwuetapową w materiale klinicznym Zakładu Chirurgii Stomatologicznej IS CM UJ. *Por. Stomat.*, 5, 12, 2005.
24. Tsukamoto G., Sasaki A., Akiyama T. et al.: A radiologic analysis of dentigerous cysts andodontogenic keratocysts associated with a mandibular third molar. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.*, 91, 2001.
25. Tyndorf M.M.: Przydatność klasycznych zdjęć rentgenowskich we wstępnej ocenie zmian w żuchwie o charakterze torbieli. *Wiad. Lek.*, 61, 2008.
26. Tysiewicz P., Sporniak-Tutak K., Sobczyk P., Mysliwiec L.: Róznicowanie zmian torbielopodobnych żuchwy na podstawie badania klinicznego i obrazu radiologicznego- opis dwóch przypadków. *Czas. Stomat.*, 57, 2004.
27. Wrotniak M., Bielecki T., Gaździk T.S.: Współczesne poglądy na temat wykorzystania żelu bogato płytkowego w ortopedii i traumatologii. *Ortopedia Traumatologia Rehabilitacja.*, 9, 3, 2007.
28. Wziątek-Kuczmik D., Drugacz J., Niedzielska I. et al.: Chirurgiczne leczenie torbieli zębopochodnych w materiale Katedry i Kliniki Chirurgii Szczękowo-Twarzowej ŚAM w Katowicach. *Por. Stomat.*, 4, 12, 2004.