

# Fractures of the mandibular condylar processes – literature review

## Case report

Iwona A. Niedzielska, Anna M. Tomczyk-Wziątek, Bartłomiej P. Borowski\*

*Department of Cranio – Maxillofacial Surgery, Medical University of Silesia  
40-027 Katowice, Poland*

Received 30 August 2012; Accepted 25 October 2012

**Abstract:** Fractures of the mandibular condylar processes are often-met injuries of lower region of face. The cause of that state is dynamic development of municipal transport and the increase of aggression in human relations. Many classifications of fractures of mandibular condylar processes are in literature. The choice of therapy is a subject for debate among doctors. Contemporary literature does not give an unequivocal answer to the question whether in the case of fractures of mandibular condylar processes non-invasive treatment should be applied or whether the method of surgical supply of fractures is better.

**Keywords:** *Mandibular condylar processes • Fracture of the mandible • Treatment of the mandibular fractures*

© Versita Sp. z o.o

Fractures of the mandibular condylar processes are often-met injuries of lower region of face. According to different authors they constitute 15–52 % of mandibular fractures [1-3]. In patients at developmental age, this number is from 28% to 60% of all fractures of the bone [4,5]. Mandible, due to its frontal location to head skeleton, is largely exposed to injuries, the number of which has significantly increased in recent years [6]. The authors see the cause of that state in dynamic development of municipal transport, and also in the increase of aggression in human relations [2,6,7]. Goldman reports that there are geographical differences regarding the causes of fractures of joint processes. In the Netherlands the leading cause is bicycle accidents, in large US cities it is beatings, whereas in the middle east of the USA it is motor vehicle collisions [7]. Zix writes that the most common cause of mandibular fractures in North America, Northern Europe, Australia and New Zealand is violence. In his study on Switzerland we read that of all the mandible fractures caused by traffic accidents, 99% are damages of the condylar processes [7]. Zachariades provides that traffic accidents constituted 56% of the cases, violence was the cause of 13,6% of injuries, accidents at work regarded 3,8% of the patients,

whereas sports related injuries concerned 3,5% [2]. Among the people who suffered an injury as a result of practicing sport Lee mentions mainly children who fell from the bike [2]. Jurkiewicz-Ciurlej also states that most often fractures of the condylar processes in children are the result of a fall from a bicycle, which represents 48% of cases [4,5]. According to Wanyura traffic accidents accounted for only 20% of the causes of the injuries of condylar processes, beating 64%, sports injuries 3% [8]. Fractures of this region much more often relate to men than women. Zachariades provides that the ratio comes to 3,5 : 1, whereas Wanyura in his research claims that the ratio amounts to 5,1 : 1 [2,8].

Fractures of mandibular joint processes according to majority of authors most often appear in patients in their third decade of life [2,7,8]. They are least often found in the first decade of life, which according to Zachariades may result from omission [2].

The kind of fracture depends on the direction, size and place of operation of the force, the age of the patient, the state of bone tissue, the state of dentition. Most of the injuries are unilateral, with a marked tendency to appear on the left side [2,8]. Most often found fractures are unilateral fractures of condylar processes, which

\* E-mail: bartborowski@tlen.pl

relate to 60 % to even 91 % of cases [2,3,8]. Kukuła provides that even 70% of the cases are indirect fractures with concomitant fractures of body of the mandible [3]. This is confirmed by Wanyura's study, where among the 100 treated persons in 63 cases the fracture of condylar process was accompanied by mandibular body or angle fracture [8]. Diagnosis of fracture of mandibular condylar process is made based on clinical and radiological examination.

In radiological diagnostic of this type of injuries the most commonly used projections are:

- P-A skull projection [4,8,9]
- oblique-lateral X-ray [4,9]
- routinely a pantomographic radiograph is done [4,8,9]
- additional information can be provided by layered images of joints in clenching and opening [8,9]
- X-ray in the projection of Waters [8]
- X-ray in the occipital-nasal projection according to Clementschitsch [9].

Authors more and more often indicate the need to supplement diagnostics with the performance of CT in frontal slice, as well as 3D CT which allows for the better visualization of the fracture line and their spatial reconstruction [4,8,9]. It plays a significant role for the choice of the method of treatment, because authors emphasize the diagnostic problems associated with the due evaluation of the degree of the dislocation, direction, as well as the mutual relation of overlapping fragments. Determining the position of articular heads and their rotation with regard to the articular also constitute the problem, thus enriching diagnostics with performing the MRI for thorough depicting of articular structures is being considered [9].

In the clinical examination authors of the literature most often observed:

- pain and swelling in the region of the temporomandibular joint on the side of the fracture
- limited mobility of the mandible
- problems in abduction and adduction of the mandible [2,4,9].
- In the case of unilateral fractures:
  - at abduction deviation of the mandible into the ill side,
  - features of the crossbite,
  - dislocation of maxillary midline diastema [2,4,9].
- In bilateral fractures the following were stated:
  - restricted forward movement of the mandible,
  - restricted or infeasible lateral movements of the mandible,
  - features of the open bite,
  - maxillary midline diastema in accordance with the midline of the body [2,4,9].

• Many classifications of fractures of mandibular condylar processes are in literature [3,4,10,11]. In Anglo-Saxon literature authors quite often refer to the classification according to Spiessl and Schroll which distinguish 6 types of fractures [4]:

- closed fracture of the neck
  1. low displaced fracture of the neck with displacement of the fragments in the line of the fracture
  2. high fracture of the neck, when the condyle stays in the articular fossa
  3. low fracture of the neck with a dislocation
  4. high fracture of the neck with a dislocation
  5. fracture of the head of the mandible (endocavitary).
  6. Kukuła mentions the Yamaoki classification, as often quoted [3]. It presents itself as follows:
    - breaking off the head of the condyle process (above the attachment of the lateral pterygoid muscle)
      1. breaking the neck of the condylar process
      2. breaking at the base of the condylar process, running obliquely backwards and downwards
      3. sagittal split of the condyle process distinguished by Yamaoka on the basis of the CT test (described in 9,8% of the cases) [3].
    - 4. According to Kukuła every listed form of the fracture can be accompanied by [3]:
      - lack of displacement of the fragments,
      - drawing the stump of the condylar process aside at the kept contact of the articular head with the articular acetabulum
      - fracture-subluxation, when the head of the mandible is leaning out from the articular cavity at an angle of 40 degrees, and the surfaces of fragments touch one another,
      - fracture-dislocation—the head of the mandible is displaced beyond the articular cavity and tilted back from the long axis in original position at an angle not bigger than 40 degrees, the contact of the surface of the fracture can be kept,
      - total detachment of the process with displacement of the smaller fragment into nearby tissues.
- Bartkowski, on the other hand, propagates the simple and practical classification according to Berch and Krywines [10]:
  - Condylar fracture—the fracture line runs within the head of the condyle and is a rare occurrence.
    1. High subcondylar fracture—the fracture line runs within the neck of the condyle.
    2. Low subcondylar fracture—the fracture line runs obliquely downwards from the semilunar indentation to the back edge of the ramus of the mandible. These can be complete, incomplete and greenstick fractures [10].
    3. Anatomical classification of fractures of mandibular condylar processes was described by Wanyura [11]:

1. Fractures of the head.
2. Fractures of the neck or high subcondylar fractures.
3. Basis cervical or low subcondylar fractures.

For many years primary treatment in the case of fractures of condylar processes was implementing preserving-orthopaedic procedures [1-3,8-10,12]. Along with the development of operating techniques also an attitude of surgeons towards the treatment of fractures in this region changed. The choice of therapy is a subject for debate among doctors [8]. The method of stable osteosynthesis allows for fast restoring the correct occlusal relations, as well as restoring the functions, and consequently it hastens the rehabilitation of the patient and his recuperation [8].

An indication for surgical treatment of fractures of the mandibular condylar processes is a unilateral fracture with large displacement of the fragments, dislocation of the process, old fracture, a fracture with a concomitant fracture of the body or the ramus of the mandible, bilateral fracture of condylar processes with a concomitant displacement and/or dislocation, and multifragmentary fracture within the articular head [2,3,12,13].

Siluk provides, that according to Zide and Kent indications for surgical treatment of fractures of the mandibular condylar processes are 3rd and 4th degree of displacement of the condylar process in MacLennan scale, bilateral fractures of processes with the open bite, fracture of the condylar process with a concomitant multifragmentary fracture of the midface and upper face, multifragmentary fracture of the condylar process and the ramus of the mandible, residual dentition, impossible to recreate correct occlusal conditions in preserving-orthopaedic treatment, intolerance of the intermaxillary bonding and counter-indications for the treatment by the closed method [13].

Indications for preserving-orthopaedic treatment are following [2,3,12]:

- fracture with small (not larger than 30 degrees) displacement of fragments,
- fractures in children,
- systemic diseases, being a contraindication for the surgical operation,
- fractures of the head of the condylar process (osteosynthesis can endanger the viability of the head of the condyle as well as creates the risk of injuring the joint),
- satisfactory range of opening the mandible, the correct dental articulation and not very advanced pain complaints.
- Applying preserving-orthopaedic treatment is also possible in the case of sagittal split of the head of the mandible [3].

Treatment of fractures of mandibular condylar processes is meant to restore correct morphological,

functional and aesthetic relations by reposition and immobilization the fragments. It is possible to divide methods of treatment in this group of injuries into preserving-orthopaedic and surgical ones [2,4,8,12,14].

Preserving-orthopaedic treatment consists in installing intermaxillary fixation by means of dental splints and intermaxillary traction (flexible). The treatment is based on immobilization of the fragments for a period of 4-6 weeks [3,12,14], whereas some authors recommend shortening the time to 10-14 days, with antegrade careful mechanotherapy until full adhesion [2,3]. Killey points out, that immobilization of the mandible for the period longer than 10 days can lead to ankylosis of the joint [2]. Silvennoinen and Gola, on the other hand, claim that the early mobilization of the joint is crucial for the proper process of treatment [2]. If correct reposition of the fragments through skin linings is impossible, Kukula recommends the application of hypomachlion that is an acrylic disc having a shape of the wedge converging towards the front, placed on the last molars on the side of the fracture. Thanks to its application under the effect of power of elastic traction it comes to transferring the larger mandibular fragment downwards, which allows for correct reposition of the fragments [3].

Currently a view prevails, that stable osteosynthesis, so surgical treatment allows for achieving better morphological-functional results [8]. In interventional therapy of fractures of the condylar process both methods are applied—extraoral, as well as intraoral. Authors all over the world are outdoing each other in implementing different ways of reduction and fixation of fractures of mandibular condylar processes. Most often as uniting elements there are used titanium miniplates which are applied in the case of methods from the extraoral as well as intraoral access [1-3,8]. The literature describes application of single plates, a few elements or L- or Y-shaped elements, as well as 3D plates. In the testing phase is application of elements from bioresorbable materials [2]. Aleksander described two extraoral methods, in which as uniting elements he used double-T-shaped Luhr mini-plate. In the case of operation of low fractures L-shaped mini Luhr plates were used [3]. Kitayama presents a treatment of subcondylar fractures from extraoral access at application of a screw inserted through the bone crest of the mandible. In his studies Krenkel describes three extraoral and two intraoral accesses. For reduction and fixation he uses anchor screws, which can additionally be stabilized with plates [3]. Ekelt propagates a method using balance screws. The access in this method is extraoral. The screw is inserted into the bottom edge of the mandible through the ramus to the repined fragment. The screw is removed in local anesthesia after the period of

4-6 months [3,9]. In the case of subcondylar fractures Kirschner wires or Steimann pins are inserted [9].

Depending on the chosen operating technique various surgeons' accesses are applicable. Wanyura thinks that an effective and useful surgical tactic is such which is relatively simple technically, and ensures the right access and an insight into the fracture focus to the surgeon as well as will be burdened with the smallest risk of complications [8]. In one of studies he describes the endoscope-aided technique of intraoral reposition and osteosynthesis of broken condylar processes [1]. Using the intraoral access with the aid of endoscope is also described by Lee [15]. Transoral approach runs on the front edge of the branch of the mandible, into the buccal cavity. It is mainly used for the operation of low fractures of processes [13,16]. One of the advantages of the method is the lack of complications in the form of skin scar and peripheral facial palsy [1,13]. This access requires using the endoscope, trocars of appropriate instrumentation and unfortunately not always ensures the possibility of correct reduction and fixation of fragments [1]. The most popular surgical accesses to the condylar process are extraoral accesses. They are unfortunately burdened with a great risk of complications, however it provides a good insight into operating field and an access to fracture fragments for the operator. The most often used approaches are: submandibular, circummandibular, preauricular [2,8,13].

Sub- or circummandibular approach has a length of about 3,5 cm, runs 1,5 cm below and parallel to the edge of the mandible towards the angle. According to Siluk this access allows for the operation of subcondylar fractures, however it makes impossible mini-plate osteosynthesis in the case of high fractures of the condylar process [13].

Retromandibular approach implemented by Ellis in 1993 extends at length of 3cm, 0,5 cm below the ear lobe and is led behind the back edge of the ramus of the mandible, not crossing its angle. Siluk informs that this access is good in the case of high fractures of the process with side displacement of the fragment, more difficult in medial displacement [13]. Wanyura describes very good results of treatments from the retromandibular access [8]. The scar is small-visible and aesthetic. Peripheral facial palsy, bathyhyposaesthesia of the ear lobe and palsy of the marginal mandibular branch were temporary [8,13,17,18].

Preauricular access requires great carefulness during preparation on account of the course of the temporal and zygomatic branch of the facial nerve, the auricular-temporal nerve and venous vessels. After performing the skin cut SMAS (superficial musculo-aponeurosis system) is reached, and next the capsula

of the temporal-mandibular joint [13,16]. This access is preferential in the case of high fractures of the condylar process. Preauricular approach has its varieties in the form of the access through skin cut of the auricle and retroauricular access. These approaches are exceptionally aesthetic. Retroarticular access requires, however, incising the cartilaginous external auditory canal and its subsequent sawing-up [13,19].

Temporal access, variety of which is a bicoronal access, leaves an invisible scar hidden in the hairline. However using it is connected with osteotomy of zygomatic arch or with partial cut of the masseter. Bicoronal approach provides a good access in the case of high fractures of the condylar processes. It is safe for the branch of the facial nerve [13].

S-shaped approach like for parotidectomy or facelift is a combination of the preauricular and circummandibular access. Using it results in the necessity of preparation of the facial nerve branches. It is recommended in the case of high fractures of mandibular condylar processes. This access ensures the good insight into the operative field [13,16,20].

Complications in treating fractures of mandibular condylar processes to a large extent depend on extensiveness of injuries, type of the fracture, degree of fragment displacement, appearance of concomitant fractures, as well as on the choice of the therapeutic method and the time of its implementation [2,21]. Common complications include: disorders of the mobility of the joint, occlusal disorders, asymmetry of the face on the side of the injury [2,4]. Ankylosis constitutes late complication in the 0,2%–0,4% of fractures of condylar processes [2]. The reduced range of dissuading regards even a 10% of cases [2]. Authors point out, that even short immobilization of the joint can result in disorders of its mobility, which weights against using the method of preserving-orthopaedic treatment [2,3]. On the other hand, rarely in this method is noticed appearance of necrosis of articular head, which is rather associated with operative ways of treatment [2,4]. To the group of complications associated with surgical treatment of the fractures of mandibular condylar processes belong: passing or long-lasting peripheral facial palsy, passing temporary palsy of the marginal mandibular branch, bathyhyposaesthesia of the ear lobe, post-operative scars, stenosis of the auditory canal, formation of the salivary fistulas, Frey's syndrome, myotonia of masseter, desorption of the head of the mandible, rupture of miniplates [3,8,10,12,20,21]. These complications mainly temporary and abate to 12 months from the operation [8,20]. It is often recommended to introduce the adjunctive pharmacotherapy (complex of the vitamin B, preparations of vitamin B 12) [20].

Rehabilitation has a very important role in the minimization of results of injuries. In the case of patients treated with surgical methods the rehabilitation can be begun just on the first day after the operation. It consists mainly of exercises of dissuading and adducing the mandible. The patient should exercise in front of a mirror in order to fix the correct track of dissuading [2-4]. Divergences exist in the literature as for the frequency and the time of performing muscle exercises. They should be performed at least 3 times a day, or even 5 times a day for 10 minutes. In patients treated non-invasively the rehabilitation process starts upon removal of the intermaxillary traction. At present, the majority of authors recommends shortening the time of immobilization to 14, even 10 days on account of the considerable risk of ankylosis of the joint [2,3]. Zachariades recommends removing the elastic traction once a week during the treatment, and before the re-installation, the patient should practice opening and closing the mouth for an hour to hour and a half [2]. After the period of the orthopaedic treatment careful physiotherapy is implemented for 3-4 weeks [2,3]. The rehabilitation is recognized as finished the moment of getting by the patient opening of the jaws similar to that from before the injury [1,2,8]. Using the elastic traction in the perioperative period (after the surgical treatment) is restricted for cases, in which despite the correct reduction and fixation of fragments, disorders of the muscle tone or a wrong position of the head in the acetabulum of the joint appear [2].

Dealing with patients in the developmental age constitutes the distinct therapeutic problem [2-4]. Those patients constitute even a 10% of people treated because of injuries to the facial part of the skull [4]. According to Thoren, bicycle accidents are the most frequent cause of injuries, which constitutes 48% of the cases [5]. In these group fractures of condylar processes constitute even 60% of all fractures of the mandible [4]. In children seldom does it come to large displacement of fragments, fractures are most often of a subperiosteal character and are greenstick fractures. Zachariades points out that due to this fact they can be easily overlooked and untreated what may, in consequence, lead to late complications [2]. Among them should be named: ankylosis of the joint, underdevelopment of the body and the ramus of mandible on the side of the injury, asymmetry of the face with displacement of the mentum towards the ill side, transverse malocclusion [4]. In case of bilateral injuries they are additionally: bilateral underdevelopment of the mandible, bird-face, microgenia, open bite, complete distal occlusion. A relation was shown between the age of the patient and the type of the fracture, which is associated with the structure of the bone of the mandible in the given age. In small children,

to 5 years old, most frequent fractures are intracapsular fractures [2,4]. Thoren showed that this type of the fracture concerned 58% of the patients to 6 years old. In older children fractures within the neck are dominant, whereas in adults—subcondylar fractures, which constitute 62%, whereas intracapsular fractures only 14% [5]. Treatment in patients in the developmental age, due to growth processes in progress, differs far from treatment in adults [4]. Indications for surgical treatment in underaged patients are very limited and narrows to situations, in which the following were stated: open fracture with great injuries of soft tissues, large displacement of fragments, multifragmentary and subcondylar fractures with concomitant fractures of the skeleton of facial cranium [2,4]. Surgical treatment in children may result in abnormal mandibular growth due to scars of soft tissues and the reduction of injured tissue, it also increases the risk of necrosis of the articular head [4]. The majority of authors of the literature recommend applying the preserving-orthopaedic strategy in the developmental age [22,23]. Kukuła provides, that maximum shortening of the time of immobilization and putting the huge pressure on the motor rehabilitation of mandible are most beneficial [3]. Hotz used orthodontic activator, whereas Komorowska—Schönherr's vestibular plate, in order to stimulate remodeling of the head of mandible after the injury [3]. Jurkiewicz—Ciurlej offers two-stage treatment with orthopaedic-functional method introduced by Reichenbach [4]. The first stage – non-invasive treatment, lasts about 14 days and is conducted by the maxillary surgeon. The second stage – orthopaedic-functional treatment, conducted by the orthodontist. It consists in applying movable functional apparatus. The patient removes it only for the time of partaking meals. A possibility of correction of the malocclusion appearing in the patient even before the injury is an advantage of this therapy [4]. The majority of authors are paying special attention to the necessity of long-term control over the patients, in particular children, because the rapid development of the skeleton can lead to formation of late complications which according to Zide and Kent may appear even in 10-50 years after the completed treatment [2].

Contemporary literature does not give an unequivocal answer to the question whether in the case of fractures of mandibular condylar processes non-invasive treatment should be applied or whether the method of surgical supply of fractures is better [1-3,8,9,12]. On the basis of the literature indications and contraindications for every type of the treatment were determined [4,12]. Every method is burdened with the risk of complications, which should be considered individually with regard to

the given patient [2,8,20]. Children should be treated separately [2-4,22,23].

It is necessary to pay special attention to the rehabilitation of the patient, as it largely determines the ultimate effect of the treatment [2-4].

## References

- [1] Wanyura H., Stopa Z., Brudnicki A., Intraoral reposition and osteosynthesis of broken mandibular condylar processes aided with endoscope – preliminary communications, *Czas. Stomatol.*, 2006, 59 (10), 687-695
- [2] Zachariades N., Mezitis M., Mourouzis C., Papadakis D., Spanou A., Fractures of the mandibular condyle : A review of 466 cases. Literature review, reflections on treatment and proposals, *J. Craniomaxillofacial Surgery*, 2006, <http://www.ncbi.nlm.nih.gov/pubmed/17055280>
- [3] Kukuła J., Sołkiewicz E., Kowal R., Contemporary methods of treatment of condylar process fractures. Literature review, *Pozn. Stomatol.*, 1997, 24, 43-52
- [4] Jurkiewicz-Ciurej B., Fractures of the mandibular condylar process in children and adolescents, *Porad. Stomatol.*, 2010, 10 (5), 158-163
- [5] Thoren H., et al., An epidemiological study of patterns of condylar fractures in children, *Br. J. Oral Maxillofac. Surg.*, 1997, 35, 306-311
- [6] Adhikari R.B., et al., Pattern of mandibular fractures in Western Region of Nepal, *NJMS.*, 2012, 1, 46-48
- [7] Zix J.A., Schaller B., Lieger O., Saulacic N., Thorén H., Iizuka T., Incidence, etiology and pattern of mandibular fractures in central Switzerland, *Swiss Med. Wkly*, 2011, <http://www.ncbi.nlm.nih.gov/pubmed/21618147>
- [8] Wanyura H., Brudnicki A., Stopa Z., Results of treating fractures of mandibular condylar processes by miniplate osteosynthesis from the retromandibular access, *Czas. Stomatol.*, 2003, 56 (10), 674-682
- [9] Koszowski R., Pogorzelska-Stronczak B., Lelek P., Waśkowska J., Computer spiral tomography with MPR and 3D reconstruction in evaluation of fractures of mandibular condylar processes, *Czas. Stomatol.*, 2000, 53 (10), 647-655
- [10] Bartkowski S., *Maxillofacial surgery*, CM UJ, Kraków, 1996
- [11] Kryst L., *Maxillofacial surgery*, Wydawnictwo Lekarskie PZWL, Warszawa, 2007
- [12] Szwarczyński A., Kucharska M., Indications for orthopaedic and surgical treatment of fractures of mandibular condylar processes based on the literature and own experience, *Dent. Forum*, 2004, 31 (2), 61-64
- [13] Siluk J., Kowalczyk R., Zawodny P., Surgical accesses in treating fractures of mandibular condylar processes—communications from the literature and own experiences, *Czas. Stomatol.*, 2003, 56 (9), 601-608
- [14] Hilt T., Arkuszewski P., Assessment of the results of treating the fractures of mandibular condylar processes by preserving-orthopaedic methods, *Mag. Stomatol.*, 2004, 14 (12), 44-46
- [15] Lee C., et al., Endoscopic subcondylar repair : Functional, aesthetic, and radiographic outcomes, *Plast Reconstr. Surg.*, 1998, 102, 1434-1239
- [16] Ellis E., Zide M.F., *Surgical approaches to the facial skeleton*, Dallas, Texas, USA, 2000, 109-163
- [17] Biglioli F., Colletti G., Transmasseter approach to condylar fractures by mini-retromandibular access, *J. Oral Maxillofac. Surg.*, 2009, Nov, 67(11), 2418-24
- [18] Biglioli F., Colletti G., Mini-retromandibular approach to condylar fractures, *J. Craniomaxillofac. Surg.*, 2008, Oct, 36(7), 378-83
- [19] Benech A., Arcuri F., Baragiotta N., Nicolotti M., Brucoli M., Retroauricular transmeatal approach to manage mandibular condylar head fractures, *J. Craniofac. Surg.*, 2011, Mar, 22(2), 641-7
- [20] Klatt J., Pohlenz P., Blessmann M., Blake F., Eichhorn W., Schmelzle R., Heiland M., Clinical follow-up examination of surgically treated fractures of the condylar process using the transparotid approach, *J. Oral Maxillofac. Surg.*, 2010, Mar, 68(3), 611-7
- [21] Wagner A. et al., A 3-dimensional finite-element analysis investigating the biomechanical behavior of the mandible and plate osteosynthesis in cases of fractures of the condylar process, *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.*, 2002, 94(6), 678-686
- [22] Medina A.C., Functional appliance treatment for bilateral condylar fracture in a pediatric patient, *Pediatr. Dent.*, 2009, Sep-Oct, 31(5), 432-7
- [23] Chatzistavrou E.K., Basdra E.K., Conservative treatment of isolated condylar fractures in growing patients, *World J. Orthod.*, 2007, 8(3), 241-8