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Up-to Date Review And Case Report

Mandibular ascending branch and condyle reconstruction in adolescence by a costochondral rib graft with an observation period over 8 years

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Abstract – Introduction: The need to resect and reconstruct the condylar process of the mandible in a teenager is rare. Reconstruction strategy must be accurately assessed in terms of donor side morbidity, postoperative risks (ankylosis) and the possibility of sufficient development in a growing patient. **Observation:** A 14-year-old boy presented with the radiographic finding of a large cystic lesion of the right condylar process. There were no clinical symptoms as pain, a limitation of mouth opening or malocclusion. Pathohistological examination confirmed a solitary bony cyst. The resected ascending jaw and condylar process was reconstructed by a costochondral rib graft. **Commentaries:** Over 8 years the development of the reconstructed ascending jaw and condyle was observed. There was an undisturbed growth. The cartilaginous part of the costochondral graft remodeled to a sufficient condylar process without ankylosis, resorption or overgrowth. **Conclusion:** The reconstruction of the growing mandible and condylar process in an adolescent is a challenge. Observation over 8 years showed a sufficient reconstruction. Intraoperative the chondral portion of the graft has to be handled carefully to avoid a separating from the bony part. The growth potential of the costochondral rib transplant allows a functional reconstruction without substantial donor side morbidity in adolescent patients.

Introduction

The need to reconstruct the condylar process of the mandible in a child or an adolescent is rare and in the literature especially described in the cases of ankylosis of the temporomandibular joint (TMJ) [1–4]. The destruction of the whole condylar process by a solid or an aneurysmatic bone cyst is even a rarity [5–7]. Solitary bone cysts are benign fluid-filled tumor-like bone lesions and more than 90% are located in the long bones, most commonly in the proximal humerus and femur [8]. Therefore less than 10% are found in the facial bones and there over three quarters are located in the [7].

If there is a need to resect and reconstruct the ascending mandibular part and condyle in a growing child or adolescent the following arguments have to be considered in therapy: a one-time therapy should lead to the cure and give the greatest possible chance of complete healing. Even a short duration of treatment and a safe therapy with a low complication rate should be sought according to Emodi *et al.* [9].

Many donor sides for the reconstruction of the mandibular condyle are found in literature. The sternoclavicular joint, the iliac crest or the rib is a favored as an avascular free donor side [10,11]. Microvascular anastomosed grafts like the lateral femoral condyle flap, that is described recently, or the free fibula flap are often used in the reconstruction of TMJ in older patients [12,13].

The reconstruction of the condylar process in children or young adolescent is mainly influenced by the expected growth of the treated person. In young children is a great experience in the use of a costochondral rib transplant for the reconstruction of the mandibular condyle [2–4,13–15]. Until now there is no detailed description of the growth behavior of a transplanted rib graft in a young adolescent during puberty with the largest growth spurt expected in life.

Observations

At the first presentation in our clinic a 14-year old patient reported from a bicycle accident with a fall on the right half of the face one week ago. In the prepared X-ray diagnostics (orthopanthomogramm P1) a brightening area and infracture in the right condyle was seen (Fig. 1). A tissue sample was taken surgically for histological investigations and showed an unspecific inflammation.

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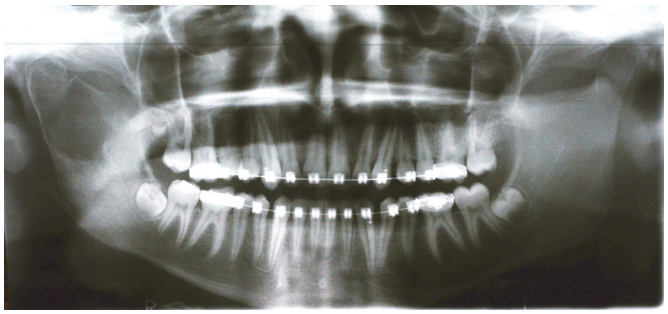

Fig. 1. Orthopantomogramm P1 shows a brightening and infracture in the right condyle.

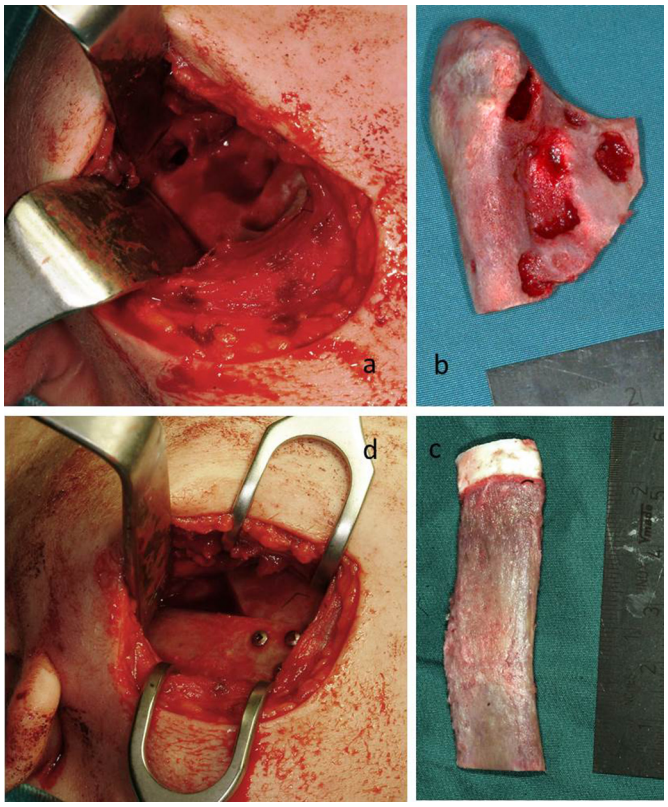

Fig. 2. Intraoperative view of the right condyle (a) with round osteolyses caused by the solitary bony cyst (b). After resection a costochondral rip graft was transplanted (c) and fixed on the remaining mandibular jaw (d).

The surgical procedure to resect the cystic bone formation of the right condyle was performed under general anaesthesia. Following the extraoral periangular approach described by Rasse a vertical skin incision was made about 4-5 cm in length in the first neck fold below the mandibular angle [16]. Subcutaneous preparation was performed in cranial direction on the surface of the platysma. One cm above the cranial mandibular margin the muscle fibers of the platysma were cut through carefully. A cut through the masseter muscle was done and subperiostal preparation followed to expose the right condyle (Fig. 2a). The condylar process was cut off using an oscillating saw. The disarticulation of the condylar process followed to remove the condyle. After complete removal, the distended and perforated condylar process was seen (Fig. 2b).

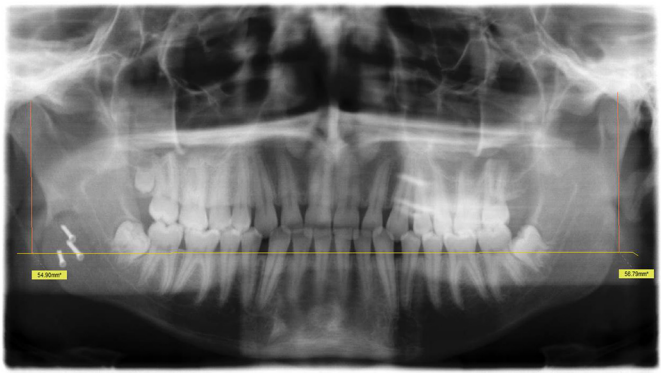

Fig. 3. Orthopantomogramm (P1) 7 years after reconstruction of the right ascending jaw and condyle with a costochondral rib graft with a comparative digital measurement of the ascending jaw.

The reconstruction of the resected ascending mandibular branch and condyle was done by an osteochondral rib graft from the right chest (Fig. 2c). The rib graft was fixed by 3 tension screws (Fig. 2d) in habitual occlusion by intermaxillary fixation. The habitual occlusion was fixed for 14 days by tight elastics, followed by a phase of controlled movement directed by up and down elastics.

In the immediate postoperative healing course an antibiotic therapy (amoxicillin 500 mg, twice daily, 7 days) and analgesic and anti-inflammatory medication (ibuprofen 300 mg, three times a day, 5 days) was provided. Local cold application and home oral care instructions were advised. Postoperative healing was uneventful. A follow-up panoramic radiograph was taken after 6 months and at least 7 years after the reconstruction. Postoperative measurement of the ascending mandibular branch revealed a symmetrical development (Fig. 3).

There was no serious postoperative complication like an infection or graft rejection, functional limitation like restriction of mouth opening or lateral side deviation. Analyzing enface photos over the last 7 years revealed no facial asymmetry and no deviation of the lower jaw to any side (no laterognathy). Until now the clinical follow-up was done for 8 years and included measurements of the maximal mouth opening, an analysis of the facial symmetry in enface photos and recording of complications such as ankylosis. With completion of growth the ascending mandibular branch showed a normal development and a sufficient remodeling of the chondral part of the costochondral rib transplant.

The standardized measurement of the ascending mandibular branch and condyle in the orthopantomogramm was done according to the method described by Hlawitzschka *et al.* [17]. This measurements showed almost the same length development after 7 years on both sides (right side: 54.90 mm, left side: 56.79 mm).

Commentary

The reconstruction of the ascending mandibular branch and condyle in young adolescent is not very common. In literature most needs for temporomandibular joint reconstruction (TMJ) in children are described in cases of craniofacial microsomia type III and posttraumatic ankyloses [1,3,8,18]. There is a long experience of TMJ reconstruction by a costochondral rib graft in children up to the 10th year of life. But there is less known about a condylar reconstruction and growth behavior of the transplant in adolescents, because all described cases were treat before puberty [1–4,8,15,18].

Our patient's age at diagnosis and therapy was 14 years. In this case the resection and reconstruction was done at the time of the highest expected growth potential in adolescence — at a very unfavorable time.

Preoperative considerations regarding the reconstruction of the ascending branch and the condylar process of the mandible dealt with allogeneic and autogenic reconstruction possibilities [10–12,15,19,20]. Due to the age of the patient and the expected growth, a costochondral rib transplant was chosen. The well-known growth potential of the costochondral graft (CCG) in the reconstruction of the mandibular branch makes it the ideal choice for children [21,22]. When care is taken to ensure proper postoperative functional therapy, according to the principles of functional orthodontics, there is an excellent prognosis to influence the reconstructed mandibular branch during growth in childhood [8,15,19]. The costochondral rib graft growth continues during adolescence [18]. There is an annually growth rate of about 1.5 mm in early childhood and an acceleration during puberty to 2.6 mm per year [20]. At the age of 17 to 18 years with the end of puberty even the growth of the transplant is also completed.

In terms of surgical reconstruction of the ascending mandibular branch and condyle with a costochondral rib graft the presence of the cartilaginous cap of the rib with its intrinsic growth potential is very important. This anatomical unity of the connection zone of bone and cartilage allows the growth and remodeling into a functional temporomandibular joint.

However, it has been described that the growth potential of this connection zone of bone and cartilage can also lead to an overgrowth of the transplanted bone in children [23]. In this case no overgrowth was seen and growth resulted in a symmetrically development of the mandibular ascending branch and condyle.

The major surgical advantages of this method are the easy accessibility and adaptation, the anatomical similarity to the mandibular condyle and the low donor site morbidity [21,22,24]. Complications that may occur by raising the costochondral rib transplant like a pneumothorax, a pleural effusion, an atelectasis or empyema must be considered.

Care must be taken by raising the transplant, because a violation of the fragile connection between bone and cartilage can result in a disturbance in the further growth process. However it must be considered that the growth of the costochondral transplant cannot be predicted precisely.

Conclusion

In adolescents, and not only in children, the reconstruction of the ascending mandibular branch can be performed adequately with a costochondral rib graft. In particular, the potential for growth is found in the connection zone of the bone and cartilage. It is noteworthy that no further operative corrections had to be made and there was no functional or aesthetic impairment.

Conflicts of interests: The authors declare that they have no conflicts of interest in relation to this article.

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