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The importance of the maxillary sinuses in facial development: a case report

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SUMMARY A case of mandibular asymmetry is presented. It appears that in this patient the mandible was adapted to changes in the maxillary sinus area. Abnormal bone growth of unknown aetiology inside the sinus most likely caused complete remodelling in the maxillary sinuses and asymmetry of the mandible. Special tests used for detailed assessment of the patient supported the definitive diagnosis.

Introduction

Growth of the sinuses has been examined in detail (Brown *et al.*, 1984). However, there have been no reported links between sinus growth and mandibular asymmetry. Mandibular asymmetries can arise by excessive growth of the mandibular condyle on one side (hemimandibular elongation; Obwegeser and Makek, 1986), but most likely are caused by a unilateral escape of the growing tissues from normal regulatory control, the exact mechanism of which is not understood (Proffit and Fields, 1993). Typically, it appears in the late teens but may begin at an earlier age. The treatment mode is surgery and it should be performed after the normal or abnormal growth has ceased. The purpose of this paper is to report a very interesting case of mandibular asymmetry from the diagnostic point of view.

Case report

The subject was a 24-year-old male patient referred to the Heidelberg University clinic for orthodontic evaluation. The medical history was non- contributory.

Intraorally: the patient exhibited a full-unit Class II relationship on the right, and half-unit Class II on the left. The overbite was 6 mm and the overjet was 8 mm (Figure 1). A maxillary midline deviation of 3 mm to the left was present and the maxilla was asymmetrical and transversally wide. The maxillary first and second premolar and the second molar were in buccal crossbite. The mandible was also asymmetrical and there was a mandibular midline discrepancy of 2 mm to the right. The occlusal line was tilted caudally on the left side. There were also space discrepancies of 3.5 mm in the maxillary arch and 5.1 mm in the mandibular arch.

Extraorally: the patient was profoundly asymmetrical with the asymmetry mainly localized in the mandible. He exhibited a strained lip closure and mentalis muscle (Figure 4).

Radiographic examination revealed all permanent teeth to be present with no periapical or marginal periodontal pathology (Figure 1).

After analysing and evaluating the records, it was decided to undertake treatment using an orthodontic/orthognathic approach. Orthodontically, it was decided to extract all four first premolars, close the spaces, and eliminate all dental compensations. Third molar extractions were also included in the treatment plan. Surgically, due to the asymmetry of the maxilla and the mandible, a bimaxillary procedure was planned.

Since the present case shared many of the characteristics of hemimandibular elongation described by Obwegeser and Makek (1986), it was felt that thorough investigations were required prior to commencement of treatment to determine the causes of the asymmetry.

To distinguish an active, rapidly growing condyle from an enlarged condyle that has ceased growing, the bone-seeking isotope ^{99m}Tc can be used as a diagnostic tool (Matteson *et al.*, 1985).

Figure 1 Intraoral photographs pretreatment and orthopantomogram.

Areas of active bone deposition concentrate this short-lived gamma-emitting isotope. ^{99m}Tc imaging of the condyle area is not intense except in cases of active condylar growth (Proffit and Fields, 1993). The above diagnostic method was applied to our patient. A full body as well as a head image in four planes revealed that instead of an intense imaging of the left condylar area (abnormal condylar growth), an intense imaging at the right side of the maxilla extending from the temporomandibular joint to the lower and posterior orbital floor was observed. To exclude any fibrotic dysplasia or Paget's disease, blood tests were performed (serum alkaline phosphatase levels) with negative results. In order to identify the exact area of pathological bone remodelling, computed tomography was performed. The findings are depicted in Figure 2. At the right maxillary sinus, an opaque area covering more than 50 per cent of the sinus was present. The different levels of the computed tomogram show the extent of this opaque area. As revealed by computed tomography, the left maxillary sinus was completely remodelled (compare the left and the right maxillary sinus). Furthermore, the left maxillary sinus was enlarged.

It appears that, in an effort to accommodate for the very viable function of the sinuses, abnormal bone deposition on the right maxillary sinus caused a complete remodelling in the area and enlargement of the left maxillary sinus. The latter most likely resulted in the buccal crossbite of the left side. The mandible was adapted to this asymmetrical maxillary condition, causing an even more asymmetrical facial appearance. Biopsy taken from the opaque area revealed no malignancy. The cause of this abnormal bone deposition in the right maxillary sinus could not be identified. It seems that in the present case, the mandibular asymmetry was the result of the abnormal bone growth of unknown aetiology on the right maxillary sinus.

Since no pathology was found, it was decided to proceed with the orthodontic/orthognathic treatment plan with a major change in the surgery plan: instead of a bimaxillary approach, a one-jaw procedure was performed, the mandibular sagittal split osteotomy. This approach was undertaken in order to avoid any changes in the equilibrium that the maxillary sinuses had reached, thus augmenting the possibility for post-operative relapse. The occipitomental view taken before orthognathic surgery also depicts this opaque area at the right maxillary sinus (Figure 2, arrows).

In the maxilla, the first premolars were extracted and the spaces were closed. The maxillary midline was dentally corrected and compensated to the facial midline, about 1.5 mm. In the mandible, the first premolars were extracted and the spaces were closed. The third molars were also extracted at the beginning of the orthodontic treatment.

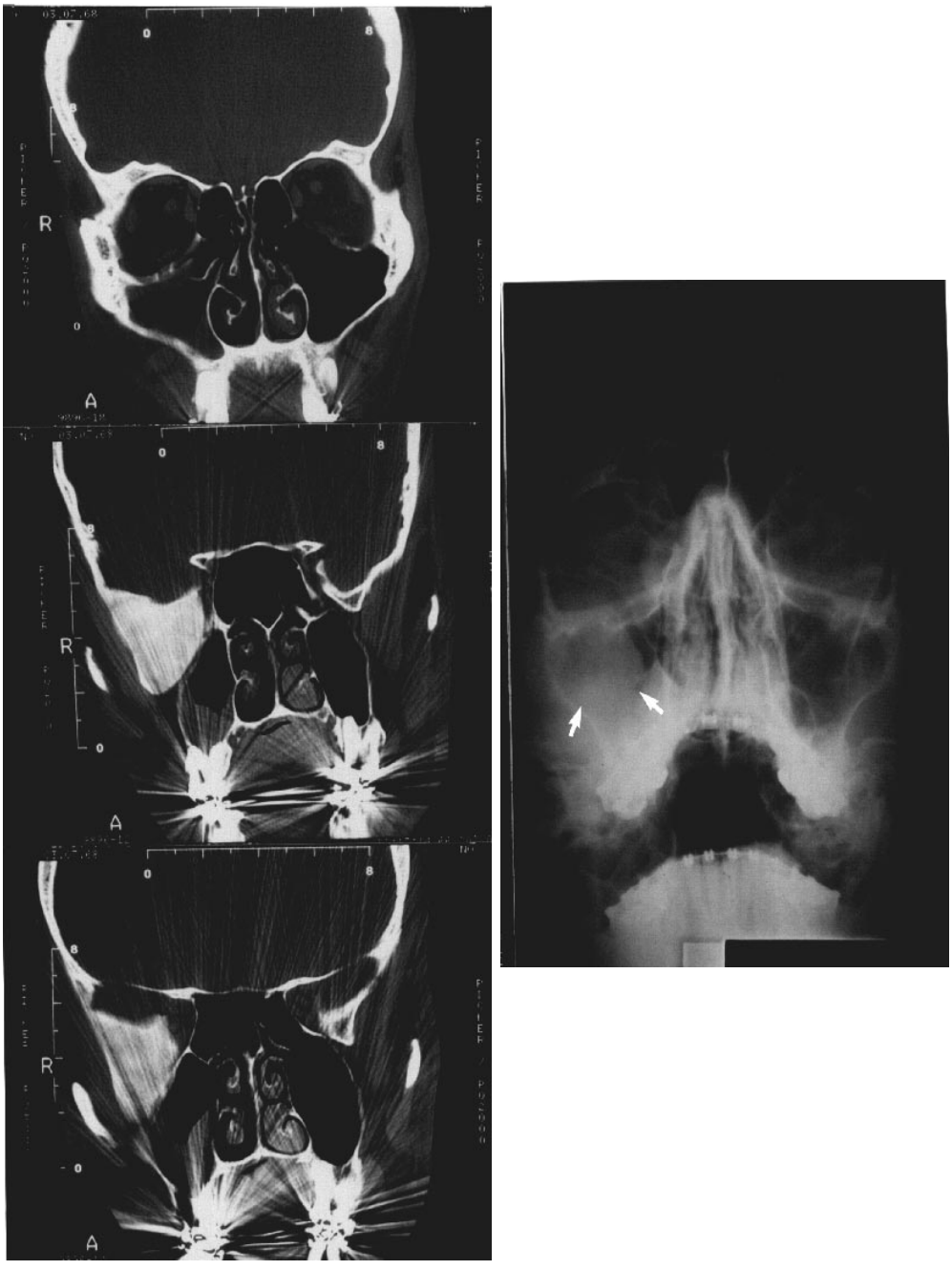

Figure 2 Computed tomogram showing the reduction of the viable space of the right maxillary sinus and the counteracting over-development of the left maxillary sinus. Occipitomental view depicting the opaque area at the right maxillary sinus (arrows).

Figure 3 Post-treatment/post-surgical intraoral photographs.

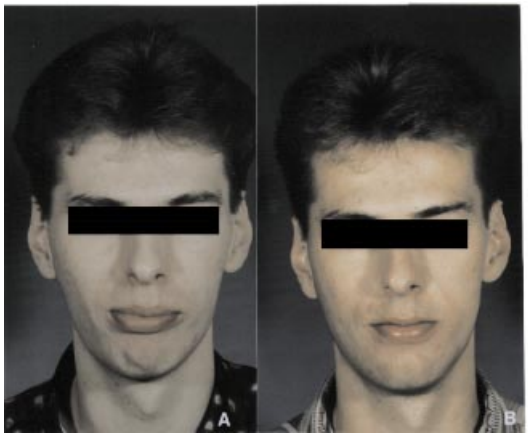

Figure 4 Extraoral photographs of the patient before (A) and after treatment (B).

A mandibular sagittal split osteotomy followed, and 4 months later the patient was debanded. On the post-treatment intraoral photographs, the patient exhibits a Class I relationship, while a slight maxillary deviation of approximately 1 mm is present (Figure 3). This is due to the fact that the skeletal midline discrepancy was able to be masked up to a certain degree. On the extraoral photographs, a great improvement of the face is evident. The lips and the mentalis muscle are relaxed and no strain is present. The face shows greater symmetry and the aesthetics are improved (Figure 4).

Conclusions

The patient was successfully treated by combining orthodontics and orthognathic surgery. This case presentation illustrates the importance of the function of the maxillary sinuses in facial development. Moreover, in facial asymmetry cases, additional diagnostic records and thorough evaluation are necessary.

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