Elongated Styloid Process With Skeletal Mandibular Protrusion

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Abstract: An elongated styloid process (ESP) causes symptoms such as pharyngeal pain, swallowing pain, and discomfort during mouth opening. The main treatment is surgical resection of the ESP. The authors present a case of ESP with skeletal mandibular protrusion. Because mandibular setback by sagittal splitting ramus osteotomy (SSRO) may lead to deterioration of symptoms of ESP, resection of ESP and bilateral SSRO were performed simultaneously. The patient was a 50-year-old man who visited our department with chief complaints of mandibular protrusion and pain in the left pharynx on mouth opening and swallowing. A lateral cephalogram helped in diagnosis of skeletal mandibular protrusion. In addition, an approximately 42-mm left styloid process elongated inferomedially was observed. Left styloidectomy was first performed via the cervical approach, followed by SSRO. Occlusion, facial appearance, and preoperative symptoms due to the ESP improved after surgery. The cervical appearance was esthetically satisfactory. In a case of ESP with skeletal mandibular protrusion with potential aggravation of symptoms because of mandibular setback of the ESP, resection of the styloid process is necessary together with orthognathic surgery.

Key Words: Elongated styloid process, mandibular protrusion, sagittal splitting ramus osteotomy

An elongated styloid process (ESP) may cause pharyngeal pain, swallowing pain, and discomfort during mouth opening. The incidence of ESP is low and its cause is often unknown. The main treatment is surgical resection of the styloid process, but follow-up alone may be conducted without apparent subsequent symptoms. An ESP is defined as a styloid process of length >25 mm, and in Western populations, 18.2% are >30 mm. In the Japanese population, 15.5% of styloid processes are >25 mm, and in Western populations, 18.2% are >30 mm. Onset of symptoms occurs only in approximately 4% of cases of ESP.

In this report, we present the first reported case of ESP with skeletal mandibular protrusion. Because mandibular setback by sagittal splitting ramus osteotomy (SSRO) may aggravate the ESP symptoms, resection of the ESP and bilateral SSRO were performed simultaneously.

CASE PRESENTATION

A 50-year-old man with chief complaints of mandibular protrusion, malocclusion, pain in the left pharynx on mouth opening, and pain on swallowing visited the Department of Oral and Maxillofacial Surgery at Gunma University Hospital. The patient had a history of high blood pressure and was taking antihypertensive drugs. His family history was unremarkable.

The patient had exhibited reverse occlusion since he was a child, but he had not received orthodontic treatment. He visited an orthodontist to improve the reverse occlusion after 35 years. He was diagnosed with skeletal mandibular protrusion and was referred to our department for surgery. Preoperative orthodontic treatment was conducted for 1.5 years, but since initiation of this treatment, the patient had experienced pain on mouth opening and swallowing.

The face was symmetrical in the frontal view and concave in the lateral view (Fig. 1A). Intraoral findings demonstrated a 1-mm deviation of the mandibular midline to the right from the facial midline. The overjet was 11 mm and the overbite was 6 mm. The association of the posterior teeth was Angle class III bilaterally (Fig. 1B). There were no problems on inspection and palpation of the left pharynx and no obvious pressure pain. The mouth opening width was 60 mm and there was no abnormal gliding movement in the temporomandibular joint. No abnormal findings such as resorption, deformity, or ankyloses in the bilateral condylar were found in panoramic images. The patient was diagnosed with skeletal mandibular protrusion on a lateral cephalogram. An approximately 42-mm styloid process that was elongated inferomedially was observed in the left temporal bone on computed tomography (CT) (Fig. 1C).

Model surgery was performed using a three-dimensional model fabricated based on the CT data. Posterior movement of the mandible of 11 mm on the right side and 12 mm on the left side was necessary because of the normal maxilla-mandibular relationship. The posterior margins of the distal segment and left styloid...
process were close to each other. Because there was a risk for worsening of ESP symptoms, such as pain on mouth opening and swallowing, simultaneous bilateral SSRO and left styloidectomy were planned.

Left styloidectomy was performed first. Based on the approach of enucleation of benign parapharyngeal space tumors, an S-shaped skin incision was designed from the preauricular to the submandibular area (Fig. 1D). Skin incision was performed, and the parotid fascia and anterior margin of the sternocleidomastoid muscle were confirmed. The inferior pole of the parotid gland was superiorly retracted, and the posterior belly of the digastic muscle was confirmed and resected, after which the stylloid process was palpated. Dissection was continued until the stylohyoid muscle was confirmed and resected. The stylopharyngeal muscle was detached from the styloid process to expose the stylloid process. The tip of the stylloid process, which was approximately 15 mm in length, was grasped using bone-cutting forceps and resected (Fig. 1E). Next, SSRO was conducted. After the distal segment was moved posteriorly, fixation was performed with a biodegradable plate.

Oclusion, facial appearance (Fig. 1F-G), and preoperative symptoms due to the ESP improved after surgery and the subsequent course was uneventful. The cervical appearance was esthetically satisfactory (Fig. 1F).

**DISCUSSION**

Eagle first reported that a stylloid process of >25 mm was abnormal.6 The length of the stylloid process in our patient was 42 mm. The details of the pathogenic mechanism of ESP are unknown, but there are several theories. According to von Eicken, there are 2 ossification centers in the stylohyoid ligament, and these centers ossify superiorly and coapt with the styloid process, but rarely ossify inferiorly and coapt with the lesser horn of the hyoid bone to form a long rib.7 There has been no previous report on an ESP with skeletal mandibular protrusion. The stylomandibular ligament was considered to be attached to the mandibular inner surface, causing extension of the growth direction.

Swallowing pain is the main clinical symptom of an ESP, but various other symptoms may also occur depending on the overgrowth direction.8 In the present case, symptoms such as pain on swallowing and mouth opening were considered to be caused by physical stimulation of the lateral pharyngeal wall and posterior part of the tongue by the ESP. Mandibular setback by SSRO may have resulted in proximity of the stylloid process and distal segment. Because posterior movement of the pharyngeal mucosa with mandibular setback enhances stimulation of the pharyngeal mucosa around the stylloid process, the possibility of exacerbation of symptoms was considered.5,9 Therefore, styloidectomy was conducted simultaneously with SSRO.

There are many reports on the oral approach to styloidectomy. There are 2 methods of oral approach: from the tonsillar fossa after removing the palatine tonsil, and incision from the palatoglossal arch, avoiding the palatine tonsil.10,11 The advantages of the oral approach are that it is less invasive, requires only brief access to the base of the stylloid process, and leaves no scar in the cervical area.1,7 Its disadvantages are the narrow surgical field and the risk for damage to the internal carotid artery and internal jugular vein.1 When SSRO is performed at the same time as styloidectomy, the incision lines and operative field are close to each other (Fig. 1I). In this situation, bleeding and edema may make it more difficult to secure the operative field; and there may be postoperative bleeding caused by the procedure in and around the tonsil, and upper airway stenosis caused by pharyngeal edema. To ensure a wide surgical field, reduce perioperative and postoperative risks, and facilitate reliable resection of the ESP, the cervical approach was selected in our case.4

Although resection to the base of the stylloid process is reportedly necessary, improvement of symptoms with resection of the elongated portion only has been shown.4 In the present case, only the portion of the stylloid process that caused the process to exceed an average length was resected. Given the risk for external ear canal damage owing to abnormal fracture, as well as damage to the facial nerve, internal carotid artery, and internal jugular vein, resection was performed only in the elongated area, rather than to the base of the stylloid process. Symptoms disappeared postoperatively, which indicates that resection of the elongated portion only can be effective in a case of ESP.

**CONCLUSIONS**

We have reported a case of ESP with skeletal mandibular protrusion. In a case with potential aggravation of symptoms cause of mandibular setback of the ESP, resection of the stylloid process is necessary together with orthognathic surgery.

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