Application of an Internal Metal Splint For Functional Reconstruction Following Segmental Resection of the Mandible

Kenjiro Hida, Toshihide Sugihara, Yoshihiro Ishida, Nagayoshi Yamada
First Department of Oral Surgery (Chief: Prof. Nagayoshi Yamada)
Kyushu Dental College, Kitakyushu, Japan

Mari Watanabe
Department of Dentistry (Chief: Mari Watanabe)
Masuda Red Cross Hospital, Shimane, Japan
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Cases that necessitate resection of the mandible are found in treatment of either benign or malignant tumors in oral surgery.

Generally, autogenous bone grafts are widely performed for mandibular reconstruction. However, in the case of treatment of patients whose bone structures are still growing, we encounter some experimental and clinical studies in which extensive bone regeneration following resection of the mandible made possible mandibular reconstruction.

Accordingly, after resection of the mandible, we fit an internal metal splint to the bone defect to compensate for the lost bone and to restore its shape and function.

In a recent case of ameloblastoma, the use of an internal metal splint proved to promote remarkable bone regeneration of the mandible. In the present paper, we would like to report on this case.

Case Report

On December 17, 1984, a 14-year-old girl was referred to our hospital because of a slowly growing lesion of the mandible. Clinical examination showed a diffuse swelling, with no sign of inflammation, on the left body of the mandible. Intraorally, the cortical bone in the left lower molar and retromolar area had expanded both buccally and lingually. When slight pressure was applied to this region, parchment crepitation was recognized. The overlying mucosa was of normal color and texture.

On a panoramic radiograph, there was a large well-defined radiolucency involving the left mandibular body and ramus region. The unerupted second molar was
contained in the lesion (Fig. 1). A clinical diagnosis of ameloblastoma was made.

In consideration of the age of the patient, an attempt was made to marsupialize the lesion; however, once surgery was begun it was found that the entire thickness of the mandible was expanded and it was judged impossible to remove the tumor adequately and still retain any bone at the tumor site. Therefore, a segmental resection of the mandible was performed on December 25, using general anesthesia and a submandibular approach.

An incision of about 10 cm was made over the left submandible. This incision was extended to the platysma, and the facial artery and vein were ligated. The periosteum of the mandible was detached by blunt dissection to expose the expanded mandible. Osteotomy of the mandible was performed at the second premolar region and the center of the mandibular ramus. The tumor was removed, leaving the mandibular canal. After resection, a stainless steel shaft with a thickness of 3 mm and a width of 5 mm was curved to form the outline of the mandible. It was then inserted between the remaining bones and was attached by stainless steel wires. The incision was closed in layers by interrupted cotton sutures, then intermaxillary fixation was performed.

At three weeks after surgery, the postoperative course was uneventful. No wound infection or deformity of facial features was evident, so the patient was discharged. A panoramic radiograph showed the presence of fine, thread-like radiopacity in the bone defect. No dislocation in the junction of the fragment was noted (Fig. 2). At three months after surgery a solid bone-like mass was palpated in the bone defect from both intra and extra-oral perspectives and was found to be combining well with the remaining bones. At this time the internal metal splint and intermaxillary fixation were removed. When the internal metal splint was extirpated, osteogenic repair of the bone was found (Fig. 3). At one year after surgery, the bone regeneration was seen to have proceeded further, producing good shaping of the body and ramus of the mandible (Fig. 4).

Clinically, there was no evident asymmetry in the facial appearance. Although the mandible deviated slightly to the left on opening, the occlusion was satisfactory, and there was no limitation in the opening of the mouth (Fig. 5, 6). The patient is now following a good course with no recurrence of the disease at one year and six months following resection of the mandible, and is satisfied with the surgical results.
Bone regeneration following mandibulectomy

Figure 1. Panoramic radiograph at initial examination well-defined radiolucency of the mandible.

Figure 2. Panoramic radiograph taken 3 weeks postoperatively showing the presence of faint radiopacity in the bone defect.

Figure 3. Panoramic radiograph showing regeneration of the mandible at 3 months after surgery.

Figure 4. Panoramic radiograph showing regeneration of well-shaped mandible with continuity to the remaining bones at 1 year after surgery.

Figure 5. Postoperative facial appearance showing minimal asymmetry.

Figure 6. Postoperative intraoral view showing satisfactory occlusion.
Discussion

Extensive bone regeneration following resection of the mandible has been occasionally reported. Byars (1946) first noted that reconstruction of the mandible was achieved by remarkable bone regeneration following a segmental resection of the mandible in an eight-year-old girl. Since then, Kazanjian (1958), Fracken (1958), Haunelder (1962), Steinhardt (1967), Steinhäuser (1968), Nishijima (1975), and Adekeye (1977) have reported cases of the same kind. All of them suggested that bone regeneration occurs by means of preserved as much periosteum as possible.

We have recently been fitting bone defects with an internal metal splint following resection of the mandible for the purpose of restoring normal shape and function, and have been observing the postoperative course both experimentally and clinically for long duration.

Yotsukura (1982) conducted an experimental study in which hemimandibullectomy was performed in young mongrels, which were divided into two groups after the same operative procedure. Group I consisted of animals which were treated with the internal metal splint and Group II consisted of those without the metal splint. It was found that the desired functional and cosmetic results could be obtained by the use of the simple internal metal splint. Hida (1983) clinically reported an unusual case in which the condylar and coronoid process were regenerated after only one year with the use of an internal metal splint following hemimandibulectomy.

In the present case, we applied the splint for segmental resection of the mandible in a young patient and experienced satisfactory results after only three months.

Up to the present, intermaxillary fixation, a plate splint and sliding device have often been used for complete rest of the wound and prevention of malposition of the jaw after segmental resection of the mandible in young patients. However after resection, the upper part of the mandibular ramus was frequently pulled forwards in both the inside and upper directions by scaring and the masseters. It was thus difficult to reproduce the normal bulge of the mandibular angle region, and symmetry in the facial appearance was liable to be lost. There was therefore much variation in the quantity or position of osteogenic repair. The splint that we used was able to preserve positional relation of the remaining bones by fitting into the bone defects. Moreover, because the proper function of the jaw could be ensured at an early stage, it may be that mandibular movement stimulated spontaneous bone regeneration, which in turn produced a well-shaped mandible.

As described above, it was recognized that the internal metal splint could be applied to a hemimandibullectomy as well as a segmental resection of the mandible, exerting a favorable influence upon spontaneous bone regeneration following resection of the mandible.
Bone regeneration following mandibul ectomy （福田ほか） 849

Summary

A case of application of an internal metal splint for functional reconstruction following segmental resection of the mandible is described.

Reference

下顎骨連続離断後の機能的顎骨再建のための
金属性組織内副子の応用

九州歯科大学口腔外科学第1講座（主任：山田長敬教授）
樋田謙二郎・杉原利英
石田吉廣・山田長敬
益田赤十字病院歯科（主任：渡部真理医長）

渡部真理

顎口腔領域において、良性あるいは悪性の腫瘍によっ
tて顎骨の切除を余儀なくされる症例は少なくない。この
ような症例では、一般に骨移植による顎骨再建が行なわ
れている。しかし若年者では残存する健康骨膜よりの骨
新生によって顎骨を再建することは十分可能であるとい
われている。本教室ではかねてより、術後の顎機能の確
保、さらには機能的、形態的に良好な顎骨の回復を画る
ために、切除後に生じた骨欠損部に金属性組織内副子を
補填し、臨床治験を重ねている。

今回、わたしたちは14才、女性の下顎骨に発生した
エナメル上皮腫に対し、下顎骨連続離断後、本副子を応
用し、わずか3カ月にして著明な骨再生によって良好な
顎骨再建が行われた症例を経験したので報告した。