The Journal of Korean Academy of Maxillofacia Plastic and Reconstructive Surgery
Vol. 11, No. 2, 1989.

SURGICAL REDUCTION OF DISPLACED SUBCONDYLAR FRACTURES OF MANDIBLE USING OF SAGITTAL SPLIT AND OBLIQUE SUBCONDYLAR OSTEOTOMY

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Abstract

The therapeutic methods and follow-up prognosis of subcondylar fractures in adults have always been sources of controversy.

To improve the therepeutic results in subcondylar fractures with displacement, and especially, the bicondylar ones, the auther employ the surgical reduction using of sagittal split and oblique subcondylar osteotomy.

This report is illustrated by six clinical cases.

Key-words; Subcondylar fracture, Sagittal split and oblique subcondylar osteotomy

INTRODUCTION

The majority of condylar fractures are treated by closed reduction and functional therapy, and the long-term results have proved the procedure to be satisfactory in the most instances. However, if one insists that closed reduction of condylar fractures is always the preferred method, then it must be admitted that the established orthopaedic principle of reduction must be considered.

Various kinds of the open reduction technique have been developed, which comprise interosseous wiring, extraoral skeletal pin fixation, screw-plate osteosynthesis, and transmedullary pinning.

The author has developed a new surgical technique of displaced subcondylar fracture using sagittal split and oblique subcondylar osteotomy. The patients included in the report were treated at Dae Rim St. Mary's Hospital(Dept. of oral & maxillofacial surgery) for subcondylar fractures.

The following cases illustrate some procedures of open reduction via submandibular approach for subcondylar fractures.

CASE REPORT

Case 1:

A 41-year-old woman was admitted with a displaced subcondylar fracture and symphysis fracture by traffic accident. There were premature contact, deviation toward the affected side, and pain in front of right ear.

Figure-of-eight transosseous wiring via submandibular approach was performed on right subcondylar and symphysis fractures (Fig. 1).

The mandible was mobilized after six weeks, and the patient had full range of mobility after 3 weeks of physical therapy.

Case 2:

A 28-year-old man was admitted with displaced subcondylar fracture sustained in a fall down. The

condylar segment was displaced(inclined 50 degree from the neck axis) severely. He complained of pain on the left side of face, inability to put his teeth together, and swelling in front of left ear.

The pin - in - groove technique was used for reduction and fixation : The K - wire was placed from the lateral side of the ramus (fig. 2). The mandible was mobilized after two weeks, and the patient had full range of mobility after three wekks of physical therapy.

Fig. 1. Preoperative and postoperative radiographs. Postoperative radiograph showing direct transosseous wiring.

Fig. 2. Preoperative and postoperative radiographs. Postoperative radiograph showing reduction of fracture by pin - in - groove technique.

Case 3 :

A 25 - year - old man was admitted with displaced subcondylar fracture suffered in automobile accident. He complained of pain, inability to bite, and deviation of jaw to the left side.

The sagittal split & oblique subcondylar osteotomy via submandibular approach was used for reduction and fixation (Fig. 3).

The mandible was mobilized after 2 weeks and after 4 weeks of physical therapy, the patient achieved month opening of 37mm.

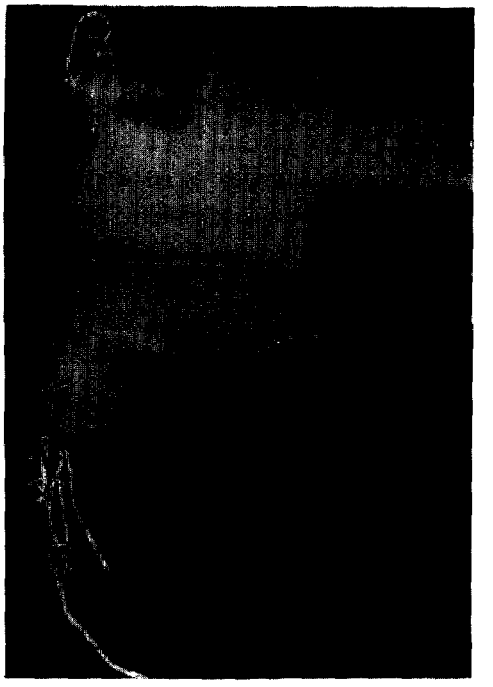

Fig. 3. Preoperative and postoperative radiographs. Postoperative radiograph showing reduction of fracture by sagittal split and oblique subcondylar osteotomy.

Case 4 :

A 27 - year - old man was admitted with displaced left subcondylar fracture sustained a direct blowing.

The condylar segment was inclined 45 degree from the neck axis, and there was premature molar contact, deviation toward the left side, and swelling in front of left ear.

The sagittal splt & oblique subcondylar osteotomy via submandibular approach was used for reduction and fixation (Fig. 4).

The mandible was mobilized after two weeks, and the patient had full range of mobility after three weeks of physical therapy.

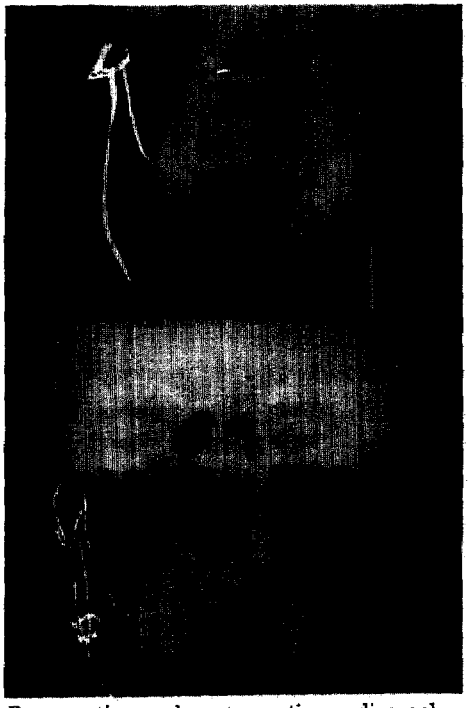

Fig. 4. Preoperative and postoperative radiographs. Postoperative radiograph showing reduction of fracture by sagittal split and oblique subcondylar osteotomy with wires.

Case 5:

A 22-year-old man was admitted with symphysis and bilateral dislocated subcondylar fracture after direct blowing. A laceration was presented under the chin. Examination of his injury revealed open bite, severe retrognathia, and separation of mandibular symphysis during mouth opening.

All fracture sites were operated and reduced using of sagittal split & oblique subcondylar osteotomy on the bilateral subcondylar areas.

The symphysis was treated with transosseous wiring through the lacerated wound (Fig. 5).

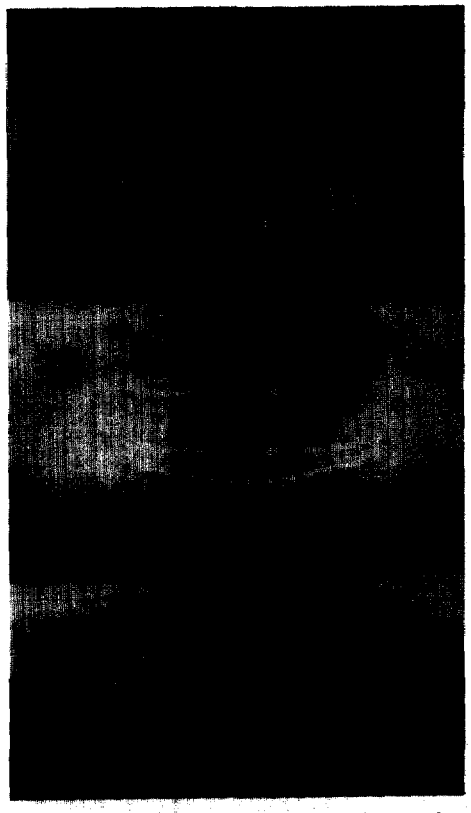

Fig. 5. Preoperative and postoperative radiographs. Postoperative radiographs showing reduction of fracture by sagittal split and oblique subcondylar osteotomy with wires on both subcondylar area.

At that time, bilateral proximal fragments were carefully removed out from the body to be reduced and immobilized together extracorporeally, and replantations were made. And splitted distal fragment was fixated to the remained distal fragment.

The mandible was mobilized after four weeks and after three weeks of physical therapy, the patient obtained full range of mouth opening

Case 6:

A 27-year-old man came to Dept. of oral & maxillofacial surgery in Dae Rim St. Mary's Hospital after being hit on the symphysis with fist. The severe open

bite deformity caused by the intrusion of distal segments. A bony prominence could be felt in front of the left ear. Radiographic examination revealed bilateral displaced subcondylar fractures and symphysis fracture. All fractures were reduced and fixated. The symphysis fracture was fixed with Champy miniplate through intraoral route. The condylar fractures were exposed and reduced via submandibular approach. Left subcondylar fracture was fixated with direct transosseous wiring and the right subcondylar fracture was fixated with transosseous wiring following sagittal split & oblique subcondylar osteotomy. The splitted distal fragment was firxated on the other dital fragment with three screws (Fig. 6).

The mandible was mobilized after two weeks and after four weeks of physical therapy the patient was able to open by full range.

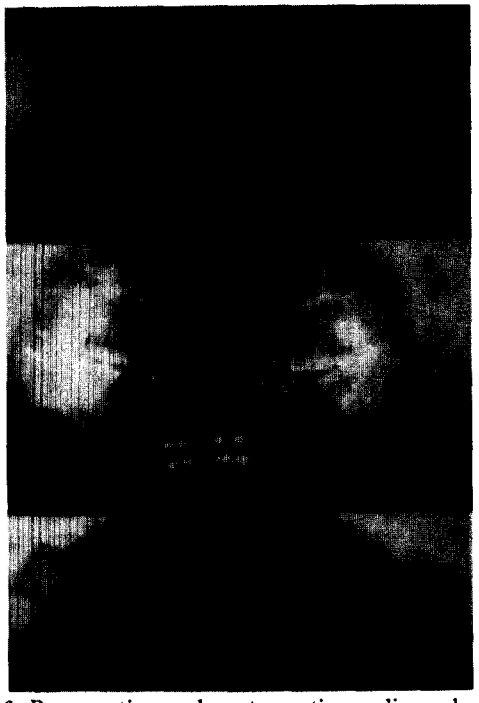

Fig. 6. Preoperative and postoperative radiographs. Postoperative radiograph showing reduction of both Subcondylar fractures by sagittal split and oblique subcondylar osteotomy, with wire and screws cright side, and direct transosseous wiring cleat side.

DISCUSSION

The incidence of condylar fractures in large series of mandibular fractures may be as high as 35.6% (Rowe & Killey : 1970)[1].

Condylar fractures are classified according to the level at which the fracture occur : High fracture(Intracapsular), Mid - fracture (Condylar neck), and Low fracture(Subcondylar neck)[1,2,3,4,5].

Intracapsular condylar fractures may be totally or partially within the capsule of the joint. The articular surface may be completely detached within the joint. Fractures at this level show little displacement because they are located above the attachment of lateral pterygoid muscle.

In the condylar neck fractures, the displacement of condyle is forward and medially and downward owing to the pulling of lateral pterygoid muscle, even though it may still remain within the capsule[1,3].

Diagnosis of fractures of the mandibular condyle and neck usually is made on the basis of clinical examination and confirmed by roentgenographic findings. Condylar fractures usually produce pain in the preauricular area on palpation and deviation to the ipsilateral side on opening. This leaves the bite open in the front and the opposite side[1,2,3]. In bilateral cases, anterior open bite deformity is caused by the contraction of the strong closing muscles of the mandible[1,2,3,4,5]. Edema over the joint, ecchymosis, and sometimes hemorrhage into the external auditory canal may occur[1,2,3,4,5,6,7].

Fractures of the condylar process usually are treated by closed reduction and appropriate physiotherapy[1,2,3,4,6,8,9,10,11,12,13] and long term results have proved the procedure to be satisfactory in most instance [10,11].

Conservative treatment allows the patient to reestablishe joint function by bony remodelling and fromation of false joint[10,11,12,13,14].

If the fracture is in the fossa, the fracture will probably heal in a fairly good functional position after the occlusion is accurately secured and physiotherapy

is performed. The failure rate using of conservative treatment (functional method) to treat subcondylar fracture in children ages 3-11 years is over 25% and increases with age while functional problems becomes associated with skeletal deformities[14,15]. Therefore, small percentage of fractures require surgical reduction and fixation to restore normal function. This indicates the need to examine the indication for open reduction of these fractures.

The potential indication for open reduction are 1) severe dysfunction, 2) continued dysfunction following IMF (a period of 1-3 weeks), 3) postfixation pain, 4) severe displacement and lateral extracapsular displacement of the condyle, 5) displacement of condyle into the middle cranial fossa, 6) bilateral condylar fractures with Le Fort or complicated midface fracture, 7) bilateral condylar fractures associated with gnathologic problems, and 8) invasion of foreign body[1,3,5,16,17].

The following factors influence the selection of method for open reduction; 1) position of condyle, 2) location of fracture, 3) amount of edema, 4) character of patient, 5) age of fracture, 6) location of incision, 7) type of fixation[16].

There are four principal surgical approachs to the fractured condyle; preauricular, submandibular, postauricular, and intraoral approach.

The preauricular approach offers the advantages of direct vision of the fracture site, ease of manipulation of the condyle and osseous wiring. The disadvantage of this method include probable transient injury of the facial nerve with possible permanent paralysis[1,2,15,18].

The medial side of the fracture site is difficult to reduce adequately, and trauma to this area may result in severy hemorrhage[18]. There is also lack of adequate access inferiorly[17,18].

The postauricular approach to the mandibular condyle has never been utilized extensively. Hoopes, Wolfort and Jabaley (1970)[19] reported the successful employment of this approach in operative treatment of the condylar fracture. The postauricular approach provides rapid, safe and generous exposure of condylar area and surgical scar is hidden. Potential disadvatages include stenosis of the external auditory canal, infection involving the external auditory canal or cartilagenous framwork, paresthesia of the external pinna, and deformity of the auricle[19,20].

Advantages of the intraoral approach consist of the avoidance of skin incision and the safty of the procedure. Disadvatages consist of limitation of visibility and accessibility[20].

The complications of submandibular approach are fewer, involving principally the marginal branch of the facial nerve[17,18,20,21]. Access might be better and there would be less chance of damage to the meniscus[1,18,19]. Difficulties include repositioning of the condyle, placement of the drill holes and threading of the transosseous wiring[17,18,19,20,21].

In the surgical repositioning of condylar fractures, the object is to perform a repositioning of the fractured condyle as near as its anatomical location as possible. There are numerous reports for the surgical fixation of fractured mandibular condyle. Petzel(1982)[25] described a technique using self-tapping intramedullary screw pins inserted from submandibular incision. Brown & Obeid(1984)[23], Wennogle & Richard(1985)[15], and Ryu et al (1987)[24] described a technique using pin-in-groove method for reduction of displaced subcondylar fractures. Cadenat et al (1983)[26], Kim et al(1983)[27] advocated central medullary "up and down" pinning via temporal approach. Henny(1951)[18] and Malkin et al(1964)[20] advocated submandibular approach for transosseous wiring of the fractured dislocation of the mandibular condyle. Messer(1972)[22] suggested a technique utilizing the Risdon approach and looping of the proximal fragment. Peter et al(1976)[17] advised the use of stab incisions in conjunction with the Risdon approach for the placement of drill holes, repositioning the condyle and threading the transosseous wiring with University of Tennessee drill guide. Nam(1980)[28] described a new method named Nam's method in term of "oblique osteotomy, interosseous wiring extracor-

poreally, and replantation". Also, Nam(1982)[29] suggested modified Nam's method without detaching the muscle and joint capsule around proximal condylar fragment.

The author's procedure is presented as a safe, efficient method for open reduction and fixation of the subcondylar fracture. However, routine open reduction of subcondylar fracture utilizing this method should be avoided. In fact, the procedure should be reserved for few cases in which it is specifically indicated.

The procedure consists of the surgical exposure of mandibular ramus and condyle via usual submandibular approach with preservation of the marginal branch of the facial nerve. The fracture site is located and the fragments are exposed. Oblique subcondylar osteotomy of the affected ramus is performed on the outer cortex and sagittal split osteotomy on the distal fragment is done through oblique osteotomized line. Before complete splitting is done, drill hole is placed on the distal fragment for postreductive wiring or screwing. Separating outer cortical plate of the ascending ramus is carfully removed out of the body to provide the space to be reduced and drilled for transosseous wiring. The proximal fragment is reduced and immobilized with separating outer cortex of the ramus, and splitted distal fragment with proper fixated condylar fragment is fixated to the remained distal fragment via preformed drill holes with wires or screws (Fig. 7).

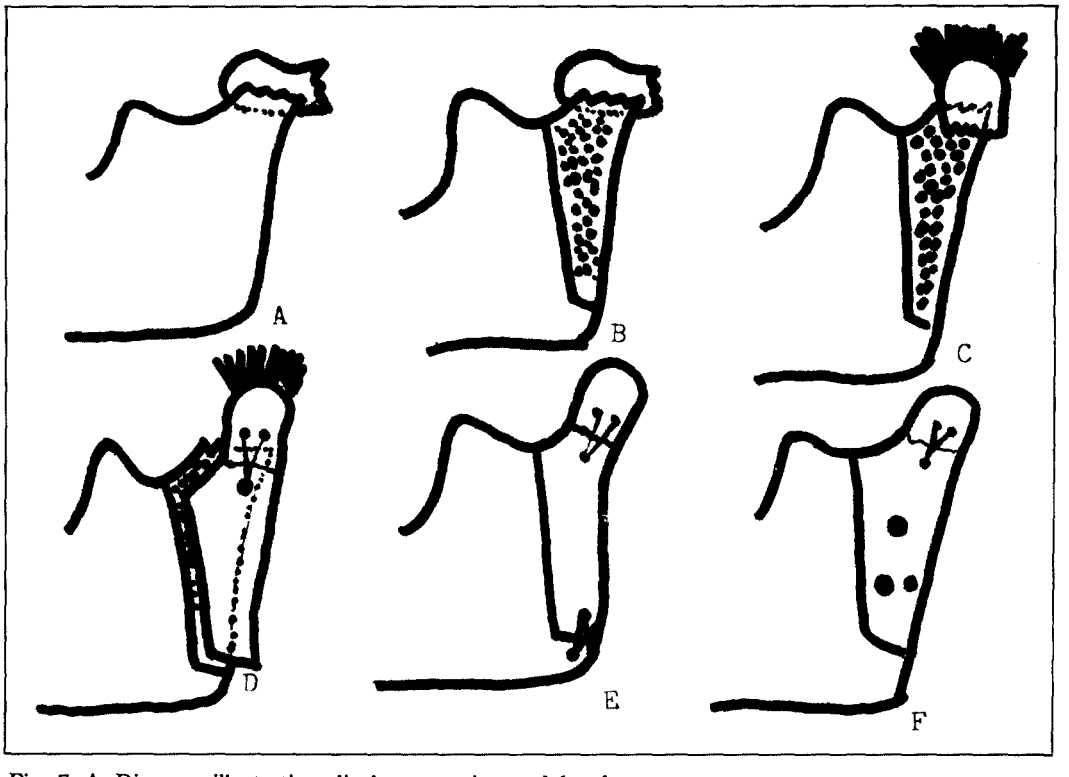

Fig. 7. A. Diagram illustrating displacement in condylar fracture.
B, C. Diagrams showing sagittal split and oblique subcondylar osteotomy.
D. Proximal fragment is reduced and immobilized with separating outer cortex of the ramus.
E, F. Splitted distal fragment with proper reduced condyle is fixated with wires or screws.

Advantages of this method are follows :

1. Because the soft tissue is not stripped from the medial side of distal fragment, a risk of avascular necrosis decreased.

2. This method minimized the difficulty in reduction and fixation for subcondylar fracture.

3. This method provided ease access, lack of damage to the facial nerve and the articular capsule.

In case 1, 2, of this report, because subcondylar fracture was placed on the low level, routine transosseous wiring and pin - in - groove method were used. However, in case 3, 4, 5, 6, condylar reduction and fixation using of sagittal split and oblique subcondylar osteotomy was used, and in case 5, srgical reduction and fixation was done, extracorporeally.

CONCLUSION

For the fairly good reduction of the subcondylar fracture, the patient must be meticulously analysed by preoperative radiograms and clinical examination. Following further analysis, the most adequate technique for the confront case must be chosen.

There may be no absolute technique for all condylar fractures. So, in this report, a new surgical method for subcondylar fracture is introduced. Six cases of the subcondylar fracture has been presented. Four cases of this report were treated by sagittal split and oblique subcondylar osteotomy. Details of the surgical procedure are given, and the advantages of this method are discussed.

REFERENCES

1. Rowe, N.L. & Kelly, H.C. : Fractures of the facial skeleton, Baltimore, William and Wilkins Co., p 143, 1970.
2. Keith, D.A. : Surgery of the temporomandibular joint, Boston Oxford London Edinburgh Palo Alto Melbourne, Blackwell Scientific Publications, p 116, 1988.
3. Digman, R.O. & Natvig, P. : Surgery of facial fractures, Philadelpia and London, W.B.Saunsres Co., p177, 1978.
4. Archer, W.H. : Oral and maxillofacial surgery, 5th ed., Philadelpia, W.B.Saunders Co., p1157, 1975.
5. Thoma, K.H. : Oral surgery, 5th ed., St. Louis, The C.V.Mosby Co., vol. I. p58, 1969.
6. Kruger, G.O. : Textbook of oral and maxillofacial surgery, 6th ed., St. Louis, Toronto, The C.V.Mosby Co., p410, 1984.
7. Rowe, N.L. and Williams, J. LT. : Maxillofacial injuries. Edinburgh London Melbourn and New York, Churchill Livinstone, Vol. I, p337, 1985.
8. Kruger, E., Chilli, W. and Warthington, D. : Oral & Maxillofacial traumatology, Chicago London Berlin Rio de Janeiro and Tokyo, Quintessence Publication Co. Vol. II, p90, 1986.
9. Mathog, R.M. : Maxillofacial Trauma, Baltimore London, Williams and Wilkins p134, 1984.
10. Members of the Chalmers J. Lyons club : Fracture involving the mandibular condyle, A post treatment survey of 120 cases, J Oral surg 5 : 45 - 73, 1947.
11. Blevins, C. and Gores, R.J. : Fractures of the mandibular condyloid process : results of conservative treatment in 140 patients, J Oral Surg 19 : 393 - 407, 1961.
12. Ikemura, K. : Treatment of condylar fractures associated with other mandibular fractures. J Oral Maxillofac Surg 43 : 810 - 813, 1985.
13. Thiele, R. and Marcoot, R.M. : Functional therapy for fractures of the condyloid process in adults, J Oral Maxillofac Surg 43 : 226 - 228, 1985.
15. Wennogle, C.F. and Delo, R.I. : Pin - in - groove technique for reduction of displaced subcondylar fractures of the mandible, J Oral Maxillofac Surg 43 : 659 - 665, 1985.
16. Zide, M.F. and Kent, J.N. : Indications for open reduction of mandibular condylar fractures, J Oral Maxillofac Surg 41 : 89 - 98, 1983.
17. Peters, R.A., Caldwell, J.B. and Olsen, T.W. : A

technique for open reduction of subcondylar fractures, Oral surg, 41 : 273 - 280, 1976.

18. Henny, F.A. : A technique for open reduction of fractures of the mandibular condyle, J Oral surg 9 : 233 - 236, 1951.
19. Hoopes, J.E., Wolfort, F.G. and Jabaley, M.C. : Operative treatment of fractures of the mandibular condyle in children, using the post - auricular approach, Plast Reconst Surg 46 : 357 - 362, 1970.
20. Irby, W.B. : Current adanced in oral surgery, St. Louis, The C.V.Mosby Co p221, 1974.
21. Malkin, M., Kresberg, H. and Mandel, L. : Submandibular approach for open reduction of condyle fracture, OS OM OP, 17 : 152 - 157, 1964.
22. Messer, E.J. : A simplified method for fixation of the fractured mandibular condyle, J Oral surg 30 : 442 - 443, 1972.
23. Brown, A.E. and Obeid, G. : A simplified method for the internal fixation of fractures of the mandibular condyle, British J Oral Maxillofac Surg, 22 : 145, 1984.
24. Ryu, S.Y. et al : The use of kirschner wire in fractures of mandibular condyle : report of 2 cases, The Journal of Korean Academy of Oral Maxillofac Surg 13 : 95 - 103, 1987.
25. Petzel, J.R. : In strumentarium and technique for screw - pin - osteosynthesis of condylar fractures, J Max - Fac Surg, 10 : 8 - 13, 1982.
26. Cadenat, H., Cambells, R., Boutault, F. and Hermous, J.D. : Osteosynthesis of subcondylar fractures in the adult (centrally medullary "up and down" pinning via temporal approach, J Max - Fac Surg, 11 : 20 - 28, 1983.
27. Kim, J.W., Lee, S.G. and Song, Y.G. : Reduction of condylar neck fracture by application of kirschner wire, The Journal of Korean Academy of Oral Maxillofac Surg 9 : 247 - 253, 1983.
28. Nam, I.W. : The condylar head and upper condylar neck fractures treated by Dr. Nam's method, The Journal od Korean Academy of Oral Naxillofac Surg 6 : 25 - 30, 1980.
29. Nam, I.W. : The condylar head and upper condylar neck fractures treated by modified Nam's method, J Dental College, Seoul National University, 6 : 25 - 30, 1982.

시상골절단과 사선골절단술을 이용한 하악골 과두골절의 외과적 치험예

대림성모병원 치과

김 현 철

국문초록

하악골 과두골절의 치료에 대해서는 여러가지 술식이 문헌상 보고되었으나 어떤 특정한 술식이 모든 증례에 적용될 수는 없으므로 각 증례에 따라 방사선 사진검사와 세밀한 임상검사 및 술자의 판단등에 따라 보존적인 치료법이나 외과적 수술법이 적절하게 선택되어야 한다.

대부분의 과두골절은 보존적인 치료만으로 만족스러운 결과를 얻을 수 있으나 보존적 처치후 장기간에 걸친 술후 검사시 하악의 기능장애, 부정교합, 하악골의 이환측으로의 전위, 위관절증 및 악관절 강직등의 병발증이 나타날 수 있으므로 골편이 심하게 전위된 경우나 무치악 환자, 구치부 고경유지가 어려운 환자 및 보존적 처치후 기능장애를 초래한 골편의 부정유합이나 비유합 환자에서는 관혈적 정복술로 보다 양호한 결과를 얻을 수 있다.

저자는 하악골 과두골절시 골편전위가 비교적 심한 6증례에서 악하부 피부절개를 통해 통상의 금속선 고정법, Kirschner 금속선을 이용한 고정법을 각 1예씩 사용하였고 4예는 골절선이 비교적 높아 통상의 수술방법으로 접근이 용이하지 않아 시상골절단과 사선골절단술을 이용하여 골편정복과 고정술을 시행하여 다소의 지견을 얻어 이에 보고하는 바이다.