

# Reduction And Fixation Of Facial Fractures

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The reduction and fixation of facial fractures requires a deep knowledge of bone response, muscle activity and function of the anatomical structures involved. One cannot hope to obtain the goal of functional occlusion in fracture reduction unless he understands the normal action and function of the associated anatomical parts.

I wish to present a group of cases which will illustrate the problems involved, the difference of opinions with regard to reduction and how to accomplish it. These opinions exist as to the type of mechanical appliances to be used and the philosophy of the reduction.

Condylar fractures seem to be the most controversial type of fractures encountered.

In fracture dislocations, Waldron (1942) believed that intermaxillary ligation gave satisfactory results. Ruedi (1928), in cases seen at the Zurich University Clinic, did not find any serious disturbance after conservative treatment of fracture dislocations. Therefore, he advised leaving the condyle in a dislocated position. Steinhart (1936) believed that in such cases, as a result of function, the dislocated condyle would be rebuilt and form a new, well-functioning joint. Perthes (1942) and Wassmund (1934) found the occlusion to be unsatisfactory, with a tendency to open-bite, and mastication and lateral excursions of the mandible hindered. They described a peculiar appearance of the face when the patient masticated food pointing out that, in many cases, the fragments

may be so displaced that union is impossible. Both writers advised surgical interference for good, anatomic results. In some instances the functional result from conservative treatment is so poor that Perthes recommends an osteotomy of the ramus to correct this deformity.

In children the successful treatment of fractures of the condyle by conservative wiring method has been reported by Brown and Hamm (1932) and Thoma (1938). These are frequently of the greenstick type, but may be complicated by dislocation. Operations on a child's condyle may interfere with epiphyseal growth of the jaw and therefore should be avoided. I have found that, in children, a good final result may be spontaneous, after a year or two, if the fracture, treated conservatively, heals in malposition.

Bellinger says that in cases of complete disarticulation of the condyle, the condyle will be drawn out of its normal position in a medial anterior direction until it is out of contact with the ramus of the mandible; perfect occlusion, perfect excursion and perfect function do not always follow. Function may be adequate but final function has not always been what could be desired.

The only muscle attached to the condyle is the unopposed external pterygoid, one of the reasons why the condyle may be drawn out of normal position.

Henny states that, "Conservative therapy consists of the simple immobilization of the jaws or immobilization with an interposing pad between the teeth."

The bad effects of conservative treatment may be:

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1. Deviation towards the affected side upon opening.
2. Inadequate opening.
3. Ankylosis

Complications involved in surgical reductions are:

1. Lack of adequate access inferiorly.
2. The medial aspect of the condylar head is not available.
3. Repeated damage to one of the ramifications of the facial nerve.

To have a well-healed fracture accompanied by a partial paralysis of the face is certainly no surgical triumph.

Surgical treatment would be the choice of treatment if the following dictums could be met:

1. The operation must promise a better result than by conservative treatment.
2. Operation would not unduly endanger the facial nerve.
3. Procedure would not further damage the meniscus.
4. Condyle would remain after repositioning.

The line of surgical approach has been preauricular. Another approach is the incision at the angle of the mandible.

The methods used in facial fracture reduction are:

1. Transosseous wiring
2. Bone plates
3. Extra-skeletal fixation
4. Orthodontic.

Thoma states that in "fractures at the angle of the jaw with upward or lateral displacements of the ramus the transosseous wiring is superior to the splint with extension arm pressing the ramus back and inferior, and to the traction method with a wire inserted in a hole at the angle of the jaw attached to a rod extended from a head-cap".

Bone plates are used mostly in edentulous jaws or sections of the jaw. Bone

plating, like transosseous wiring, must be supported by immobilization. Reliance on the bone plates alone for fixation of the fracture in most cases will end in failure because of undue strain brought on the plate during functional movements of the jaw.

Correct occlusal function is today generally accepted as the goal of fracture reduction, not bone apposition.

Regardless of the number of facial fractures present, many times one or both of the mandibular condyles are involved. In the reduction of condylar fractures one must oppose the resulting Class II tendency in the occlusion due to the shortening of the mandibular length. Many fractures of the condyle only are missed in the initial radiographic examination. These fractures usually make themselves known in two or three weeks time through function as mandibular movements and the occlusion are changed.

The fracture cases which I wish to present were reduced with the edgewise orthodontic appliance. All teeth within reason were banded for the most anchorage. The fractured segments were moved as units into apposition by orthodontic mechanics which permitted exact control of each segment. Expansion arches, contracting arches, torque, closing and opening loops, coil springs, elastics, and routine orthodontic tying were forces used in the reduction.

Contrary to the usual method of orthodontic procedure, complete records, except x-rays, are not taken in fracture cases. The first responsibility to the patient is the reduction of the fracture and his comfort. The patient's one is called upon to treat in hospitals are frequently from distant areas. For this reason one does not attempt to secure complete records such as photographs and models. The x-rays, of course, are always available from the hospitals.

### MANDIBULAR CONDYLAR FRACTURES

Case No. 1 was a young lady, age 20, who had been injured in a car accident. She suffered a compound fracture of the femur and of the neck of the right mandibular condyle. The head of the condyle was displaced medially into the infratemporal fossa. A full edgewise orthodontic appliance was placed, each tooth banded in order to distribute the force of the elastics. Passive .0215 x .028 gold arches with hooks for vertical and Class II elastics were tied into place. The Class II elastics opposed the hyoid group of muscles which tend to pull the mandible downward and backward. After the mesiodistal reduction had been accomplished, vertical elastics were placed to hold the teeth in occlusion. A rubber pad, one-eighth inch thick, was placed between the maxillary and mandibular right molars to relieve the pressure at the fracture site. If this step is not done, the masseter and internal pterygoid muscles pull upward and prevent any uprighting of the fractured condyle. Reduction is accomplished usually between six and twenty-four hours. The elastic tension fatigues the muscle trismus and permits the mandible to assume its normal spatial position. The occlusion was readily brought back to normal and held for ten days. The intermaxillary elastics were then removed and she continued on a liquid and soft diet for several weeks.

It has been the practice to release early the fixation in condylar fractures because of the danger of ankylosis. It is thought that if they are held rigidly for a period of six weeks, as is customary in facial fractures, ankylosis of the joint may occur.

As condylar growth was not a factor in this case, no problems were foreseen. Upon opening the normal width as during speech, no deviation is noticeable. However, upon wide opening the

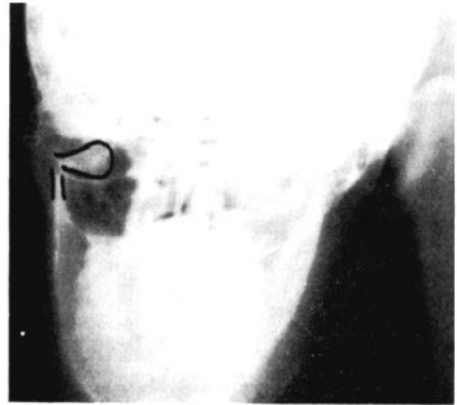


Fig. 1 Photograph of the frontal headplate showing the displacement of the condylar segment into the infratemporal fossa.

mandible opens normally up to a point, and then deviates to the right. She has lost the ability to protrude anteriorly, but has had no temporomandibular soreness or pain.

Figure 1 is a photograph of the frontal headplate showing the condylar fracture and its displacement into the infratemporal fossa.

It has been six years since the accident and there is no evidence of temporomandibular disturbance to date.

Case No. 2 was a case of a young girl, age 11, who had been injured in a bicycle accident. Radiographic examination revealed a fracture of the neck of the right condyle, almost identical to the above patient. However, because of the young age, the problem of future condylar growth was of most importance.

The occlusion was reduced and fixed for a period of seven days. The intermaxillary elastics were then removed and slight function was encouraged.

An acrylic bite plane was later placed to guide the occlusion. The tracings of lateral headplates show that the mandible has grown downward and forward; however, the amount is small and it is impossible to show any difference between the right and left side.

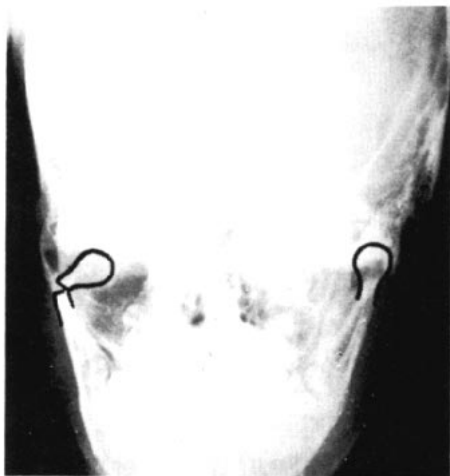


Fig. 2 Photograph of the frontal headplate showing the displacement of the right condyle into the infratemporal fossa.

Tracing of the frontal headplate again shows little asymmetry; clinically, the right buccal segment still tends toward a Class II occlusion which indicates

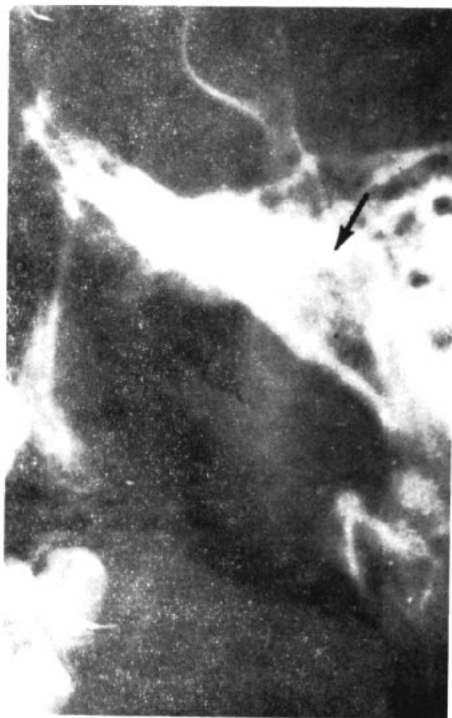


Fig. 3 New functioning condyle.

less mandibular growth on the right side. To date, six years after the accident, no temporomandibular disturbance is present. She opens normally to a point and then the mandible deviates to the right a slight amount.

The treatment of this type fracture at this age is a very controversial subject. It is difficult to know whether or not open reduction of the fracture would have been a better treatment.

Figure 2 shows the photograph of the frontal headplate and the displacement of the right condyle into the infratemporal fossa.

Figure 3 shows the x-ray taken four years after the accident. Most condyles, which are completely dislocated from the ramus, resorb. The x-ray shows that a new functioning condyle has formed. It could be that there has been resorption of the old bone on the medial surface and new bone laid down on the lateral surface of the condyle according to the principle of Wolf's Law, or the original condyle resorbed and a new functioning pad of bone produced which permits a vertical movement.

Fig. 4 shows the frontal and profile photographs of the patient at ages 11 and 15 and no apparent deviation of mandibular growth.

I used acrylic bite planes in this case for two years. My purpose was to guide the mandible into occlusion and to relieve pressure in the affected joint. At the present time the midline is correct up to an opening of three-fourths inch, from there it deviates to the right and continues to open to more than one inch.

The basic problem in this fracture was the factor of future growth. The severe trauma received by the condyle in some fractures injures the growth center and circulation, and ankylosis of the joint may result. In this particular case I feel that the conservative treatment was satisfactory and that



Fig. 4 Photograph taken after treatment of fracture and photograph taken four years later.

open reduction was not indicated.

The finished photographs show that the small amount of growth lost due to the fracture at the growth site is not clinically noticeable.

It is my opinion that, unless the condyle is driven into the middle cranial fossa or into the external auditory meatus in fractures of the neck of the mandible, an open reduction should not be done. There is an occasional case in children that will develop an ankylosis, but I think this probably would occur even if an open reduction operation had been performed. Moreover, open reduction operations do not always give satisfactory results.

The conclusion that may be drawn in this case is that future growth was not as big a problem as first thought; at the age of 11 years future growth was not enough to cause noticeable asymmetry.

Case No. 3 was a young man, age 26, injured in an auto accident. He suffered fractures of both mandibular condyles, fracture through the right lower canine-incisor area, and fracture



Fig. 5 Photograph of x-ray showing tendency toward Class II occlusion with open bite. X-ray taken before complete reduction was accomplished.

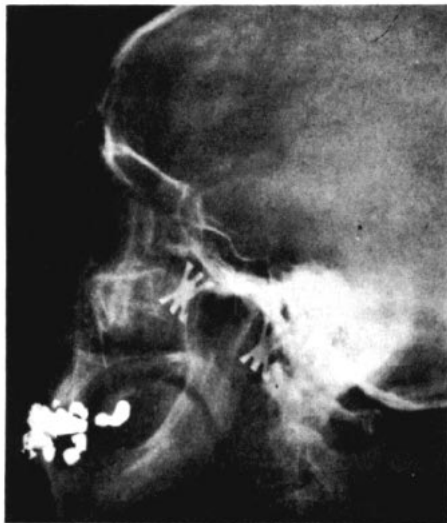


Fig. 6 Photograph of x-ray showing complete fracture of maxilla.

of the mentale or chin portion of the mandible. This case is shown to point out the distal positioning of the mandible and the problem involved in reduction in order to avoid a Class II result with open bite.

Figure 5 shows the x-rays of the patient before complete reduction had been obtained. It also demonstrates the repositioning of mentale bone fragment due to the muscle function. This fragment was displaced downward. Many small bone fragments which, in the past, were removed because of fear of sequestration are molded back into position by the musculature.

#### TRANSVERSE MAXILLARY FRACTURES

Case No. 4 was an elderly gentleman age 76. He suffered a complete transverse fracture of the maxilla and zygomatic arches. The dentition consisted of the lower six anteriors and first bicuspids; in the maxillary arch only the six anteriors were present. Upon repositioning the maxilla it was found that he possessed a Class III occlusion with the upper left central, lateral; and canine occluding lingual to the lower

teeth. The complete maxilla was a floating section and was easily brought forward and held in occlusion (Fig. 6).

Due to the constant movement of the maxilla during deglutition, intermaxillary elastics were discontinued after the third day. From then on healing progressed slowly but nicely.

It might be stated at this time that the displacement of the maxilla in fracture cases is in the same direction as the force. In mandibular fractures the displacement of the fragments is due to the muscle attachments and their pull.

Of course, before one can consider reduction of fractures he must ascertain the type of occlusion the patient had originally. This is done through study of the x-rays, wear on teeth, photographs taken before the accident, and consultation with the family as to appearance.

This case is shown to point out the fact that after reduction of many fractures, fixation is not indicated. Slight movement of the fractured fragments does not seem to hinder union. However, greater movement seems to encourage soft connective tissue union and movement of the fragments may be permanent.

#### MANDIBULAR BODY FRACTURES

Case No. 5 was a young man presenting a fracture of the mandible just mesial to the third molar with the third molar in the distal fragment. It was determined that the most posterior tooth was a third molar through study of the tooth size and form, and the space between the first and third molar after reduction (Fig. 7).

The problem involved in this type of case is, naturally, lateral and vertical control of the distal fragment. Many methods of reduction and fixation have been suggested for control of the distal fragment (ramus) in mandibular

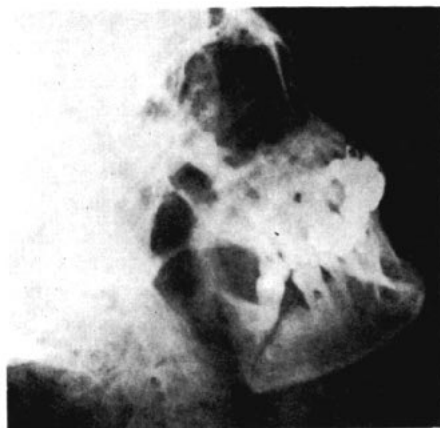


Fig. 7 Photograph of the x-ray showing fracture at the angle of the mandible.

fractures. Probably the first to be advanced was the plaster skullcap with heavy gauge wires running downward and connected by elastics to a pin inserted into the distal fragment. Another method is the surgically-placed bone plates as used in fractures of the lower extremities. However, one must remember that the orthopedic surgeon usually places a plaster cast on the plated leg to maintain immobility. This, of course, is impossible in facial fractures.

The extra-skeletal pin fixation appliance is also used. In this method small holes are drilled into the bone and threaded screw pins are screwed into the fragments and then joined together with sliding connecting bars. Anchorage of the pins is in the cortical plate. This plate, approximately two mm thick, is not the most reliable source of anchorage.

All three of these methods have the disadvantage of the necessity for surgically entering the soft and bony tissues. As bone resorbs in response to the slightest pressures, it is difficult to maintain fixation.

This fracture was reduced with complete edgewise orthodontic appliances with molar band attachments on the third molars. This attachment gives

exact control of the fragment.

Case No. 6 was that of a young man, age 28. He suffered fractures through the angle of the mandible between the second and third molar on the right and distal to the third molar on the left.

This fracture was reduced, as all have been, with only the edgewise orthodontic appliance with no attachment, arm, or pin connected to the distal portion of the left ramus. The third molar in the distal fragment on the right side was included in the fracture appliance. The free distal portion is brought into reduction by nature itself. Upon obtaining occlusion of the den-

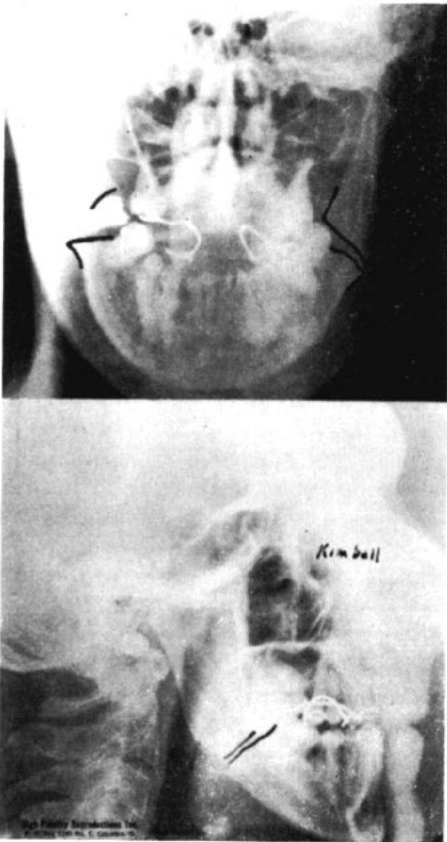


Fig. 8 Above, photograph of x-ray taken before reduction; below, after reduction of fracture.

ture, the muscles relax from their trisomatic tension to bring the fragments into normal apposition. When one considers that we have the massive masseter muscle on the outside and the internal pterygoid on the inside, the picture becomes clearer.

Figure 8 shows photographs of x-rays taken before and after reduction of the fracture.

Case No. 7 was a woman age 62. Injured in an automobile accident, she suffered a fracture of the right mandible at the angle distal to the first molar. There were no teeth present in the distal fragment.

She was first treated by extra-skeletal pin fixation. The pins became loose and the tissue infected due to the tension. Resorption of bone around the pins inserted into the bone is the problem of pin type appliance reduction. Interdental wiring was next tried, but didn't maintain stability.

I received the patient eight months following the accident in the condition shown in Figure 9, a photograph of the x-ray taken at the start of reduction. Complete edgewise appliances were used and reduction and fixation pro-

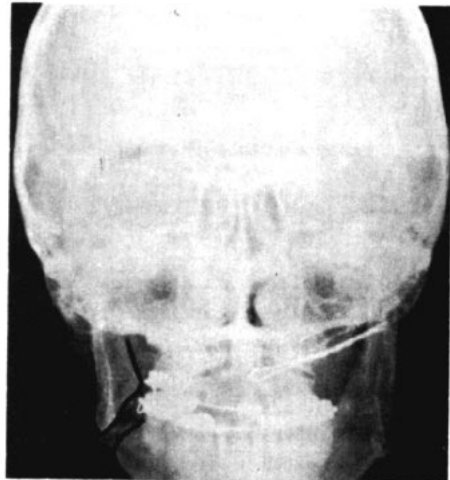


Fig. 9 Photograph of x-ray taken at the start of reduction.



ceeded without any problems. Again, no attachment was made to the distal free portion.

These last cases illustrate that it is not always necessary to insert attachments in the distal fragment of the mandible in order to accomplish reduction or apposition of the bony fragments. After the occlusal reduction has been accomplished, the masseter and external pterygoid muscles bring the distal segment into apposition and maintain it in that position during union.

Case No. 8 was a fracture case of a man, age 36, who had crashed in an airplane accident. His face smashed into the steering wheel and post. He suffered a crushed chest and fourteen facial fractures. There were fractures in the mandible between the canines and laterals on each side with a protrusion of the segment containing the lower incisor teeth. These teeth were forced completely through the lower lip. The maxilla was fractured completely loose from the basal support and contained an anteroposterior fracture along the middle of the palate; the upper left first and second molars with the alveolar process were fractured, the nasal bones were crushed. The upper left central was knocked out as was a bridge on the upper left side. Because of the fracture of the maxilla coordinate movement of the eyes was impossible.

A complete edgewise appliance was placed with arches to reduce the fractures. The mandibular arch was first reduced to have a base or foundation for the maxillary arch. Crisscross elastics were used in the buccal segments and vertical elastics in the anterior segment. After the lateral and vertical reduction had been corrected, physical force was necessary to bring the maxilla anteriorly to position. Then the vertical elastics were again used for fixation.

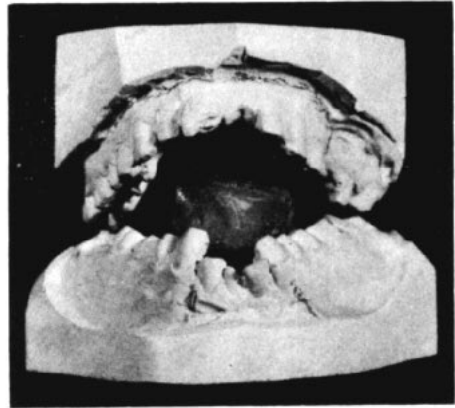


Fig. 10 Photograph of the plaster cast showing the occlusion immediately after the accident.

Simultaneously the plastic surgeon corrected the nasal bones. Not until we had the maxilla in complete reduction was proper coordination of the eyes possible.

Fortunately the patient's dentist had a plastic set of study models made a few weeks before the accident. These were used as a guide in reducing the fractures.

Now, five years later, the lower incisors are all vital.

Figure 10 is a photograph of the plaster cast of the occlusion immediately after the accident. Note the lingual inclination of the mandibular buccal segments and the anterior displacement of the lower incisal segment. In the upper arch one can see the upper left molar segment displaced to the buccal and the complete open bite in the anterior region.

Figure 11 shows the photographs of the original plastic model and the plaster cast made after completion of treatment. One can readily see that every segment was returned to its original position so that every tooth occluded as before the accident.

#### SUMMARY

All the fracture cases were reduced

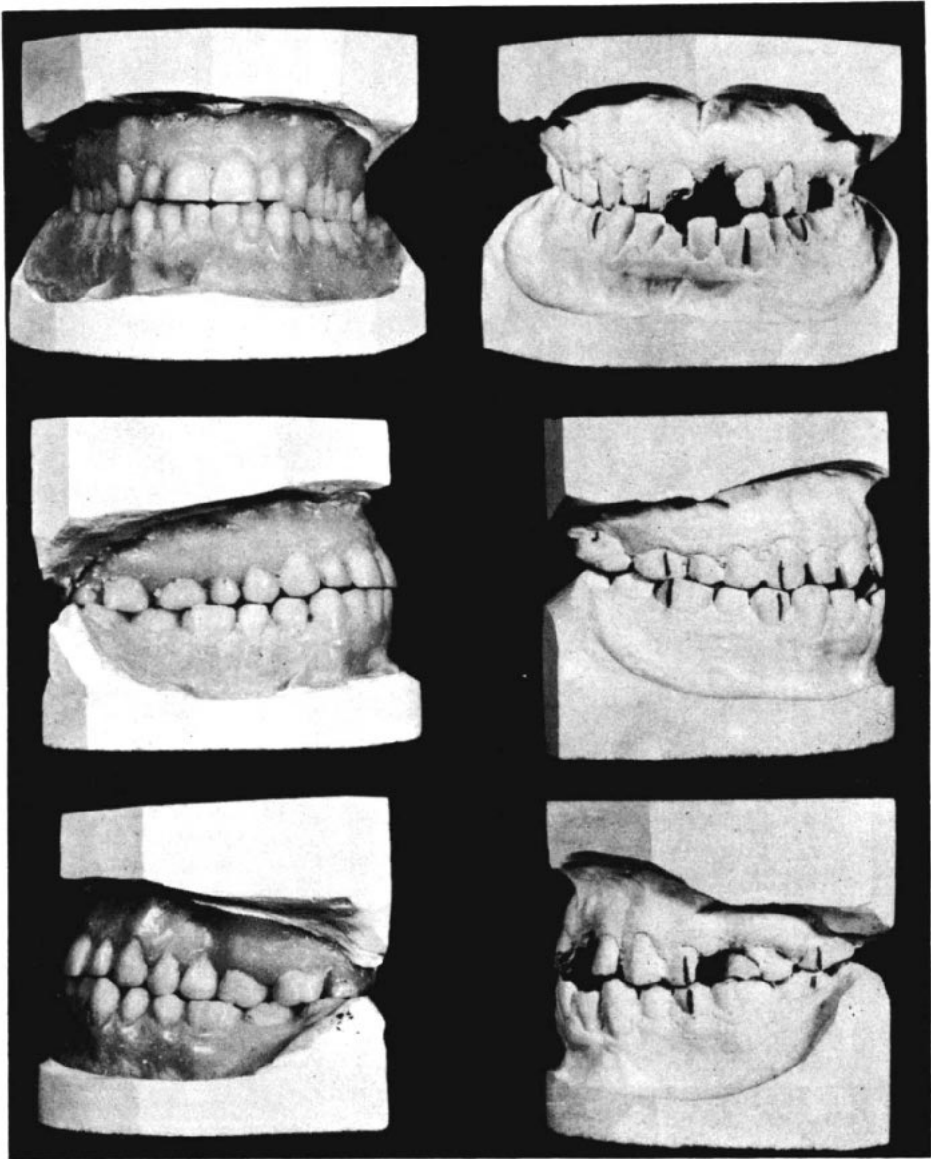


Fig. 11 Photographs of the plastic (before) and plaster (after) models showing the result of the fracture reduction.

with the edgewise appliance. I have never extracted a tooth before or during the reduction of a fracture nor have I ever used general or local anesthesia. All the work was done in the patient's hospital room with the patient in bed. The edgewise appliance is an ideal mechanism for the reduction of fractures because it is a precision appliance and one does not have to incise tissue or drill holes in the bone. No new avenues of infection are opened in order to accomplish the goal of fracture reduction, occlusion.

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