A STUDY ON THE MANDIBLE FRACTURES

By

Yang, Chia Chee

Second Department of Oral Surgery (Director: Prof. Shigeru IKEJIRI)

Kyushu Dental College, Kitakyushu, Japan

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下顎骨々折に関する研究

第2口腔外科教室（指導：池尻 茂教授）

楊 家 騎

九州歯科大学，北九州，日本

抄 録

顎、顔面領域の骨折に関する原因として，従来は，戦傷，暴力等によるものが多いとされてきたが，第二次大戦後，特に，種々の交通機関の発達に伴い，交通災害によるものが多く，その首位を占めるようになった．また，骨折形式も複雑多岐に及ぶ，受傷程度も深いものとになり，従って，治療法も，その変革を余儀なくされている。

顎骨骨折の治療については，open reduction, closed reduction によるものが多いが，前述の理由から骨移植等を要するような症例さえもふえており，当然，特殊な顎固定装置等の必要にせまられてきた。

今回，私は本教室における過去3年間の顎骨骨折患者のうち，その発見頻度の高い下顎骨骨折について，種々の観点から，統計的観察を行ない，改めて，顎骨骨折に関する考察を加えると同時に，最近，考察された池尻式顎外ピン固定装置について報告した。

So far, many memoirs of maxillary fractures resulting from fist fights, falls, automobile accidents and war wounds have been reported.

Recently, frequency of maxillary fractures have been increasing with the increase in vehicular traffic and the progress of industrial, commercial and domestic mechanization.

The types of fractures are various and complicated, and esthetics has been considered seriously in the treatment of maxillary fractures.

Many fractures can be treated adequately by closed methods, but in the more serious injuries, the open method reduction and interosseous fixation, together with intermaxillary fixation are required.

Now, I am going to analyze the diagnosis of fractures, apparatuses, and the statistic of fractures in our department during the past three years (from 1966.4—1968.10).

Recently, Prof. Shigeru Ikejiri of our department developed an external skeletal pin fixation. I have the privilege of introducing this apparatus with two photographs in this report.
A study on the mandible fractures

I (Diagnosis)

A. The diagnosis of common symptoms of fractures of the mandible, may be made if following are evident.
1. Pain
2. Tenderness
3. Disability
4. Swelling
5. Discoloration
6. Deformity
7. Abnormal mobility
8. Crepitation
9. Salivation
10. Fetor ex ore

B. On palpation, tenderness will be noted at the site of the fracture (Fig. 1, 2).

(Fig. 1)

By pressing horizontally with the thumbs at the angle of the mandibles, the approximate area of a fracture of the symphysis can be located by a painful response at the point of fracture.

(Fig. 2)

By pressing in-and-upward with the thumbs against the lower edge of the mental, a fracture of the condyle process can be located by a painful response at the point of fracture.

C. Roentgenographic examination

Diagnosis of the fracture of the mandible usually can be made by clinical evaluation. Roentgenogram can identify and determine the direction of the fracture and pre-existing pathologic conditions of the mandible (e.g. pathologic fractures, displacement of some fragments, etc.).

The roentgenogram is an invaluable adjunct to the diagnosis. The following figures show the fractures by roentgenograph (Fig. 3, 4, 5, 6).
A study on the mandible fractures

(Fig. 3)
Fracture occurred through the right angle of the mandible and the symphysis.

(Fig. 4)
Fractures of the right condylar process with lateral displacement of the neck; the head remains in the fossa.

(Fig. 5)
The fracture line through the body with a molar tooth present on each side, and the fragment pulled upward by the muscle attached to the ramus of the mandible.

(Fig. 6)
Postoperative view of the lateral, showing fixation with inter-osseous wiring.

II (Classification of fractures of the mandible)
Fracture may be classified in several categories.
The following are the most common.

A. According to the direction of the fracture.
1. Horizontal
2. Vertical

B. According to the severity of the fracture.
1. Simple fracture
   In the simple fracture, the soft tissues may be damaged, but there is no open wound.
2. Compound fractures
   Compound fractures are those in which there is a break through the overlying structures and skin or mucosa with direct communication of the fragments with the outside.

C. According to the type of fracture
1. Single fracture
   This case has a single fracture line in the fractured area.
2. Multiple fracture
   Multiple fractures are those in which fractures occur in several areas.
3. Complex fracture
   Complex fractures are those in which fractures occur in several directions, sometimes into a joint resulting in a severe injury to tissues.
4. Communized fracture
   There are many fragments in a communized fracture, which may be simple or compound.
5. Depressed fracture
   These show depression and dislocation of the fractured segment, as in fractures of the zygoma.
6. Pathological fracture
   The bone is broken by weak force, if an osteoclastic disease like a tumor, osteomyelitis or radionecrosis exists (Fig. 7).

(Fig. 7)

Pathological fracture of the mental area caused by radioosteonecrosis.

D. Fractures classified according to the presence or absence of the teeth in the jaws.
1. Dentulous
2. Partially edentulous
3. Edentulous
   Rowe and Killey (1955) classified fractures according to the presence or absence of serviceable teeth in the segments of the mandible.
   Class 1; Teeth are present on both sides of the fracture line.
   Class 2; Teeth are present on only one side of the fracture line.
   Class 3; Fragments containing no teeth.
E. Mandible fractures classified as to location.
1. Fractures of the symphysis region.
   Those that occur in the region of the symphysis between the lower canine teeth.
2. Fractures in the canine region.
3. Fractures in the body of the mandible.
4. Fractures in the angle of the mandible.
   Those occurring through the angle of the mandible behind the second or third molar.
5. Fractures of the ramus of the mandible.
   Those fractures occurring between the angle of the mandible and the sigmoid notch.
6. Fractures of the coronoid process.
   Fractures in which the coronoid process is fractured at the level above the mandibular process.
7. Fractures of the condylar process.
   Those fractures include all fractures of the neck above the level of the sigmoid notch of
   the mandible.

Dingman added a new item to the foregoing classification. That is, fractures of the
alveolar process. I agree with his opinion (Fig. 8).

(Fig. 8)

Dislocation of four incisors by the fracture of the
alveolar process.

II (Methods of treatment)

The operation method is divided into three ways.
1. Closed reduction
2. Open reduction
3. Open reduction with bone graft
   The closed method is particularly true of simple or compound fractures of the mandible
   where teeth are present (Class 2 by Drs. Rowe & Killey).
   Open reduction may be commonly done by way of the extraoral approach. In multiple
   jaw fractures, replacement often requires open reduction and interosseous fixation,
   together with intermaxillary fixation in many cases.
   The method of open reduction with bone graft is adapted to pathologic fracture cases
   caused by malignant tumor or other cases, and adapted to the cases involving extensive
loss of mandible bone.

IV (Types of apparatuses for the maxillary bone fractures)

There are three classifications of these apparatuses.

A. Intermaxillary splint
B. Intermandibular bone pin
C. External skeletal pin

A. Intermaxillary splints are utilized for patients who have enough maxillary and mandibular teeth.
   1. Wire splint
      Winter splint
      Jelenko splint
      Saure splint
      Schuchardt splint
      Kingsley splint
      Niro splint
      Sakamura splint
      Ueno splint
   2. Dental wiring
      Kajanjian button ligation
      Silverman ligation
      Continuous dental ligation
   3. Acrylic resin splint
      Curing splint
      Stout splint
   4. Cast splint

B. Intermandibular bone pins which are utilized for patients who have enough teeth for stabilization.
   Thoma peripheral bone clamp

C. Extraoral skeletal pins are utilized for the edentulous mouth patients who have lost all or most of their teeth.
   They include:
   Chin cap
   Plaster skull cap with bird bridge
   Woodward appliance
   Griffin appliance
   Roger Anderson bone pin
   Frac Sure appliance
   H. Hayashi appliance
   H. Yamanaka appliance
A study on the mandible fractures

S. Ikejiri appliance (Fig. 9, 10).

(Fig. 9)

The new apparatus developed by Prof. Shigeru Ikejiri of Kyushu Dental College.

(Fig. 10)

Application of the new apparatus shown in Fig. 9.

V (Statistical studies of our department)

The following items were investigated.

1. Comparison of the alveolar and jaw fractures of all patients during the past three years (from 1966.4—1968.10).
2. The ages of the patients
3. Causes of the fractures
4. Area of the fractures
5. Comparison of the percentages by age groups
6. Comparison of the percentages by sex
7. Routine chronology
8. Number of patients by month

The following comparisons were made:

1. Comparison of mandible fractures of all patients during the past three years (from 1966.4—1968.10).

Patients who were not undergoing treatment at that time were not included in this table. Therefore, the figure shown for 1968 is substantially lower than the actual number of patients.

Table 1. Comparison of mandible fractures

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>23</td>
<td>51</td>
</tr>
<tr>
<td>1967</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>1968</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>100</td>
</tr>
</tbody>
</table>

Shows the percentages of the years from 1966.4—1968.10
A study on the mandible fractures

2. The ages of the patients.
Patients in the twenties show the highest percentages and the patients from the teens to the thirties constitute a majority of all cases, accounting for 80%.

Table 2. The ages of the patients

<table>
<thead>
<tr>
<th>Year</th>
<th>Age 0-9</th>
<th>10-</th>
<th>20-</th>
<th>30-</th>
<th>40-</th>
<th>50-</th>
<th>60-</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>1967</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>1968</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>12</td>
<td>16</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>45</td>
</tr>
</tbody>
</table>

This table shows that 37.7% of all fractures have occurred as a result of automobile accidents. The percentage of fractures resulting from fist fight is not as prevalent as in foreign reports.

Table 3. Causes of fractures

<table>
<thead>
<tr>
<th>Year</th>
<th>Causes</th>
<th>Work accident</th>
<th>Fist fight</th>
<th>Falls</th>
<th>Automobile accident</th>
<th>Sports</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>11</td>
<td>2</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>1967</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>1968</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>9</td>
<td>14</td>
<td>17</td>
<td>2</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

4. Area of the fractures.
This classification of fractures is according to the Reed. O. Dingman, & Paul Nativig's clinical nomenclature.
It shows that the highest percentages of fracture occurred through the condylar process. These account for approximate 31.3% of all mandible fractures. I concur in the next points contained in Dingman’s report concerning the area of fractures.
a. The area exhibiting the highest percentages of fracture is the condylar process.
b. The percentages of fractures of the mandible body agree with that of Dingman’s report. But, we experienced more fractures of symphysis area than Dingman’s and the percentage was twice that contained in his report. In this table, we didn’t include the cases of alveolar process fractures nor patients with multiple fractures, so the total number is different from the other tables.
A study on the mandible fractures

Table 4. Area of fractures

<table>
<thead>
<tr>
<th>Year</th>
<th>Symphysis</th>
<th>Body</th>
<th>Angle</th>
<th>Condylar process</th>
<th>Coronoid process</th>
<th>Alveolar process</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>1967</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>1968</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>11</td>
<td>7</td>
<td>16</td>
<td>4</td>
<td>0</td>
<td>51</td>
</tr>
</tbody>
</table>

5. Comparison of the percentages by the age groups.

The evaluation of several studies indicates that most mandible fractures occur between the teens and the fourties. My study shows 36% occur in the twenties.

Table 5. Comparison of the percentages by age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>0-9</th>
<th>10-</th>
<th>20-</th>
<th>30-</th>
<th>40-</th>
<th>50-</th>
<th>60-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reiter</td>
<td>4.0</td>
<td>2.0</td>
<td>18.0</td>
<td>42.0</td>
<td>18.0</td>
<td>16.0</td>
<td>-</td>
</tr>
<tr>
<td>Winter</td>
<td>1.0</td>
<td>2.0</td>
<td>30.5</td>
<td>29.5</td>
<td>23.5</td>
<td>9.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Oda</td>
<td>13.1</td>
<td>8.0</td>
<td>33.2</td>
<td>25.3</td>
<td>13.1</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Miyagawa</td>
<td>11.7</td>
<td>15.0</td>
<td>35.0</td>
<td>18.7</td>
<td>11.2</td>
<td>3.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Shiroyma</td>
<td>9.7</td>
<td>19.5</td>
<td>24.2</td>
<td>29.0</td>
<td>8.1</td>
<td>6.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Yoshioka</td>
<td>13.6</td>
<td>15.5</td>
<td>37.6</td>
<td>13.6</td>
<td>12.5</td>
<td>2.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Fukui</td>
<td>12.1</td>
<td>21.2</td>
<td>25.4</td>
<td>23.4</td>
<td>0.5</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Yang</td>
<td>2.2</td>
<td>26.2</td>
<td>36.0</td>
<td>17.7</td>
<td>8.8</td>
<td>2.2</td>
<td>6.6</td>
</tr>
</tbody>
</table>

6. Comparison of the percentages by sex.

The evaluation of several studies indicates that most fractures occurred in males. This study shows identical occurrence and its figures were similar to those obtained by Dunning, Reiter, Oda, Winter, Miyagawa, Shiroyma, Yoshioka and Fukui.

Table 6. Comparison of the percentages by sex

<table>
<thead>
<tr>
<th>Reporter</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunning (1915)</td>
<td>93.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Reiter (1928)</td>
<td>92.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Oda (1938)</td>
<td>92.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Winter (1943)</td>
<td>87.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Miyagawa (1957)</td>
<td>79.0</td>
<td>12.6</td>
</tr>
<tr>
<td>Shiroyma (1959)</td>
<td>90.4</td>
<td>9.6</td>
</tr>
<tr>
<td>Yoshioka (1961)</td>
<td>80.7</td>
<td>21.0</td>
</tr>
<tr>
<td>Fukui (1967)</td>
<td>89.7</td>
<td>10.3</td>
</tr>
<tr>
<td>Yang (1968)</td>
<td>93.3</td>
<td>6.6</td>
</tr>
</tbody>
</table>
7. Routing chronology.

The table indicates that over 64% of injured persons were taken to a general surgery for emergency treatment.

Then, they were transferred to our department.

Table 7. Routing chronology

<table>
<thead>
<tr>
<th>Year</th>
<th>Route</th>
<th>Direct to our department</th>
<th>Transferred from a dental clinic</th>
<th>Transferred from a general hospital</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td></td>
<td>5</td>
<td>1</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>1967</td>
<td></td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>1968</td>
<td></td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>8</td>
<td>7</td>
<td>30</td>
<td>45</td>
</tr>
</tbody>
</table>

8. Number of patients by month.

The frequency of patients suffering from injuries didn’t vary greatly from month to month.

Table 8. Number of patients by month

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td></td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>1967</td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>1968</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>45</td>
</tr>
</tbody>
</table>

VI Conclusion

1. I studied the Diagnosis, Classification, Treatment and the Apparatuses of jaw bone fractures.

2. I have improved the types of Dingman's classification for fractures. That is, the pathologic fracture was added to his categories, and I have shown an example of roentgenography in this report. This case was caused by radioosteonecrosis.

3. I have introduced the new apparatus which was developed by Prof. Shigeru Ikejiri of our department.

This apparatus is adapted for patients suffering fractures of the edentulous, or patients who have lost a large portion of mandible bone.

Acknowledgement

The author is indebted to Prof. S. Ikejiri, Dr. K. Komoto, Dr. K. Nakajima and other laboratory mates of Kyushu Dental College for their kind advice and services.

References
