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PANORAMIC RADIOGRAPHIC EVALUATION OF PATIENTS WITH TM DISORDERS

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CONTENT

Ⅰ. INTRODUCTION

The etiology, diagnosis and treatment of temporomandibular joint pain and dysfunction is a controversial subject.(1-2) That is possibly because of lack of definite evidence in determining the causes and effects of this disorder and gives continual subject of investigation in every aspect.

As for the cause of this disorder, multifactorial etiology has been suggested.(3) There are varying opinions regarding the contribution of occlusion(malocclusion) to development of TM disorder and further, the contribution of occlusal alterations, such as, (orthodontic and restorative) to the development of pain and dysfunction. There're numerous reports concerning the pros and cons of this causal relationship.(4-11)

Dibbets and van der Weele(1991)(9) did a 15-year longitudinal prospective study and concluded that the original growth pattern that cause the teeth to be selected for extraction for the orthodontic treatment rather than the extraction itself is the most likely factor responsible for the frequency of TMD reported years later. Seligman and Pullinger(1991)(10) examined the possible role that intercuspal occlusal relationships play in the development and progression of TMD. They found the skeletal anterior open bite, reduced overbite, and increased overjet are associated with osteoarthritic TMJ patients, but lack specificity for defining patient populations per se.

The effect of TM disorder to the occlusion and jaw bone is also widely studied. The bony morphological changes of condyle itself due to TM disorder is well known. Katzberg et al (12) studied 170 temporomandibular joints in 85 patients with plain tomography and arthrotomography and detected arthritis in 19 patients(22%), and suggested that internal derangements related to meniscal dysfunction may be an important factor in the etiology of TMJ arthritis. Schellhas et al(1990)(13) analyzed retrospectively one hundred patients with recently acquired, externally visible mandibular deformity and no history of previous extraarticular mandible fracture and concluded that TMJ degeneration is the principal cause of both acquired facial skeleton remodeling and unstable occlusion. In 1993, Schellhas et al(14) studied the pediatric internal derangements of the TMJ and concluded that TMJ derangements are both common in children and may contribute to the development of retrognathia, with or without asymmetry, in many cases. In 1985 Katzberg et al(15) reported secondary condylar hypoplasia associated with the meniscal abnormality in 3 pediatric patients. In 1983, Nickerson and Moystad (16) postulated and supported that certain typical changes in condylar morphology, previously described but unexplained, are the result of chronic anterior dislocation of the meniscus without reduction, and that centric occlusion-centirc relation discrepancies may be the result of condylar remodeling in some TMJ patients. Isberg et al (1987)(17) studied the patients with longstanding course of internal derangement of TMJ and found the elongation of the coronoid process of mandible.

In 1991, Kampe et al(11) re-examined 189 subjects, aged 18 to 20 years, 5 years after the first examination and found that the subjects with restored dentitions had a higher degree and frequency of mandibular dysfunction than the subjects with intact teeth. Of course more studies are necessary to find the exact mechanisms involved, but it is quite clear that the TM disorder runs a gradual and chronic course of disease even with a minor dentition changes. It is a slowly developing situation that the patient may not notice it but there must be a slight and gradual change of the supporting structures as well as vague mild clinical symptoms.

It is the main purpose of this present paper to detect the even mild change of TMD which can be visualized on panoramic views so that it can assist in diagnosis and also can be used as a preventive measure that the course of the disease process may be noticed and the progression of the process be stopped.

Ⅱ. MATERIALS AND METHODS

1. MATERIALS:

364 joints from 272 patients with(age; 12-68 yrs, mean; 31.0 yrs)(Male 80, Female 192) (Both 92, Right 173, left 99) Temporomandibular disorder diagnosed and treated at the Pusan National University Hospital during 1992-1993 period were studied. 160 joints from 80 normals were used as controls.

2. METHODS:

The length of condyle, coronoid process and the sigmoid notch, the width of ascending ramus, the depth of antegonial notch, the inclination of condyle, deepest concavity of the posterior border of ascending ramus, gonial angle, the ratio of length of coronoid process to the condyle were measured on the panoramic views of both patients and controls. The figure 1 shows the details of the measurements.

The overall results of each measurement in patients were compared with those of controls.

The patient group was subdivided according to the diagnosis of the temporomandibular joints, duration of symptoms, and ages and each was compared with that of controls.

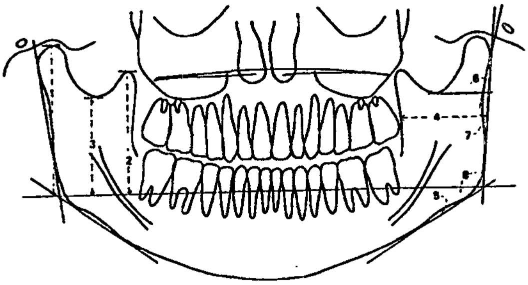

Figure 1. The diagram of each measurement: The length of condylar process(1), coronoid process(2), and sigmoid notch(3), the width of ramus(4), the depth of angegonial notch(5), the inclination of condyle(6), the posterior concavity of ramus(7), and the gonial angle(8) were measured.

Ⅲ. RESULTS

The age distributions of the patients and controls are listed in Table 1.

The results of this study which is listed in table 2 show that the overall size of the affected jawbone was smaller than that of the controls except the coronoid process which gives relative longer ratio of coronoid process to the condlye. And the antegonial notch were deepened and ascending ramus and condyle were slightly dorsaly flexured in patients.

The patient groups were subdivided into disc problems, muscle problems and the combined problems. Each was compared with that of controls. The results are listed in Table 3. According to the results, the patients with combined problems showed the most prominent jaw bone changes with every measurements statistically significant differences to controls. The patient with muscle problems showed least changes.

The patient groups were subdivided into the duration of symptoms and each was compared with that of controls. The results are listed in Table 4. From this it could be said that the patient with longer duration of symptoms had longer coronoid process and dorsal flexure of ramus.

Table 1. Age distribution

Age (Years)	No. of patient (joints)	No. of control (joints)
10-20	61 (80)	20 (40)
21-30	88(123)	20 (40)
31-40	71 (94)	20 (40)
41-50	26 (37)	13 (26)
51-60	21 (25)	5 (10)
61-70	5 (5)	2 (4)
Total	272(364)	80(160)

Table 2. The comparisons of each measurement in patients(364 joints) and controls(160 joints).

Items	Patient: 364 Joints (Mean±S.D.)	Controls: 160 Joints (Mean±S.D.)	p<0.05 (*)
Length of Condyle (MM)	70.11±6.92	72.83±6.99	*
Length of Coronoid Process(MM)	60.55±7.99	61.76±7.38	
Length of Sigmoid Notch(MM)	48.10±6.50	49.56±5.77	*
Width of Ascending Ramus(MM)	33.45±5.12	34.67±3.49	*
Depth of Antegonial Notch(MM)	2.41±1.22	1.72±0.92	*
Inclination of Condyle (Degrees)	105.75±8.07	104.79±5.53	
Concavity of Ramus (MM)	2.90±1.14	2.50±0.84	*
Gonial Angle(Degrees)	123.57±6.67	122.47±6.95	
Coronoid Process/Condyle(Ratio)	0.86±0.08	0.85±0.06	*

* statistically significant

Table 3. Division of patients into each diagnosis of TMJ.

Items	Disc Problem 99 Joints (Controls)	Muscle Problem 132 Joints (Controls)	Combined Problem 88 Joints(Controls)
Length of Condyle (MM)	69.30±6.97 * (72.83±6.99)	70.36±7.12 * (72.83±6.99)	69.34±6.31 * (72.83±6.99)
Length of Coronoid Process(MM)	60.34±8.24 (61.76±7.38)	60.17±8.95 (61.76±7.38)	60.36±6.02 (61.76±7.38)
Length of Sigmoid Notch(MM)	47.61±6.64 * (49.56±5.77)	48.23±7.26 (49.56±5.77)	47.93±4.98 * (49.56±5.77)
Width of Ascending Ramus(MM)	33.50±3.24 * (34.67±3.49)	34.05±6.11 (34.67±3.49)	33.25±2.71 * (34.67±3.49)
Depth of Antegonial Notch(MM)	2.51±1.17 * (1.72±0.92)	2.29±1.23 * (1.72±0.92)	2.39±0.98 * (1.72±0.92)
Inclination of Condyle (Degrees)	106.65±6.25 * (104.79±5.53)	104.81±10.73 (104.79±5.53)	106.50±6.16 * (104.79±5.53)
Concavity of Ramus (MM)	2.80±0.94 * (2.50±0.84)	3.01±1.00 * (2.50±0.84)	2.75±0.90 * (2.50±0.84)
Gonial Angle(Degrees)	123.67±7.61 (122.47±6.95)	122.65±6.47 (122.47±6.95)	124.44±5.39 * (122.47±6.95)
Coronoid Process/Condyle(Ratio)	0.87±0.09 (0.85±0.06)	0.85±0.10 (0.85±0.06)	0.87±0.07 * (0.85±0.06)

* statistically significant at $p<0.05$.

Table 4. Division of patients into duration of symptoms.

Items	1 Year or Less 216 Joints(Controls)	More than 1 Year 148 Joints (Controls)
Length of Condyle (MM)	69.62±6.73 * (72.83±6.99)	70.83±7.14 * (72.83±6.99)
Length of Coronoid Process(MM)	59.47±7.62 * (61.76±7.38)	61.90±8.30 (61.76±7.38)
Length of Sigmoid Notch(MM)	47.31±6.25 * (49.56±5.77)	49.26±6.71 (49.56±5.77)
Width of Ascending Ramus(MM)	33.89±5.84 (34.67±3.49)	32.82±3.75 * (34.67±3.49)
Depth of Antegonial Notch(MM)	2.27±1.15 * (1.72±0.92)	2.54±1.14 * (1.72±0.92)
Inclination of Condyle (Degrees)	105.90±6.89 (104.79±5.53)	106.13±5.93 * (104.79±5.53)
Concavity of Ramus (MM)	2.86±1.17 * (2.50±0.84)	2.96±1.08 * (2.50±0.84)
Gonial Angle(Degrees)	123.74±6.38 (122.47±6.95)	123.32±7.10 (122.47±6.95)
Coronoid Process/Condyle(Ratio)	0.85±0.09 (0.85±0.06)	0.87±0.07 * (0.85±0.06)

* statistically significant at $p<0.05$.

Table 5. Division of patients into age groups.

Items	0 - 20 Years	21 - 30 Years	31 - 40 Years	More than 41 Years
	80 Joints (Controls)	123 Joints (Controls)	94 Joints (Controls)	67 Joints (Controls)
Length of Condyle(MM)	67.12±6.00* (72.83±6.99)	71.29±7.02 (72.83±6.99)	70.31±7.14* (72.83±6.99)	71.43±6.23 (72.83±6.99)
Length of Coronoid Process (MM)	57.85±6.54* (61.76±7.38)	62.60±8.10 (61.76±7.38)	59.84±6.84* (61.76±7.38)	61.22±6.69 (61.76±7.38)
Length of Sigmoid Notch (MM)	45.36±5.54* (49.56±5.77)	49.96±6.53 (49.56±5.77)	47.64±5.32* (49.56±5.77)	49.19±5.33 (49.56±5.77)
Width of Ascending Ramus (MM)	32.95±2.64* (34.67±3.49)	33.90±4.31 (34.67±3.49)	34.24±3.69 (34.67±3.49)	34.12±5.31 (34.67±3.49)
Depth of Antegonial Notch (MM)	2.41±1.06* (1.72±0.92)	2.48±1.29* (1.72±0.92)	2.29±1.07* (1.72±0.92)	2.31±1.13* (1.72±0.92)
Inclination of Condyle (Degrees)	106.98±5.95* (104.79±5.53)	104.75±10.20 (104.79±5.53)	105.79±7.66 (104.79±5.53)	106.05±6.08 (104.79±5.53)
Concavity of Ramus(MM)	2.85±0.90* (2.50±0.84)	2.88±1.20* (2.50±0.84)	2.94±1.44* (2.50±0.84)	2.97±0.76* (2.50±0.84)
Gonial Angle(Degrees)	126.03±5.11* (122.47±6.95)	122.89±7.19 (122.47±6.95)	123.50±6.61 (122.47±6.95)	121.98±6.76 (122.47±6.95)
Coronoid Process/Condyle (Ratio)	0.87±0.08 (0.85±0.06)	0.88±0.07* (0.85±0.06)	8.84±0.11 (0.85±0.06)	0.86±0.07 (0.85±0.06)

* statistically significant at $p<0.05$.

The patient groups were subdivided according to the age and each was compared to that of controls. The results are listed in Table 5. It could be said from this result that the youngest age group showed the most prominent jaw bone change except the coronoid process and the oldest group showed the least change. But the deepened antegonial notch and the curved cortex ramal border were consistent findings of all subgroups.

Ⅳ. DISCUSSIONS

Panoramic radiographs are taken routinely in patients with temporomandibular joint disorders. They give full view of the dentition and alveolar bone as well as TMJ to examine the gross changes associated with these structures. There are some reports concerning the relationships of TM disorders to the facial skeleton with cephalometric views.(9-10, 13-14, 16) But there are no such reports on the panoramic views.

The result of present study show that the overall size of the affected jawbone was smaller that that of the controls. Schellhas et al(14) studied the effect of internal derangements of the temporomandibular joint on facial development in pediatric patients. In the growing facial skeleton, they propose that internal derangement of the TMJ disk either retards or arrests condylar growth, which results in decreased vertical dimension in the proximal mandibular segment with ultimately mandibular deficiency or asymmetry. Katzberg et al(15) suggested that two factors might have contributed to the deficit in mandibular length. The first is that the limited function of the TMJ leads to the limited growth, the second is that the actual degeneration of the mandibular condyle leading to the collapse of bone and shortening of the condyle.

The consistent findings of this study is the deepened antegonial notch and dorsal flexure of ascending ramus of patient group. Schellhas et al(14) noted this phenomenon and commented that gonial notching appeared to result from osteoporosis, as it was commonly observed with ipsilateral TMJ derangement and regressive condylar remodeling changes. Dibbets(18) and Boering(19) presented cases of arthrosis deformans juvenilis demonstrating the influence of this condition on the developing facial skeleton. The typical manifestations were a lag in posterior facial height, a steeper mandibular plane, and the formation of a gonial notch. Farrar and McCarty (20) mentioned that the mandible and temporomandibular joint continue to change throughout a person's lifetime. The potential for remodeling is extremely strong, probably much more than in other joints. When the mandibular condyle is shortened as a result of a developmental abnormality or a degenerative disease there are several changes which can be oberved in mandibular morphology. On the side of the shortened TMJ the mandibular ramus is reduced in its vertical height and there is accentuation of antegonal notching. The mandibular condyle on that side is shortened, the mandibular angle is increased, and the angle of the neck of the mandible is inclined more posteriorly.

The relative longer ratio of coronoid process to the condyle were also found in this study as was in the study done by Isberg et al.(17) Farrar and McCarty(20) mentioned that a significant change occurs in the relative height of the coronoid process. If the condyle is shortened, it naturally follows that the coronoid will be positioned more superiorly. However, we have observed that in cases of this type when the condyle is shortened there is not only a proportional or relative superior repositioning of the coronoid but also the coronoid itself elongates so that it is measurably higher above the sigmoid notch than the coronoid on the opposite side. It is this elongation of the coronoid, frequently associated with tendinitis and myofibrocitis of the temporalis muscle, which is an obvious contributing factor to temporal headache.

Trauma or developmental pathology to the temporomandibular joints in early childhood may lead to asymmetrical jaw and face growth. The effect on further development is probably variable. but this fact is well known and the attention is paid.

But effect of TM disorder to the jaw development was not clearly defined even the many of the patient with TM disorder nowadays are young enough.

If the gradual morphological changes of jaw bone due to the progression of TM disorders is understood, this could also be used as a predicing criteria for the disease, and could be used as a guide as a preventive measure to the potential patients.

The figure 2 shows the panoramic view of controls and the figure 3 shows that of the TMD patients.

It is evident that some morphological change of jaw might occur by the TM disorder, and it could be visible on panoramic views. I suggest this result can be used as a part of objective criteria in the diagnosis of TMD in our daily practice of radiological services.

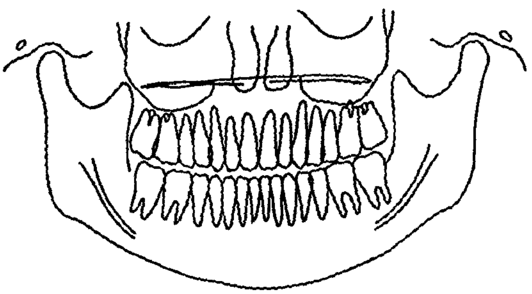

Figure 2. The average diagram of the panoramic view of controls.

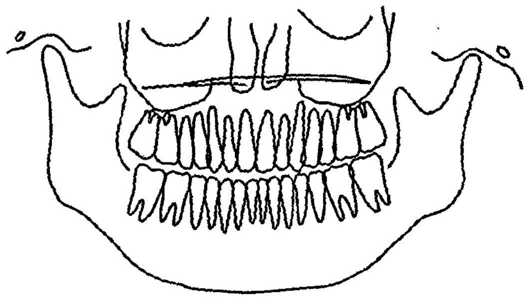

Figure 3. The average diagram of the panoramic view of patients

V. CONCLUSION

The author studied the panoramic radiographs of patients with TM disorders to find changes associated with them that the panorama may serve more information to the diagnosis and treatment of TM disorders.

The depth of antegonial notch, the degree of posterior flexure of condyle and ascending ramus, the length of condyle, coronoid process and signoid notch were measured on the panoramic views of the 364 joints with TM disorders and 160 control joints.

The result show that the affected mandibles show statistically significant shorter condyle, ramus and relatively longer coronoid process to the condyle, deeper antegonial notch and more concave posterior border of ascending ramus than those of the controls.

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-국문초록-

측두하악장애 환자의 파노라마 방사선 상에 관한 연구

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나 경 수

저자는 측두하악장애 환자의 파노라마 방사선사진 상에서 이 장애와 관련된 변화를 조사하여 측두하악관절 장애의 진단과 치료에 도움을 주고자 하였다.

측두하악장애 환자의 364관절과 정상인 160관절부위를 대상으로 antegonial notch의 깊이, 과두돌기와 하악골상행지의 후방변위정도, 과두돌기, coronoid process 와 sigmoid notch의 길이를 측정하였다.

결과를 보면, 측두하악장애에 이환된 경우 정상인에 비하여 통계적으로 유의하게 짧은 과두돌기와 하악지, 과두돌기에 비하여 상대적으로 긴 coronoid process, 그리고 깊은 antegonial notch와 오목한 하악골 상행지의 후연을 보였다.