Cephalometric Craniofacial Characteristics in Patients with Temporomandibular Joint Ankylosis

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Background: The sequelae of temporomanibular joint (TMJ) ankylosis include limitation of jaw movement, interference of oral function and affects on the craniofacial growth. Analysis of the craniofacial form of TMJ ankylosis offers guidelines for managing this disease.

Methods: Forty-five patients with intraarticular TMJ ankylosis were collected from the files at the Chang Gung Craniofacial Center. There were 21 male and 24 female patients, aged 3 to 47 years. Thirty-seven patients were unilaterally affected and eight had bilateral involvement. Patients were grouped according to gender and age. Both the medical history and onset of the disease were investigated in all patients. The pretreatment lateral cephalograms were used for analysis. The variables were compared with the Chinese norms with corresponding sex and age groups.

Results: The etiology included 48.9% facial trauma history, 17.8% traumatic delivery or birth injury, 15.6% middle ear or dental infection, 2.2% chronic arthritis and 15.6% unknown causes. The onset of mouth opening limitation was under 16 years of age. The average total mandibular length was less than the norm by 30 mm. Each patient presented with a mandible that had backward rotation with chin recession. Accentuated antegonial notch and inferiorly located condyle were observed on the affected side. The maxilla was shorter and the ANB was larger than the norm by 10° but the overbite and overjet were within normal ranges.

Conclusions: The facial growth was severely disturbed in terms of dimension, morphology and direction of growth in patients with TMJ ankylosis. Better management of mandibular fractures, good infection control and early treatment intervention are ways to reduce the influence on craniofacial growth.

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Key words: temporomandibular joint (TMJ) ankylosis, cephalometric analysis.

Temporomandibular joint (TMJ) ankylosis is defined as interference in the mobility of the jaws. The limitation of mandibular movement varies from slight interference to complete inability to open the jaw. The movement is also restricted in protrusion and lateral excursion with varying degrees,

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depending on the extent and type of the joint involvement.[1]

Kazanjian was the first to classify TMJ ankylosis into two types.[2] The first type was extraarticular or false ankylosis, which resulted from pathologic conditions outside the joint causing the limitations in opening the mouth. The findings in radiographs and laminograms may reveal normal-appearing TMJ and joint spaces. The etiology of extraarticular TMJ ankylosis includes, fibrosis of the masticatory muscles, paralysis of muscles due to neurogenic disorders, psychoneurosis, coronoid impingement, facial scars and neoplastic diseases.[1,3] Limitations in opening the mouth caused by cancrum oris[4] and osseous union between the coronoid process and the skull base or zygomatic arch after trauma have been reported.[5,6]

The other type was intraarticular or true ankylosis.[2] This was a condition that produced fibrous or bony adhesions between the articular surfaces of the mandibular condyle and glenoid fossa. The diagnosis was established when limitations of mandibular movement were associated with radiographic evidence of condylar deformation, obliteration of joint spaces and abnormal bone formation in and around the TMJ.[7]

The most common etiology of intraarticular TMJ ankylosis was trauma, especially fracture of the mandibular condyle(s) which resulted in TMJ ankylosis in 29 to 98% of the cases.[8,9] The second most common cause (10~49% of the cases) was local or systemic infection; such as otitis media, mastoiditis, severe dental infection and hematogenous spread of tuberculosis, gonorrhea, and scarlet fever.[8] Some systemic diseases such as ankylosing spondylitis, rheumatoid arthritis, and psoriasis were reported as possible etiologic factors in less than 10% of the cases.[3,10]

The impairments on orofacial function included; limited chewing ability, alterations in speech, compromised oral hygiene and dental care, restricted airway, and decreased posterior dental eruption.[10-13] The clinical features of unilateral TMJ ankylosis include; facial asymmetry, chin deviation to the affected side, elongation and flatness on the non-affected side with roundness or fullness on the affected side when observed from a frontal view.[11] A bony thickening is often felt in the preauricular area of the affected TMJ. The lateral profile has a reduced mandibular projection with “bird face deformity” in the most severe cases. The degree of mandibular recession depends on the severity, unilateral or bilateral joint involvement, age of onset, and duration of TMJ ankylosis.[7,14]

The mandibular morphology is severely influenced in terms of size and shape with marked antegonial notch, enlarged coronoid process, reduced vertical ramus height on the affected side; and flattened mandibular body and ramus on the non-affected side. The ankylosed mandibular condyle can be hyperplasic with irregular contours and absent joint spaces.[13]

Other clinical characteristics include secondary changes on the maxilla affecting its size, shape, and position.[10,15] Overall the patients have reduced posterior facial height, as well as steep mandibular and occlusal planes.[13,16] In the unilateral condition, the transverse occlusal plane is higher on the affected side.

In patients with TMJ ankylosis, the impact on mandibular deviation and retrusion has been reported. However descriptions on the growth of facial structures are lacking. This retrospective cephalometric study was conducted to analyze morphologic characteristics and maxillomandibular growth in patients with TMJ ankylosis.

METHODS

Subjects

Forty-five patients with intraarticular TMJ ankylosis were chosen from the files of the Chang Gung Craniofacial Center, Taipei, Taiwan. There were 21 male and 24 female patients. The age distribution ranged from 3 to 47 years old. There were seven boys and eight girls under the age of 10 years, two boys and four girls were juveniles between 10 and 17 years old and 12 men and 12 women in the adult group. Thirty-seven patients were unilaterally affected, including 19 on the right side and 18 on the left side; eight patients were bilaterally affected. The diagnostic radiographs included panoramic films, lateral and frontal cephalograms as well as tomograms in some patients. The clinical data included the medical history and course related to the TMJ ankylosis. A definite diagnosis was based on radiographic and clinical findings.

Cephalometric analysis

The cephalometric measurements included skeletal and dental measurements. The cephalometric landmarks and reference planes are demonstrated in Figure 1. The measurements include 29 variables (Table 1 to Table 5). There is no magnification correction for linear measurements.

Data collection

For the skeletal and dental measurements, the patients were separated into four groups: juvenile males (under 17 years old), juvenile females (under 15 years old), adult males and adult females. For the juvenile group (Table 1), data available from 12-year-old Chinese male and female norms were used for comparison.[17] For the adult group (Table 2), data available from adult Chinese norms were used for comparison.[18,19] An independent t test was used to analyze sex difference.

Condylar position (Co to SN vs. Co 'to SN') and mandibular concavity on the affected and the non-affected sides were recorded. The comparisons were grouped by sides, when the patients had bilateral TMJ ankylosis, the measurements of both sides were incorporated into the affected side group. Therefore "n" was 53 in the affected side group, and 37 in the non-affected side group. (Table 3)

For the mandibular linear measurements, the patients were grouped according to sex and affected side. (Table 4 and Table 5) There were three age groups: under 10 years of age, juvenile and adult. The measurements were compared with the corresponding Chinese norms.[17,18,20]

RESULTS

1. Etiologies of TMJ ankylosis

Pre-operatively, the maximal mouth opening ranged between 0 to 15.5 mm, and the average was 6.6 mm.

According to their medical history, possible etiologies were identified. Twenty two cases (48.9%) had history of mandiblular trauma, eight cases (17.8%) had history of difficult delivery or birth injury (forceps delivery), seven cases (15.6%) related their TMJ ankylosis to middle ear or dental infection, one case (2.2%) was diagnosed with chronic arthritis and the cause was not identified in seven cases.

The onset of mouth opening limitations began when the patients were younger than 16 years in all of the patients. There were nine patients with onset at infancy (0 to 1 year old), 15 patients between 1 and 6 years of age, 16 patients between 6 and 12 years, and five patients occurred between 12 and 16 years.

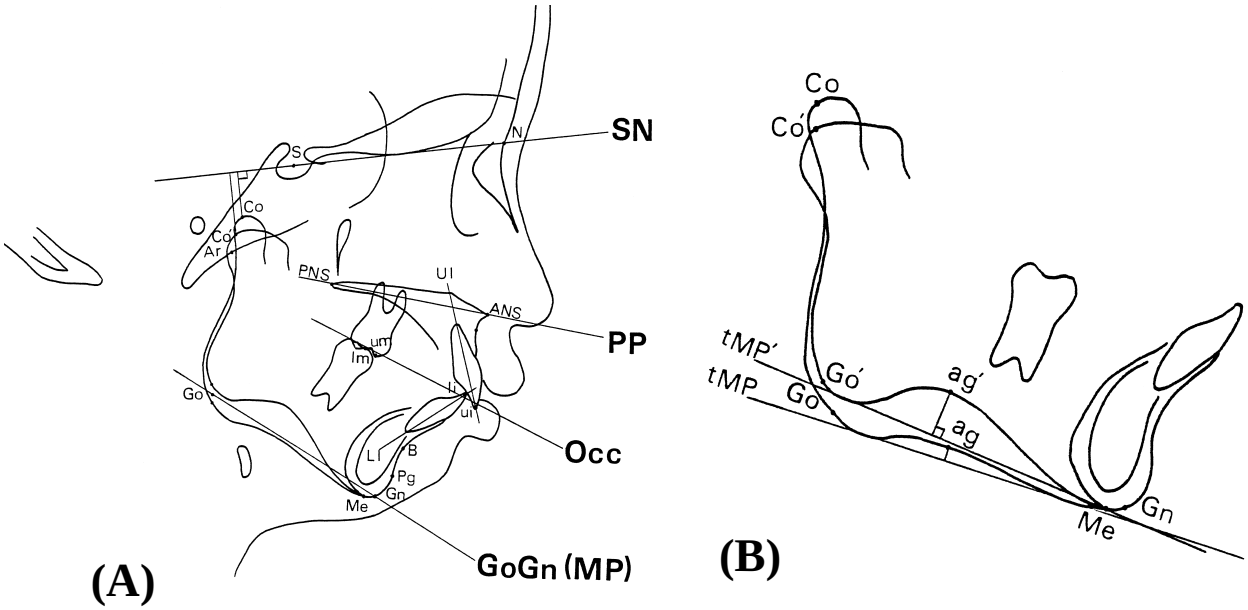

Fig. 1 Cephalometric landmarks, plane and distance describing (A) facial morphology and (B) mandibular morphology.

2. Morphologic abnormality of TM joint

The total number of the affected joints was 53. Their morphologies were investigated using panoramic films and cephalograms. Forty-six joints showed condylar hyperplasia with irregular bony deposition surrounding the affected joints. One of the patients was diagnosed with hemimandibular hyperplasia and TMJ ankylosis. He presented with overgrowth of the whole mandibular condyle, ramus and body at the affected side, which was different from the typical mandibular morphology of TMJ ankylosis. The original morphology of all of the hyperplastic TMJs could not be clearly identified. Only seven TMJs presented with hypoplasia; one patient was diagnosed with chronic arthritis of both joints.

3. Skeletal and dental measurements

Juvenile group: (Table 1)

The mandible demonstrated severe retrognathia. The average SNB angle was 9° to 10° below the norm, and the average SNPg was less than 11°. The occlusal plane and mandibular plane were steep. There were no differences in the measurements of Gonial angle between TMJ ankylosis group and the norm.

For the maxillary position, only the girls demonstrated maxillary retrusion (SNA decreased by 4.4°); no differences were observed in the boys. However, the average maxillary length for the boys was 2.2 mm less than the norm. In the girls, the maxillary length was 3.1 mm less than the norm.

All other linear measurements were smaller in the TMJ ankylosis group than the norm. The average total anterior facial height (N-Me) was reduced by 20 mm in the boys and 16.5 mm in the girls. The reduction in the upper (N-ANS) and lower facial heights (ANS-Me) was similar in the boys (8 mm and 7.6 mm, respectively). However, in the girls, the average lower anterior facial height (ANS-Me) was reduced slightly more than in the upper facial height (N-ANS). The average posterior facial height (S-Go) was smaller in the boys and girls by 11 and 12 mm, respectively. This reduction was larger than the one observed for the anterior facial height (N-Me).

The upper incisor position was retroclined in the affected patients. The average SN/UI was 92° in the boys and 86° in the girls. The lower incisor was severely proclined; the average GoGn/LI was 118° in the boys and 112° in the girls.

The vertical alveolar growth was affected in both jaws in the molar and incisor regions. The range of reduction varied between 4.5 and 6.8 mm. The incisor and molar regions demonstrated similar reductions in vertical dentoalveolar development.

The OB was slightly smaller, and the OJ larger in the TMJ ankylosis patients as compared with the norms. However large maxillomandibular discrepancies (ANB) were shown (12.6° in the boys, 9.3° in the girls) which are indicative of extreme dentoalveolar compensations.

There were no significant differences between the sexes for the above measurements.

Adult group: (Table 2)

Both the maxillary and mandibular positions were affected in the TMJ ankylosis group. The average SNA was smaller than the norm by 3.7° in the men and 2.8° in the women. The SNB was less than the norm by 10.8° in the men and 11.6° in the women. The occlusal plane was steeper by 6.8° in the men and 11.6° in the women. The mandibular plane was also steeper than the norm by 7.9° in the men and 10.4° in the women. Although there were no data available in the Gonial angle for comparison, the mean tended to be smaller in the TMJ ankylosis group when compared with standards in Caucasian subjects.[21] The gonial angle was 115.7° in the men, and 118.1° in the women.

The ratios S-Go/N-Me were similar in the juvenile and adult TMJ ankylosis groups (0.61~0.64). A significant difference between the sexes in total anterior facial height and posterior facial height was observed. The female subjects were 7.3 mm smaller in the anterior total facial height (N-Me) and 9.6 mm smaller in the total posterior facial height (S-Go) than the male subjects. The average ratio of upper and lower anterior facial height (N-ANS/ANS-Me) was 44%/56%.

The inclination of upper incisors was less than the norm by an average 5.7° in the women, but similar in the men. Severe proclination of the lower incisors was observed with a mean of 121.6° in the men and 117.7° in the women. These values were larger than those obtained in the juvenile group.

The ratios of posterior alveolar and anterior alveolar height for both jaws (lm-MP/li-MP and um-PP/ui-PP) were similar between the TMJ ankylosis group and the norm.

The OB was not different between adult TMJ

Table 1. Comparison of Cephalometric Measurements between TMJ Ankylosis and Chinese Norms in the *Juvenile Group*.

	Male (n = 9)		Chinese norm (n = 34)		Difference	Female (n = 12)		Chinese norm (n = 35)		Difference	Gender Difference
	mean	SD	mean	SD		mean	SD	mean	SD		
Age (years)	7.02	3.59	11.83	0.54		7.87	3.05	11.83	0.53		
Skeletal/ Angular											
SNA	81.98	3.75	81.34	2.62	0.64	78.55	3.89	82.91	3.70	-4.36	3.43
SNB	69.38	6.04	78.39	2.72	-9.01	69.28	5.97	79.81	3.05	-10.53	0.10
ANB	12.60	3.38	2.95	1.64	9.65	9.27	4.14	3.10	1.49	6.17	3.33
SNPg	67.32	6.19	78.43	2.80	-11.11	68.05	5.90	79.67	3.00	-11.62	-0.73
SN/Occ	24.26	5.66	19.70	3.47	4.56	23.23	6.12	19.80	4.23	3.43	1.03
SN/GoGn	35.73	5.81	33.50	3.61	2.23	35.73	3.02	32.25	4.77	3.48	0.00
Gonial	125.20	7.10	123.21	4.92	1.99	124.80	6.54	121.75	6.13	3.05	0.40
Skeletal/ Linear (mm)											
ANS-PNS	46.36	2.64	48.56	3.80	-2.20	45.75	2.18	48.85	2.73	-3.10	0.61
N-Me	100.58	8.53	120.51	5.96	-19.93	100.90	9.09	117.39	4.36	-16.49	-0.32
S-Go	64.60	7.79	76.33	4.87	-11.73	63.95	6.33	75.33	4.78	-11.38	0.65
N-ANS	46.67	4.47	54.69	2.85	-8.02	46.03	4.97	52.98	3.09	-6.95	0.64
ANS-Me	60.23	5.50	67.87	4.33	-7.64	58.88	4.51	66.58	2.78	-7.70	1.35
Dental/ Angular											
SN/UI	92.07	15.26	104.54	4.68	-12.47	86.03	15.60	104.95	4.36	-18.92	6.04
PP/UI	101.62	15.62	112.43	4.69	-10.81	95.28	15.26	113.07	4.38	-17.79	6.34
UI/LI	114.86	13.79	125.76	7.61	-10.90	126.73	22.75	129.60	8.31	-2.87	-11.87
GoGn/LI	117.96	9.59	98.22	6.85	19.74	111.84	15.17	94.9	36.75	16.91	6.12
Dental/ Linear (mm)											
lm-MP	27.86	2.91	32.34	2.47	-4.48	27.20	2.80	32.24	2.32	-5.04	0.66
li-MP	34.21	2.98	41.06	2.85	-6.85	33.70	3.43	40.15	2.30	-6.45	0.51
lm-MP/li-MP	81.43		78.76			80.71		80.30			
um-PP	17.14	3.41	21.97	2.31	-4.83	16.70	1.29	21.98	1.82	-5.28	0.44
ui-PP	24.91	3.12	30.08	2.48	-5.17	24.43	2.71	29.98	1.84	-5.55	0.48
ui-PP/um-PP	68.80		73.04			68.35		73.32			
OB	2.27	2.75	3.30	1.80	-1.03	2.01	2.93	2.70	1.80	-0.69	0.26
OJ	5.01	4.14	3.70	1.90	1.31	3.05	3.17	3.20	1.50	-0.15	1.96

ankylosis patients and the norm. The average OJ was larger than the norm by 4.3 mm. Interestingly the ANB was even greater than the norm, 10.2° in the men and 11.2° in the women.

4. Condylar position (Table 3)

The affected joints were inferiorly located by 3.7 mm when compared with the non-affected joints.

5. Morphology of mandibular inferior border (Table 3)

All of the affected hemi-mandibles presented with severe antegonial notching. The average concavity (ag-tMP) was 5.8 mm on the affected side and 2.7 mm on the non-affected side.

6. Mandibular Dimension (Table 4 and Table 5)

The total mandibular length (Co-Gn) was severely decreased in both the affected and non-affected sides. It was smaller than the norm by more than 30 mm on the affected side and more than 24 mm on the non-affected side.

The mandibular body length was significantly reduced in both the affected and non-affected sides in

Table 2. Comparison of Cephalometric Measurements between TMJ Ankylosis and Chinese Norms in the *Adult Group.*

	Male (n = 12)		Chinese norm (n = 30)		Difference	Female (n = 12)		Chinese norm (n = 30)		Difference	Gender Difference
	mean	SD	mean	SD		mean	SD	mean	SD		
Age (years)	28.50	7.37	23.2	---		22.69	7.04	23.2	---		
Skeletal/ Angular											
SNA	79.65	4.42	83.36	3.25	-3.71	79.58	1.30	82.39	3.23	-2.81	0.07
SNB	69.44	6.60	80.21	3.85	-10.77	68.39	3.32	79.95	3.27	-11.56	1.05
ANB	10.21	3.24	3.08	2.04	7.13	11.18	2.86	2.44	1.32	8.74	-0.97
SNPg	68.15	7.32	---	---		66.80	4.57	---	---		1.35
SN/Occ	22.45	8.07	15.67	5.61	6.78	27.13	3.63	15.56	3.06	11.57	-4.68
SN/GoGn	36.22	7.43	28.28	6.48	7.94	40.60	8.15	30.17	4.16	10.43	-4.38
Gonial	115.73	11.00	---	---		118.09	9.06	---	---		-2.36
Skeletal/ Linear (mm)											
ANS-PNS	53.51	3.04	---	---		52.78	3.32	---	---		0.73
N-Me	126.82	7.73	---	---		119.48	8.61	---	---		7.34*
S-Go	82.26	10.15	---	---		72.68	5.08	---	---		9.58†
N-ANS	58.60	3.38	---	---		56.08	3.37	---	---		2.52
ANS-Me	74.43	5.65	---	---		70.52	6.38	---	---		3.91
Dental/ Angular											
SN/UI	103.51	9.54	103.81	7.56	-0.30	98.15	7.30	103.81	7.56	-5.66	5.36
PP/UI	114.47	10.23	---	---		109.33	8.63	---	---		5.14
UI/LI	100.11	25.90	122.28	8.07	-22.17	106.04	15.58	122.85	7.93	-16.81	-5.93
GoGn/LI	121.58	22.25	95.87	6.13	25.71	117.73	12.50	95.87	6.13	21.86	3.85
Dental/ Linear (mm)											
lm-MP	32.63	5.50	---	---		30.62	4.68	---	---		2.01
li-MP	43.80	4.89	---	---		41.45	5.05	---	---		2.35
lm-MP/li-MP	74.50	15.62	73.87	4.56		73.87	10.75	73.87	4.56		
um-PP	24.58	3.60	---	---		21.99	3.72	---	---		2.59
ui-PP	32.21	4.23	---	---		30.73	3.37	---	---		1.48
ui-PP/um-PP	76.31	13.69	72.04	8.63		71.56	13.63	72.04	8.64		
OB	4.66	3.74	4.00	1.84	0.66	4.12	2.38	4.00	1.84	0.12	0.54
OJ	7.13	4.98	2.78	1.13	4.35	7.08	4.24	2.78	1.13	4.3	0.05

* $p < 0.05$;

† $p < 0.01$;

---: no available norm data.

Table 3. Comparison of Measurements Related to Mandibular Morphology between Affected and Non-affected Sides in Patients with TMJ Ankylosis.

	Affected side (n = 53)		Non-affected sid e (n = 37)		Difference (mm)
	mean (mm)	SD	mean (mm)	SD	
Co to SN	25.82	5.14	22.15	5.66	3.67
Ag-tMP	5.83	2.87	2.74	1.28	3.09

the three age groups.

The mandibular ramus height was significantly smaller on the affected side in all groups. In all groups, both sides were shorter than the norm by more than 14 mm on the affected side and more than 6 mm on the non-affected side.

DISCUSSION

In this study, 29 cephalometric measurements

Table 4. Linear Measurements (mm) of Mandible in Different Age Groups for *Male Patients.*

Age group (years)	Affected side		Difference with norms	Non-affected side		Difference with norms	Chinese norms		Difference between affected and non-affected
	mean	SD		mean	SD		mean	SD	
Co-Gn									
<10 (n = 7)	73.37	10.56	-37.50	75.68	9.15	-35.19	110.87	4.11	-2.31
10~17 (n = 2)	81.80	1.27	-34.58	86.65	0.49	-29.73	116.38	6.29	-4.85
>17 (n = 12)	93.76	13.81	-32.47	98.73	14.16	-27.50	126.23	5.24	-4.97
Go-Gn									
<10 (n = 7)	47.83	5.88	-24.59	44.94	5.69	-27.48	72.42	2.74	2.89
10~17 (n = 2)	56.95	6.01	-20.27	52.10	9.47	-25.12	77.22	4.19	4.85
>17 (n = 12)	64.69	7.83	-17.89	63.14	15.08	-19.44	82.58	5.15	1.55
Co-Go									
<10 (n = 7)	35.41	3.80	-19.19	42.18	5.84	-12.42	54.60	3.37	-6.77
10~17 (n = 2)	39.35	2.05	-16.68	48.85	2.75	-7.18	56.03	4.36	-9.5
>17 (n = 12)	47.68	13.23	-17.10	56.10	7.42	-8.68	64.78	4.63	-8.42

Table 5. Linear Measurements (mm) of Mandibular Morphology in Different Age Groups for *Female Patients*.

Age group (years)	Affected side		Difference with norms	Non-affected side		Difference with norms	Chinese norms		Difference between affected and non-affected
	mean	SD		mean	SD		mean	SD	
Co-Gn									
<10 (n = 8)	77.73	8.68	-31.35	80.90	9.08	-28.18	109.08	4.24	-3.17
10~15 (n = 4)	77.88	11.32	-35.84	89.00	7.67	-24.72	113.72	4.65	-11.12
>15 (n = 12)	87.01	10.88	-30.37	93.30	9.57	-24.08	117.38	3.90	-6.29
Go-Gn									
<10 (n = 8)	49.55	5.96	-23.17	51.05	8.30	-21.67	72.72	4.58	-1.50
10~15 (n = 4)	51.18	9.53	-25.49	55.76	6.00	-20.91	76.67	3.70	-4.58
>15 (n = 12)	59.83	10.17	-19.34	59.56	8.08	-19.61	79.17	4.09	0.27
Co-Go									
<10 (n = 8)	37.96	5.11	-14.24	42.97	5.78	-9.23	52.20	3.03	-5.01
10~15 (n = 4)	38.38	7.12	-15.90	47.53	3.55	-6.75	54.28	3.38	-9.15
>15 (n = 12)	42.43	4.28	-17.15	49.23	6.10	-10.35	59.58	4.07	-6.80

were used to evaluate the craniofacial characteristics and morphology of patients with TMJ ankylosis. Each mandible was severely affected; not only in size and shape but also in position. TMJ ankylosis occurred in one side, the morphology of both sides was affected.

The SNB was smaller than the norm by 10~11° in the both juvenile and adult groups. The average

SNPg was smaller than the average SNB in the TMJ ankylosis group, which presented that the mandible was retruded with a backward rotation of the mandiblular plane. The mandibular plane angle (SN/GoGn) and occlusal plane angle (SN/Occ) were larger than the norm. These two measurements appeared to worsen with age in patients with TMJ ankylosis.

All the dimensions of the affected hemimandibles were smaller than the contralateral dimensions. In addition the mandibles in the TMJ ankylosis group had smaller overall dimensions than the norms in the both affected and non-affected sides. The sagittal mandibular length was shorter by more than 30 mm for both sides in all age groups. The average sagittal mandibular body length was shorter by 20 mm in all age groups. The ramus height was less than 15~20 mm on affected sides in all age groups; a significant difference of 5~10 mm was shown between the affected and the non-affected ramus heights. The body length was larger on the affected sides than the non-affected sides (except for two). This is a controversial finding as clinically the body length on the affected side is shorter than the non-affected side. We believe that this discrepancy is the result of using a two-dimensional technique to measure a three-dimensional condition.

The altered mandibular vector of growth (mandibular plane) and reduction in size can be explained by the condylar lesion and also the absence of mandibular function. The size, shape, location, and structural integrity of every skeletal unit (including the mandibular condyle) is a secondary or a compensatory response to the requirements of the soft tissue functional matrix.[22] In TMJ ankylosis patients, the soft tissue matrix is normal but the pathologic process secondarily affects it by reducing the functional spaces (oral cavity, airway, etc). The mandibular growth direction is altered to a backward rotation. Similar facial growth pattern can be found in patients with juvenile rheumatoid arthritis.[23-25] Researchers have found that TMJ abnormalities were the most important factor altering the mandibular growth and subsequently the facial growth patterns.[16,22-25] The severity of the radiographic findings in the TMJ abnormalities and destruction were positively correlated with the severity of the facial deformities.[26] The degree of mandibular and facial deformities also depends on the time of onset of the TMJ ankylosis and its subsequent duration.[16]

The condylar position (Co to SN & Co' to SN) was inferiorly located on the affected side. On the affected side, the glenoid fossa was also positioned more inferiorly. The altered condylar and gleniod fossa positions might be a natural attempt to keep the underdeveloped mandible in a more anterior position.[24,25]

Characteristic antegonial notching was seen in the affected sides of all subjects except for one case of hemimandibular hyperplasia with TMJ ankylosis. The depth of the antegonial notch was 5.8 mm on the affected sides and only 2.7 mm on the non-affected sides. No norms were available to compare, but similar findings were found in individuals with juvenile rheumatoid arthritis (JRA). The depth of the antegonial notching has been reported to be 3.4 mm in patients with JRA, and only 1.8 mm in age-matched control subjects at 14.5 years of age.[24]

The occurrence of the marked antegonial notch is likely the result of pathologic reduction of vertical ramus height with a compensatory overgrowth of the mandibular body. In addition, bone remodeling and apposition in the gonial region as a result of abnormal muscle forces should be considered.[27,28] The coronoid process becomes hypertrophied due to the abnormal contraction of the temporalis muscles.[3,7,13] Further in order to maintain a patent airway, the patients extend their heads. This results in stretching of the suprahyoid musculature which may cause posterior mandibular rotation or changes in mandibular morphology.[29]

TMJ ankylosis also affected the anteroposterior and vertical position of the maxilla. The vertical deficiency in alveolar height was shown in both the maxilla and mandible. Their changes are likely secondary to the lack of vertical development of the mandible posteriorly.

All of the vertical facial dimensions were substantially reduced in the TMJ ankylosis group. It demonstrated that the average total anterior facial height (N-Me) was affected more than the total posterior facial height (S-Go). There were similar reductions in the upper and lower anterior facial heights (N-ANS and ANS-Me).

The skeletal maxillomandibular discrepancies (ANB) were marked, however, they tended to maintain anterior dental relationships in terms of overbite and overjet. These represent extreme compensatory

proclination of the lower incisors to reduce the skeletal discrepancy caused by mandibular retrognathism. The effects were more pronounced in the adult group where the upper incisors were more proclined and interincisal angle were more acute than in the juvenile group.

When we traced their medical history, mandibular trauma was the main cause (48.9%) of TMJ ankylosis in these patients. When birth trauma was incorporated into the trauma group, trauma was responsible for 2/3 of the possible etiologies. The pathogenesis of TMJ ankylosis relating to trauma was considered as a chronic progressive destruction. The TMJ injury combined with hemarthrosis was followed by varying periods of restricted mobility and joint pain. The hematoma organization was followed by fibrosis and gradual bone formation from the disrupted periosteum.[7] The age of onset for TMJ ankylosis was the highest from 6 to 15 years.[7] In this study, all the patients started the signs of limitations for opening the mouth under the age of 16 years. That means facial trauma and infection in children should be monitored for the possibility of TMJ ankylosis.

Since the management of mandibular and condylar fractures and infection control have progressed a lot, the incidence of TMJ ankylosis is much lower in recent years. The effects of TMJ ankylosis were not only in the joint per se, but the neuromuscular function and facial growth were also severely disturbed. It is difficult to restore the normal functions and reconstruct dentofacial balance if the condition is left untreated. Thus, early diagnosis and treatment are recommended.

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顳顎關節粘連患者之測顱顱顏型態分析

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背 景： 顳顎關節粘連除了造成病患下顎功能障礙及口腔疾患的增加，亦對顏面的發育與形態造成影響。藉由對此類患者顱顏形態精確的了解，以提供治療之參考。

方 法： 本研究包括長庚醫院顱顏中心歷年來 45 例顳顎關節粘連患者，男性 21 位，女性 24 位，年齡 3 至 47 歲。其中 37 位爲單側，8 位爲雙側粘連。患者依性別與年齡分組，男性 17 歲以下，女性 15 歲以下爲生長組，其餘爲成人組。調查個別病史及發病時間並測量治療前側面測顱 X 光片，包含 29 項線性及角度變項，與台灣地區相對應之性別及年齡層之平均值做比較。

結 果： 造成顳顎關節粘連 48.9% 爲顏面外傷，17% 爲生產過程之外傷，15.6% 爲口腔或中耳感染，2.2% 爲關節炎，其餘原因不明。所有發生張口受限之年齡均於 16 歲以前。患側下顎總長度平均短於正常值 30 厘米，即使爲單側黏連之患者，其雙側下顎骨發育均受影響。下顎骨呈後旋轉致頷部後縮，其形態改變包括下緣內凹曲線明顯異常及相對患側關節窩往前下方位移。患者上顎長度亦短於正常值。上下顎間關係 (ANB) 平均大於正常值10° 之多。但上下門齒間距平均值正常爲代償性角度改變的結果。此外顏面垂直高度及上下臼齒齒槽骨高度均小於正常值。

結 論： 顳顎關節粘連影響不只是關節本身或功能障礙，對顱顏生長之大小，方向及形態均造成顯著影響。治療目標應兼具及早恢復下顎功能與改正顱顏形態。此外針對顳顎關節和下顎外傷骨折做適當治療，妥善處理頭頸部感染，將可預防顳顎關節粘連及其伴隨之後遺症。

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關鍵字： 顳顎關節粘連，測顱分析。

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