

The distribution and trend
of surgical-orthodontic patients
in Dental College Hospital
of Yonsei University

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**The distribution and trend
of surgical-orthodontic patients
in Dental College Hospital
of Yonsei University**

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교정과 수련 생활의 큰 힘이 되어준 의국 동기-김철순, 시경근, 최성환, 최혜영 선생님과 의국 선배님들, 후배님들, 교정과 식구들에게 감사의 마음을 전합니다.

마지막으로 언제나 아낌 없이 지원해주시고 사랑으로 돌봐주시는 부모님과 남편에게 감사드립니다.

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Abstract

The distribution and trend of surgical- orthodontic patients in Dental College Hospital of Yonsei University

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The number of patients undergoing surgical-orthodontic treatment has been increasing. This change is due to development of surgical-orthodontic techniques and efforts of orthodontists and oral and maxillofacial surgeons to recommend orthognathic surgery for better balanced esthetics other than camouflage treatment. But there has not been enough epidemiological study on distribution and trend of surgical-orthodontic cases.

In this study, trends and distributions of patients undergoing surgical-orthodontic treatment in Dental College Hospital of Yonsei University between 2001 and 2010, were evaluated by age, sex and other characteristics.

1. The number of surgical-orthodontic patients has increased, and comparing 2001 with 2010, the number of patients doubled.
2. Sex distribution of surgical-orthodontic patients did not have significant changes over a decade, showing mean ratio of 1.05:1 (female: male).
3. Age distribution had shown 20-24 year-old group being the largest (53.9%), followed by 25-29 year-old group (19.3%), under 19 year-old group (18.4%), 30-34 year old group (5.6%), 35-39 year-old group (2.1%) and over 40 year old group (0.6%).
4. Distributions in the types of malocclusion had shown: 4.2% for Class I, 12.8% for Class II, and 83.0% for Class III. Class III group constantly comprised outstandingly most prevalent group over the time.
5. 2-Jaw surgery cases (81.1%) had outnumbered 1-Jaw surgery cases (18.9%), with a general trend toward 2-Jaw surgery over the 10 year period. In 1-Jaw surgery cases, mandibular surgery only outnumbered maxillary surgery only

cases. For techniques on mandibular surgery, percentage of sagittal split ramus osteotomy was 24.1% whereas that of intraoral vertical ramus osteotomy was 76.2%.

6. Geographic distributions showed majority of patients from the nearby areas: 55.7% from within the same city, Seoul, 34.1% of the patients were from the same province, Kyounggi-Do, and 10.2% from other district of the country.

From this study we could take adequate informations regarding the characteristics of surgical-orthodontic patients, and the changing trend about treatment modality.

Key words : surgical-orthodontic treatment, epidemiology, Class III, distribution

The distribution and trend of surgical- orthodontic patients in Dental College Hospital of Yonsei University

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I . Introduction

Patients with severe dentofacial deformity cannot be corrected by orthodontic treatment alone and need combination of orthodontics and orthognathic surgery. Since 1950s, orthognathic surgery could fix skeletal disharmony as well as dental malocclusion and now orthognathic surgery has become well established treatment modality.

The number of patients undergoing surgical-orthodontic treatment has been increasing each year. This change is due to improved surgical outcomes by technical advances, and efforts of orthodontists and oral surgeons to

recommend orthognathic surgery for optimum esthetic result other than camouflage treatment.

Epidemiological study on prevalence of malocclusion can give informations on prevalence of malocclusion, and types malocclusion and show racial preference and change of values over times.

But the actual number of patients seeking for orthodontic and surgical treatment may differ from the prevalence of malocclusion due to economic status, knowledge and consciousness on malocclusion.

There have been many epidemiologic studies on prevalence of malocclusion or patients visiting for orthodontic treatment. But there has not been enough study on distribution and trend of orthognathic surgery in Korea. Bailey et al.(2001) reported on trends of surgical-orthodontic patients in USA. But trends are different from Korea and other Asian countries as Class III patients are the most prevalent surgical-orthodontic patients compared to USA. Also, a report by Zins et al.(2008) documented decrease in orthognathic surgical cases due to insurance problems whereas number of surgical-orthodontic patients are not affected by insurance issue as there is no private insurance company that covers surgical-orthodontic treatment in Korea, not many patients can get national insurance coverage. Baik et al.(1995), Im et al.(2003) and Jung(2009) mentioned about surgical-orthodontic patients in Korea but there has not been an in-depth study on trends and distributions of surgical-orthodontic treatment in Korea.

In this study, patient who underwent orthodontic treatment combined with orthognathic surgery between 2001 and 2010 in Dental College Hospital of Yonsei University were evaluated to see distribution and trends of surgical-orthodontic patients.

II. Subjects and Methods

1. Subjects

In this study, patient who underwent surgical-orthodontic treatment in Dental College Hospital of Yonsei University between 2001 and 2010 were evaluated.

2. Methods

Records and cephalographs for the patients who received combination of orthodontics and orthognathic surgery between January 2001 and December 2010 were reviewed. The number of patients were counted based on operation dates of orthognathic surgery. All the patients had orthodontic treatment in Department of Orthodontics of Dental Hospital of Yonsei University, and had surgery in department of Oral and Maxillofacial surgery of the same hospital. Any patients who did not have orthodontics or orthognathic surgery at the Dental College Hospital of Yonsei University were excluded as their records and informations were incomplete.

A. Annual distribution of surgical-orthodontic patients

Numbers of surgical-orthodontic patients for 10 years were evaluated. Also, number of patients who had been examined and diagnosed at Department of Orthodontics for orthodontic treatment to evaluate percentage and trend of orthodontic-surgical patients over total patients in orthodontic clinic.

B. Sex distribution of surgical-orthodontic patients

Sex distribution and trends of the surgical-orthodontic patients in 10 years were evaluated.

C. Age distribution of surgical-orthodontic patients

The surgical-orthodontic patients were divided in six groups by age which were under 19, between 20-24, between 25-29, between 30-34, between 35-39, and over 40. Distribution change and trend were evaluated.

D. Distribution of surgical-orthodontic patients by skeletal types and facial asymmetry

Patients were divided in three groups as skeletal Class I, Class II, and Class III (Class I: $0 \leq ANB \leq 5$, Class II: $ANB > 5$, Class III: $ANB < 0$). Also patients with facial asymmetry (menton deviation $> 3\text{mm}$) and number of syndromatic patients such as hemifacial microsomia or cleft lip and palate were evaluated.

E. Distribution of surgical technique performed on surgical-orthodontic patients

Distribution and trends of the patients according to 1-Jaw or 2-Jaw surgery were evaluated and surgical techniques were evaluated : sagittal split ramus osteotomy (SSRO), intraoral vertical ramus osteotomy (IVRO), vertical and sagittal osteotomy (VNSO), genioplasty, distraction osteogenesis (DO), segmental osteotomy (SO).

F. Distribution of surgical-orthodontic patients by residential area

The surgical-orthodontic patients were divided into six groups according to their residential areas : The patients living within Seoul were divided in 4 areas as north-east, north-west, south- east and south-west, and a group from Kyonggi – Do except from Seoul, and one group coming outside the province.

III. Results

1. Annual distribution of surgical-orthodontic patients

During the ten years from January of 2001 to December of 2010, the total of 1408 patients underwent orthodontic-orthognathic combined treatment. The number of patients were increasing over the ten years, and in year 2010 (n=191) the number doubled compare to year 2001 (n=94). The percentage of orthodontic-surgical patients over the total patients visiting Department of orthodontics also increased from 3.2% to 8.8% over ten years.

Table I. Annual distribution of surgical-orthodontic patients and visiting patients in department of orthodontics

year	orthodontic-surgical patients	visiting patients	Surgery/visiting(%)
2001	94	2931	3.2
2002	105	2841	3.7
2003	94	2935	3.2
2004	120	2563	4.7
2005	173	2318	7.5
2006	166	2359	7.0
2007	159	2382	6.7
2008	178	2326	7.7
2009	128	2124	6.0
2010	191	2177	8.8
Total	1408	24956	5.6

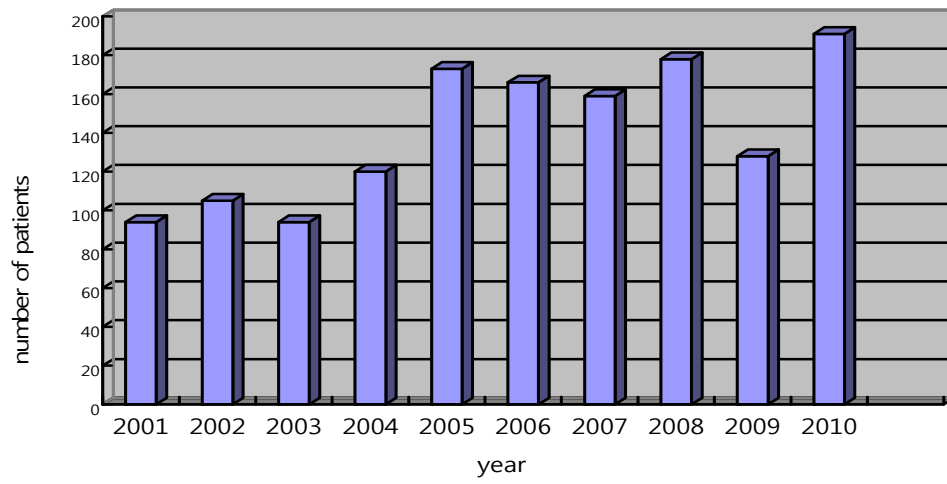


Figure I. Annual distribution of surgical-orthodontic patients

2. Sex distribution of surgical-orthodontic patients

Sex distribution of patients did not have significant changes over the decade, showing 1.05:1 (female: male).

Table 2. Sex distribution of surgical-orthodontic patients each year

Year	Sex	Male		Female		Total
		n	%	n	%	n
2001		41	43.6	53	56.4	94
2002		52	49.5	53	50.5	105
2003		47	50.0	47	50.0	94
2004		58	48.3	62	51.7	120
2005		78	45.1	95	54.9	173
2006		85	51.2	81	48.8	166
2007		88	55.4	71	44.7	159
2008		86	48.3	92	51.7	178
2009		59	46.1	69	53.9	128
2010		83	43.5	108	56.5	191
Average			48.1		51.9	1408

3. Age distribution of surgical-orthodontic patients

Age distribution had show 20-24 year-old group being the largest (53.9%), followed by 25-29 year-old group (19.3%), under 19 year-old group(18.4%), 30-34 year-old group (5.6%), 35-39 year-old group (2.1%) and over 40 year-old group (0.6%) respectively.

Table 3. Age distribution of surgical-orthodontic patients

Year	≤19		20-24		25-29		30-34		35-39		≥40		Total n
	n	%	n	%	n	%	n	%	n	%	n	%	
2001	22	23.4	54	57.4	10	10.6	5	5.3	3	3.2	0	0.0	94
2002	22	21.0	63	60.0	11	10.5	9	8.6	0	0.0	0	0.0	105
2003	11	11.7	56	59.6	13	13.8	7	7.4	7	7.4	0	0.0	94
2004	13	10.8	70	58.3	32	26.7	4	3.3	1	0.8	0	0.0	120
2005	29	16.8	88	50.9	40	23.1	12	6.9	3	1.7	1	0.6	173
2006	24	14.5	86	51.8	43	25.9	10	6.0	2	1.2	1	0.6	166
2007	33	20.8	79	49.7	38	23.9	6	3.8	2	1.3	1	0.6	159
2008	34	19.1	90	50.6	37	20.8	10	5.6	4	2.2	3	1.7	178
2009	34	26.6	60	46.9	24	18.8	6	4.7	3	2.3	1	0.8	128
2010	38	19.9	102	53.4	37	19.4	9	4.7	2	1.0	3	1.6	191
Aver.		18.4		53.9		19.3		5.6		2.1		0.6	1408

4. Distribution of patients by skeletal types and facial asymmetry

Distributions in the skeletal types of malocclusion had shown 4.2% for Class I, 12.8% for Class II, and 83.0% for Class III. Class III group comprised outstandingly most prevalent group over the time. Of all the patients who had undergone surgical-orthodontic treatment, 39.5% of the patients had facial asymmetry regardless of sagittal skeletal types. Syndromic patients such as hemifacial microsomia or cleft lip and palate were also investigated.

Table 4. Distribution of patients by skeletal types

Year	Class I		Class II		Class III	
	n	%	n	%	n	%
2001	4	4.3	11	11.7	79	84.0
2002	4	3.8	12	11.4	89	84.8
2003	4	4.3	13	13.8	77	81.9
2004	4	3.3	13	10.8	103	85.8
2005	4	2.3	26	15.0	143	82.7
2006	12	7.2	21	12.7	133	80.1
2007	7	4.4	13	8.2	139	87.4
2008	10	5.6	25	14.0	143	80.3
2009	4	3.1	25	19.5	99	77.3
2010	7	3.7	22	11.5	162	84.8
Aver.		4.2		12.8		83.0

Table 5. Distribution of patients by facial asymmetry and facial syndrome

year	Facial asymmetry		HM	CLP
	n	%	n	n
2001	27	26.5	1	9
2002	34	32.1	0	6
2003	38	40.4	0	2
2004	50	41.3	0	8
2005	58	33.3	1	7
2006	84	49.1	3	11
2007	74	45.4	0	7
2008	71	39.9	0	7
2009	59	46.1	0	2
2010	78	40.8	0	3
Aver.		39.5		

HM: hemifacial microsomia, CLP: cleft lip and palate

5. Distribution of surgical-orthodontic patients by surgical technique

2-Jaw (81.1%) surgery cases had outnumbered 1-Jaw (18.9%) surgery cases, with a general trend toward 2-Jaw surgery over the 10 year period. In 1-Jaw cases, mandibular only surgery cases were more commonly performed than maxillary only surgery cases.

Table 6. Distribution of 1-Jaw/ 2-Jaw surgery

Year	Surgery		1-Jaw		2-Jaw		Total
	(Max. only)	(Mand. only)	total		n	%	
			n	%			
2001	2	14	16	17.0	78	83.0	94
2002	1	21	22	21.0	83	79.1	105
2003	1	22	23	24.5	71	75.5	94
2004	3	26	29	24.2	91	75.8	120
2005	6	35	41	23.7	132	76.3	173
2006	8	29	37	22.3	129	77.7	166
2007	1	24	25	15.7	134	84.3	159
2008	4	16	20	11.2	158	88.8	178
2009	1	13	14	10.9	114	89.1	128
2010	1	7	8	4.2	183	95.8	191
Average				18.9		81.1	1408

Max.=maxilla

Mand.=mandible

For mandibular surgery, percentage for SSRO technique was 24.1% whereas for IVRO was 76.2%. Genioplasty was performed in patients ranging from 38 to 62% combined with ramal osteotomy in most of the cases.

Table 7. distribution of patients by types of surgery

Year	IVRO		SSRO		VNSO	Genioplasty		DO(M)	DO(m)	SO(M)	SO(m)	Total
	n	%	n	%	n	n	%	n	n	n	n	n
2001	77	81.9	15	16.0	0	42	44.7	2	2	3	4	94
2002	87	82.9	21	20.0	0	40	38.1	1	2	3	4	105
2003	69	73.4	27	28.7	0	44	46.8	0	3	1	0	94
2004	85	70.8	39	32.5	1	52	43.3	0	0	3	5	120
2005	114	65.9	63	36.4	1	80	46.2	4	1	3	11	173
2006	121	72.9	48	28.9	1	86	51.8	8	5	0	3	166
2007	120	75.5	53	33.3	1	98	61.6	5	4	3	2	159
2008	144	80.9	24	13.5	6	111	62.4	0	6	2	1	178
2009	91	71.1	28	21.9	4	79	61.7	1	3	4	1	128
2010	166	86.9	18	9.4	3	75	39.3	1	2	9	2	191
Average	76.2		24.1			49.6						1408

IVRO: intraoral vertical ramus osteotomy

SSRO: sagittal split ramus osteotomy

VNSO: vertical and sagittal osteotomy

DO(M): distraction osteogenesis on maxilla

DO(m): distraction osteogenesis on mandible

SO(M): segmental osteotomy on maxilla

SO(m): segmental osteotomy on mandible

For skeletal Class II patients over 10 years (n=181), only 13 patients underwent maxillary surgery only. For 168 patients having mandibular advancement, 55.2% had SSRO, 29.2% had IVRO, 4.8% had VNSO and 13.1% of the Class II patients had mandibular distraction osteogenesis (Some of the DO patients had 2-Jaw surgery afterwards as well).

Table 8. distribution of Class II patients by surgical technique performed for mandible advancement

Year	SSRO		IVRO		VNSO		DO(m)		Class II
	n	%	n	%	n	%	n	%	n
2001	5	45.5	5	45.5	0	0.0	1	9.1	11
2002	6	50.0	5	41.7	0	0.0	3	25.0	12
2003	10	76.9	2	15.4	0	0.0	1	7.7	13
2004	10	76.9	1	7.7	0	0.0	0	0.0	13
2005	18	69.2	4	15.4	0	0.0	2	7.7	26
2006	9	42.9	7	33.3	0	0.0	3	14.3	21
2007	7	53.8	4	30.8	1	7.7	3	23.1	13
2008	11	44.0	6	24.0	4	16.0	8	32.0	25
2009	14	56.0	6	24.0	5	20.0	3	12.0	25
2010	8	36.4	12	54.5	1	4.5	0	0.0	22
Aver.		55.2		29.2		4.8		13.1	181

IVRO: intraoral vertical ramus osteotomy, SSRO: sagittal split ramus osteotomy

VNSO: vertical and sagittal osteotomy

DO(m): distraction osteogenesis on mandible

For 1168 Class III patients, all the patients without cleft lip and palate had mandibular set-back surgery; 14.3% had SSRO, 84.0% had IVRO, and 0.5% of the class III patients had VNSO.

Table 9. distribution of Class III patients by surgical technique performed for mandible set back

	SSRO		IVRO		VNSO		Class III
	n	%	n	%	n	%	n
2001	8	10.1	69	87.3	0	0.0	79
2002	11	12.4	79	88.8	0	0.0	89
2003	13	16.9	64	83.1	0	0.0	77
2004	21	20.4	81	78.6	0	0.0	103
2005	31	21.7	108	75.5	1	0.7	143
2006	23	17.3	105	78.9	1	0.8	133
2007	26	18.7	112	80.6	0	0.0	139
2008	11	7.7	130	90.9	0	0.0	143
2009	13	13.1	83	83.8	2	2.0	99
2010	8	4.9	150	92.6	2	1.2	162
Aver.		14.3		84.0		0.5	1167

IVRO: internal vertical ramus osteotomy, SSRO: sagittal split ramus osteotomy

VNSO: vertical and sagittal osteotomy

6. Distribution of surgical-orthodontic patients by residential area

Geographic distributions showed majority of patients from the nearby areas: 55.7% from within the same city, Seoul, 34.1% of the patients were from the same province, Kyunggi-Do and 10.2% from other district of the country. Of the patients from Seoul, large number of patients lived near the hospital, from north-west and south-west area.

Table 10. Distribution of surgical-orthodontic patients by resident area

Year	North-west		North-east		South-west		South-east		Kyunggi-Do		Other regions		Total n
	n	%	n	%	n	%	n	%	n	%	n	%	
2001	25	26.6	4	4.3	21	22.3	5	5.3	32	34.0	7	7.4	94
2002	23	21.9	12	11.4	25	23.8	10	9.5	30	28.6	5	4.8	105
2003	22	23.4	3	3.2	27	28.7	7	7.4	29	30.9	6	6.4	94
2004	22	18.3	4	3.3	29	24.2	5	4.2	52	43.3	8	6.7	120
2005	37	21.4	7	4.0	45	26.0	8	4.6	55	31.8	21	12.1	173
2006	33	19.9	7	4.2	41	24.7	8	4.8	61	36.7	16	9.6	166
2007	35	22.0	6	3.8	34	21.4	12	7.5	53	33.3	19	11.9	159
2008	43	24.2	9	5.1	38	21.3	11	6.2	55	30.9	22	12.4	178
2009	23	18.0	4	3.1	33	25.8	4	3.1	45	35.2	19	14.8	128
2010	36	18.8	14	7.3	34	17.8	8	4.2	69	36.1	30	15.7	191
Aver.		21.4		5.0		23.6		5.7		34.1		10.2	1408

IV. Discussion

Socioeconomic development, change in recognition on appearance and malocclusion and rapid growth of mass media and internet have brought increase in interest on esthetics and number of orthodontic-orthognathic combined patients has been increasing. Intensive study on distribution and trends of surgical patients can help on treatment planning and diagnosis of patients.

1. Annual distribution of surgical-orthodontic patients

The annual number of the patients in year 2001 was 94 and doubled over a decade to 191 in year 2010. The percentage of orthodontic-surgical patients among the total patients visiting orthodontic department also increased from 3.2% to 8.8% over ten years. The reason for increasing number of patients is that patients are taking active roles in treatment and seeking more facial changes other than better occlusion and dental relationship. Also, with developing orthognathic surgical techniques, orthodontists recommend surgical-orthodontic treatment more to patients with confidence, and with the development of mass media patients could achieve informations on orthognathic surgery easily.

Reasons for increasing number surgical-orthodontic patients in dental college hospital would be that considerably simple orthodontic cases such as skeletal

Class I or mild Class II and Class III malocclusion patients go to local orthodontic clinics and relatively severe patients who need orthopedic treatment or surgical orthodontic treatment are referred to dental hospitals.

According to Baik et al. (1995), the number of surgical-orthodontic patients were increasing and the ratio of surgical-orthodontic patients were getting bigger among the total patients having orthodontic treatment and reached almost 10% of total orthodontic patients in mid 1990s.

In the study of trends of malocclusion visiting orthodontic local clinics, the ratio of surgical patients are similarly 10.2% of total patients having orthodontic treatments (Jung, 2009).

According to a study on distribution of patients over 19 years by treatment methods, ratio of patients with fixed appliance to surgical patients was 2:1 in 1992 whereas it changed to 1:1 in year 2002 (Im et al. 2003).

One exception to this pattern in year 2009 may be due to economic depression in that year.

2. Sex distribution of surgical-orthodontic patients

For ten years between 2001 and 2010, the sex distribution of female to male was 1.05:1 on average, ranging from 44.7% to 56.4% over the years meaning that in some years male surgical patients were outnumbered female patients but there

was no significant pattern change of sex distribution.

Women utilize medical services in general more than men, and females are more likely to receive orthodontic treatment than males (Brunelle et al., 1996). According to Im et al. (2003), sex distribution among the patients of orthodontic treatment was higher in female as 2.1:1 and also in the study by Jung (2009) the sex distribution was 73.1% in female and 26.9% in male which showed similar patterns. Also for surgical – orthodontic patients, Bailey et al. (2001) reported that women were twice as likely to seek and receive surgical -orthodontic treatment as men.

Interestingly, in this study sex distribution of surgical patients were similar and it was thought to be because male are more prone to severe skeletal discrepancy than female. Actually in study by Baik et al. (2000), cephalometric analysis of surgical patients showed that male had greater value of mandibular length, ANB angle which make camouflage treatment impossible.

3. Age distribution of surgical-orthodontic patients

Age distribution had show 20-24 year-old group being the largest (53.9%) and over 40 year old group the smallest. The proportion of patients in each age group stayed about the same over a decade.

The reason the age group between 20-24 taking the highest proportion was that orthognathic surgeries are usually held off until the growth ends as orthognathic

surgery does not have growth control effect and especially for patients having mandibular prognathic problems (Proffit et al., 2007).

Patients under the age of 19 years were hemifacial microsomia patients undergoing distraction osteogenesis or patients having psychosocial problems with their facial esthetics and willing orthognathic surgery in earlier ages after the growth is assumed finished.

The group of age between 25 to 29 is increasing in numbers because the patients of the age seek for esthetic improvement before getting jobs.

The mean age of the patients has been increasing slightly and it could be the result of increasing number of older adult patients.

4. Distirbution of surgical-orthodontic patients by skeletal types and facial asymmetry

Among the surgical-orthodontic patients, the ratio of Class III patients were the highest showing 83.0%, the Class II malocclusion group had consistently comprised the second most prevalent group(12.8%) and the Class I malocclusion group the third (4.2%). According to Baik et al. (1995), the highest skeletal group among surgical-orthodontic patients was Class III which showed 74.8% following by Class II(16.9%), and I(8.8%) respectively, showing similar result with ours. The first reason for Class III surgical patients being the largest was that the prevalence

of Class III patients is higher in Korea compare to western countries. Yu et al. (1999) reported that the prevalence of Class III were ranging from 9.4 to 19% among the total population and it was much higher than western countries (0.5~1.6%) and similar with China (14.5%)(Chan et al., 1974) or Japan (4.0~13.0%)(Lew et al., 1993).

Second reason for Class III surgery being highest is that both growth modification and camouflage are difficult and even relatively modest deviation in the Class III direction are not socially acceptable, especially in females. Existing data suggested that the worst 5% of Class II patients are surgical candidate but in contrast, for those with a skeletal Class III jaw relationship, at least the worst one third would need orthognathic surgery (Proffit et al., 1990).

Thirdly, Asians are unfavorable in modification treatment. Baik et al.(2000) reported that comparing Koreans and Caucasian patients selected for surgical correction of skeletal Class III problems, the percentage of Korean patients whose Class III relationship was primarily a result of mandibular prognathism was 48%, more than twice as high as the corresponding number for American Class III surgical patients(19.2%). On the other hand, the percentage of Korean Class III patients whose Class III relationship was a result of maxillary deficiency without prognathism was 16% compare to 19.5% of Caucasians. In other words, Asian Class III patients are more likely to be madibular prognathism than their Caucasian counterparts so it would be hard to treat Class III relationship with growth modification in early ages, resulting high ratio of Class III surgery.

Another reason that Class III malocclusion patients were high in ratio is that Class III malocclusion are perceived to be disagreeable appearance in Asian countries. Class III relationship and Class II division 1 profile are perceived to be less attractiveness and westernization of attractiveness might lead to high percentage of visit of Class III patients (Lee et al., 1994). Soh et al. (2007) agreed on facial profile preferences of Asians, as bimaxillary retrusion and normal Class I relationship Chinese profiles were judged to be the most attractive and profiles with mandibular protrusion were judged to be the least attractive.

Syndromic patients such as hemifacial microsomia or cleft lip and palate who need long time treatment periods, decreased over a decade. There are decreasing number of cleft lip and palate patients who need orthognathic surgery according to Proffit et al. (2003).

The percentages of those with facial asymmetry had broad range of percentage variation over the years, ranging from 26.5 to 49.1% but there was no appreciable pattern with times. Bailey et al. (1995) mentioned that thirty percent of all Dentofacial Clinic patients displayed some sort of facial asymmetry. Severt et al. (1997) have reported that a 40% prevalence of asymmetry often found in Class III patients, supporting the observation that mandibular asymmetry often seems to accompany excess mandibular growth.

5. Distribution of surgical-orthodontic patients by surgical technique

The patients undergoing 2-Jaw surgery is increasing, 81.1%, whereas 1-Jaw surgery patients are 18.9% over the ten years.

In the study by Baik et al. (1995), percentages of 1-Jaw surgery patients and 2-Jaw surgery patients among surgical orthodontics patients were 26.4% and 73.5% respectively. Also in the study by Baik et al.(2000), percentage of Koreans surgical patients undergoing 2-Jaw surgery among the surgical patients was 79.6% which was higher than that of white Americans (62.6%)(Bailey et al., 1995).

Baik et al. (1995) evaluated cephalometric analysis of Class III surgical patients and 47.7% among sample group Class III surgical patients had maxilla within normal position, but 79.6% of the surgical orthodontic patients underwent 2-Jaw surgery. The high incidence of 2-jaw surgery maybe that large single-jaw movements may increase the risk of relapse (Ghali et al., 2000) and excessive mandibular set back surgery may result double chin. Also large number of patients with Class III problems has a component of mandibular asymmetry. In the university of North Carolina database, more than half are reported to be asymmetric (Bailey et al., 1995). More frequently asymmetry is present in all three planes of space so two jaw surgery is the only option for the problem in many class III cases.

Among the patients undergoing 1-Jaw surgeries they mostly had surgery on mandibles. For 1408 patients having orthognathic surgery for 10 years in Yonsei

dental hospital, the patients having one jaw surgery were 235 patients, and among those only 28 patients underwent isolated maxilla surgery who were all cleft lip and palate patients. This was a very different trend from western countries because Bailey et al. (1995) have reported that among the skeletal Class III patients undergoing 1-Jaw surgery in America, only 10% of the patients underwent mandibular set back surgery only and 40% of the Skeletal Class III surgical patients underwent maxillary advancement surgery.

Surgical techniques for mandible was 24.1% for sagittal split ramus osteotomy (SSRO) and 76.2% for intraoral vertical ramus osteotomy (IVRO). In Class III patients IVRO were performed more than SSRO and reasons can be that IVRO is relatively easy technique and only a few cases have shown sensory disturbances in the mental region due to lower incidence of surgical injury to inferior alveolar nerve injury associated with IVRO(Yoshioka et al. 2008), and although rigid fixation is not used with the IVRO, current study confirmed the stability of IVRO (Chen et al. 2011).

For mandibular advancement in Class II patients, SSRO was performed in 55.2% of Class II cases, IVRO in 29.2%, and DOG in 13.1% during ten years. A specific surgeon preferred modified ramus osteotomy technique, named vertical and sagittal osteotomy (VNSO) which is a combination of SSRO and IVRO. Advantage of SSRO is thought to be larger area of bony contact that allows more rapid healing and improved stability. (Yoshioka et al. 2008)

Distraction osteogenesis (DO) is the surgical technique in which new bone formation is induced by gradual separation of bony segments after an osteotomy

and not only does the bone lengthen, there is an increase in the size of the soft tissue as well. DO can be performed in severe mandibular deficiency that require lengthening of the mandible more than 10 to 15mm but it is hard to control complex three dimensional movements so in five patients among DO patients, second orthognathic surgeries were performed later.

The hemifacial microsomia patients with underdeveloped mandible underwent distraction osteogenesis in age under 10. Also in cleft lip and palate patients, some patients underwent orthognathic surgery later again, after maxillary DO done.

Genioplasty is the most common esthetic adjunctive procedure performed for dentofacial patients. This may involve augmentation or reduction of the chin, horizontally or vertically. Genioplasty was performed in many patients ranging from 38 to 62% in each year.

Segmental surgery on maxilla and mandible was performed not in many cases but constantly done. Segmented osteotomy can be done after a LeFort I osteotomy to close premolar extraction site or widen or narrow arch width or also in isolated posterior teeth to reposition before prosthodontics etc. Anterior subapical osteotomy in the mandible commonly has been used after extraction of premolars in the hospital.

6. Distribution of surgical-orthodontics patients by residential area

Residence of the surgical patients at the time of examination was 55.7% from within the same city, Seoul, and there was a trend that patients were mainly from

nearby area: 21.4% from north-west area, 23.6% from south-west area, 5.7% from south east area and 5.0% from north east area. 34.1% of the patients were from the same province, Kyounggi-Do and 10.2% from other district of the country. The patients living within Seoul were 55.7% of the sample group and large number of patients lived near the hospital, from north-west and south-west area. It was in an agreement with the study by Hwang et al. (2001), that time taking to clinics is one of the major criteria patients choose their hospital. But a study by Oh et al. (1983) reported that 64% of visiting patients were living with 10Km of the hospital but the percentage was lower in our study and reason could be that surgical-orthodontic patients generally had severe deformity and patients considered more than convenience to reach hospital in choosing hospital. Also development of transportation and internet had brought patients seeking for specialized dentists far in the distance.

In Korea, patients seeking for esthetic improvement had brought great interest in orthognathic surgery. This study may help to understand trend and distribution of surgical-orthodontic treatment over times in Korea. But it would have been better to know the motivation that made the patients seeking for orthognathic surgery as patient's demands are getting diverse and detailed. Continuous study on distribution and trend of orthodontics and orthognathic surgery will be needed.

V. Conclusion

Distribution and trends were investigated in 1408 patients who had undergone orthognathic surgery and orthodontic treatment in Dental College Hospital of Yonsei University from January 2nd of 2001 to December 31st of 2010 and came to following conclusion.

1. The number of surgical patients has increased, and comparing 2001 with 2010, the number of patients doubled.
2. Sex distribution of patients did not have significant changes over a decade, showing 1.05:1(female: male)
3. Age distribution had shown 20-24 year-old group being the largest (53.9%), followed by 25-29 year-old group (19.3%), under 19 year-old group (18.4%), 30-34 year old group (5.6%), 35-39 year-old group (2.1%) and over 40 year old group (0.6%).
4. Distributions with regard to skeletal types had shown: 4.2% for Class I, 12.8% for Class II, and 83.0% for Class III, Class III grouping showing the largest.

5. 2-Jaw surgery (81.1%) cases had outnumbered 1-Jaw surgery (18.9%) cases, with a general trend toward 2-Jaw surgery over the 10 year period. In 1 –Jaw cases, mandibular surgery only is more commonly performed than maxillary surgery only. For mandibular surgery, percentage for sagittal split ramus osteotomy technique was 24.1% whereas for intraoral vertical ramus osteotomy technique was 76.2%.

6. Geographic distributions showed majority of patients from the nearby areas: 55.7% from within the same city, Seoul, 34.1% of the patients were from the same province, Kyounggi- Do and 10.2% from other district of the country.

From this study we could take adequate informations regarding the characteristics of surgical-orthodontic patients, and the changing trend about treatment modality.

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국 문 요 약

연세대학교 치과병원에서 치료받은 악교정 수술-교정 환자의 분포 및 경향

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악교정 수술 환자의 수가 매년 증가하는 추세에 있다. 이러한 변화는 최근 외과적 교정술의 발달과 더불어 교정의 한계를 이해하고 환자에게 보다 좋은 안모의 조화를 줄 수 있는 외과적 교정술을 추천하게 되었고 환자 역시 이에 대한 인식이 증대되었기 때문이다. 그러나 악교정 수술 환자의 정확한 분포와 경향에 관한 연구는 미비한 실정이다.

본 연구는 2001년부터 2010년까지 10년간 연세대학교 치과대학 교정과에서 수술 교정 치료를 받고 구강악안면외과에서 수술한 환자들을 조사하여 환자들의 성별, 연령별 분포와 다양한 양상을 평가하였다.

1. 수술 환자 수는 증가하는 추세이며 2001년과 2010년을 비교하였을 때 94명에서 191명으로 2배 이상 증가하였다.
2. 남자 환자와 여자 환자의 비율은 평균 1.05:1로 비율이 비슷하였으며 남녀간 수술 환자 수비율은 10년간 큰 변화를 보이지 않았다.

3. 내원환자의 연령별 분포는 20-24세 군이 53.6%로 가장 높았으며, 다음으로는 25-29세군이 19.3%, 19세 이하군이 18.4%, 30-34세군이 5.6%, 35-39세군이 2.1%, 그리고 40세 이상군이 0.6%로 나타났다.
4. III급 부정교합이 평균 83.0%, II급 부정교합군이 12.8%, I급 부정교합 군이 4.2%으로 III급 수술환자 비율이 가장 크게 나타났다.
5. 2-Jaw 수술의 비율은 평균 81.1%, 1-Jaw 수술의 비율이 18.9%로 나타났으며, 1-Jaw 수술은 감소추세이며 2-Jaw 수술은 증가 추세이다. 1-Jaw 수술에서는 하악만 수술하는 비율이 상악만 수술하는 비율보다 높았으며. 하악의 수술 방법은 SSRO가 24.1%, IVRO가 76.2%였다.
6. 55.7%이 병원이 있는 서울에서 내원하였으며 경기 지역에서 34.1%, 그 외 지역에서 10.2%의 분포를 나타내었다.

이상의 결과는 수술-교정 환자의 특성과 치료 방법의 변화 양상에 대한 참고자료가 될 수 있을 것이다.

핵심 되는 말 : 수술-교정 치료, 역학, III급 부정교합, 분포