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Comparison of one-jaw and two-jaw orthognathic surgery in patients with skeletal Class III malocclusion using data from 10 multi-centers in Korea: Part I. Demographic and skeletodental characteristics

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Objective: To investigate demographic and skeletodental characteristics of one-jaw (1J-OGS) and two-jaw orthognathic surgery (2J-OGS) in patients with skeletal Class III malocclusion. **Methods:** 750 skeletal Class III patients who underwent OGS at 10 university hospitals in Korea between 2015 and 2019 were investigated; after dividing them into the 1J-OGS (n = 186) and 2J-OGS groups (n = 564), demographic and skeletodental characteristics were statistically analyzed. **Results:** 2J-OGS was more frequently performed than 1J-OGS (75.2 vs. 24.8%), despite regional differences (capital area vs. provinces, 86.6 vs. 30.7%, $p < 0.001$). Males outnumbered females, and their mean operation age was older in both groups. Regarding dental patterns, the most frequent maxillary arch length discrepancy (ALD) was crowding in the 1J-OGS group (52.7%, $p < 0.001$) and spacing in the 2J-OGS group (40.4%, $p < 0.001$). However, the distribution of skeletal pattern was not significantly different between the two groups (all $p > 0.05$). The most prevalent skeletal patterns in both groups were hyper-divergent pattern (50.0 and 54.4%, respectively) and left-side chin point deviation (both 49.5%). Maxillary spacing (odds ratio [OR], 3.645; $p < 0.001$) increased the probability of 2J-OGS, while maxillary crowding (OR, 0.672; $p < 0.05$) and normo-divergent pattern (OR, 0.615; $p < 0.05$) decreased the probability of 2J-OGS. **Conclusions:** In both groups, males outnumbered females, and their mean operation age was older. The most frequent ALD was crowding in the 1J-OGS group, and spacing in the 2J-OGS group, while skeletal characteristics were not significantly different between the two groups.
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Key words: Class III orthognathic surgery, Class III diagnosis, Class III treatment

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INTRODUCTION

With the advancement of orthognathic surgery techniques, patients with severe skeletal discrepancies such as prognathism, retrognathism, and asymmetry can have the opportunity to undergo skeletal correction.[1,2] The most prevalent skeletal discrepancy of the patients undergoing orthognathic surgery has been reported as skeletal Class III malocclusions.[3-9] This is also demonstrated in the Korean population, which has a high prevalence of Class III malocclusions and a negative social perception of the prognathic appearance.[9-18] Therefore, Korean has become one of the countries performing orthognathic surgery extensively in patients with skeletal Class III malocclusions.

Regarding the clinical characteristics of the skeletal Class III malocclusion, complex vertical and transverse skeletal problems are usually accompanied by sagittal problems. The excessive downward growth of the maxilla resulting in a flat occlusal plane (OP) is commonly exhibited with the mandibular overgrowth.[19] In addition, transverse problems, such as chin point deviation (CPD) and OP cant, commonly occur in patients with skeletal Class III malocclusions.[19,20] Therefore, the severity of the malocclusion and skeletal discrepancy, unattractiveness of facial appearance, the effectiveness of the pre- and post-surgical orthodontic treatment, surgical risks, and financial concerns should be comprehensively evaluated before deciding orthognathic surgical modality.[21-23]

There are two common types of orthognathic surgery to correct skeletal Class III malocclusions: one-jaw orthognathic surgery (1J-OGS; mandible only approach), and two-jaw orthognathic surgery (2J-OGS; bimaxillary approach).[21] 1J-OGS usually involves the posterior setback movement of the mandible without interfering with the maxilla. This modality is less invasive and requires a lower cost than the 2J-OGS. However, the sagittally flat or transversely canted maxillary OP is hard to be corrected with 1J-OGS alone; hence it should be corrected with pre- or postsurgical orthodontic treatment.[24] In addition, the proclined maxillary incisors, which generally occur due to dental compensation, should be normalized with orthodontic treatment.[25,26] For this reason, the maxillary premolars are frequently extracted while establishing Class II molar relation with an increased mandibular setback.[26,27] On the other hand, 2J-OGS enables correction of the torque of the maxillary incisor as well as sagittally flat or transversely canted OP by a single operation.[28,29] However, this is not only more invasive and technically difficult, but also incurs a higher cost than 1J-OGS.[21-23]

Even though there have been numerous investigations regarding orthognathic surgery for patients with skeletal Class III malocclusions, their characteristics in relation to the surgical modalities have not been well documented.[3] Therefore, it would be necessary to investigate the demographic and skeletodental characteristics concerning these surgical modalities to provide qualitative and quantitative information beneficial to both clinicians and patients. In this study, the recent demographic data of orthognathic surgery patients with skeletal Class III malocclusions were obtained from 10 multi-centers nationwide. In addition, the patient's clinical characteristics involving skeletodental patterns were investigated and compared between and within the 1J-OGS and 2J-OGS groups. This retrospective study aimed to investigate the demographic and skeletodental characteristics of 1J-OGS and 2J-OGS in patients with skeletal Class III malocclusions using data from 10 multi-centers in Korea.

MATERIALS AND METHODS

Subjects

The initial samples consisted of 1,073 Korean adults who underwent orthognathic surgery at 10 University Hospitals in Korea between 2015 and 2019. They were randomly selected from the Department of Orthodontics of 10 multi-centers as follows: Seoul National University Dental Hospital (SNUDH, n = 513), Kyung Hee University Dental Hospital (KHUDH, n = 213), Kyungpook National University Dental Hospital (KNUDH, n = 55), Asan Medical Center (AMC, n = 52), Ajou University Dental Hospital (AUDH, n = 42), Korea University Anam Hospital (KUAH, n = 40), Chonnam National University Dental Hospital (CNUDH, n = 40), Wonkwang University Dental Hospital (WUDH, n = 40), Ewha Womans University Medical Center (EUMC, n = 43), and Chosun University Dental Hospital (CSUDH, n = 35).

Young Korean adults diagnosed with skeletal Class III malocclusions and whose age was above 18 years with the completion of facial growth were included. Patients whose charts were not available were excluded.

Finally, we collected the data of 750 Korean adult patients as the final samples from Department of Orthodontics in SNUDH (n = 302), KHUDH (n = 149), KNUDH (n = 44), AMC (n = 46), AUDH (n = 31), KUAH (n = 35), CNUDH (n = 38), WUDH (n = 36), EUMC (n = 34), and CSUDH (n = 35). They were divided into the 1J-OGS (n = 186; mandible only; 104 males and 82 females) and 2J-OGS groups (n = 564; 306 males and 258 females; Table 1). In addition, AMC, AUDH, EUMC, KHUDH, KUAH, and SNUDH were categorized as the capital region hospitals, while CNUDH, CSUDH, KNUDH, and WUDH were categorized as the provincial region hospitals according to their geographical locations in Korea (Figure 1).

This study was reviewed and approved by the Institutional Review Board (IRB) Committee of 10 multi-centers; including SNUDH (ERI18002), KHUDH (D19-

Table 1. Composition of the subjects

University Hospitals	Final samples	Surgical modality	
		One-jaw orthognathic surgery (1J-OGS) group	Two-jaw orthognathic surgery (2J-OGS) group
Asan Medical Center (AMC)	46 (6.1)	6 (13.0)	40 (87.0)
Ajou University Dental Hospital (AUDH)	31 (4.1)	10 (32.3)	21 (67.7)
Chonnam National University Dental Hospital (CNUDH)	38 (5.1)	20 (52.6)	18 (47.4)
Chosun University Dental Hospital (CSUDH)	35 (4.7)	33 (94.3)	2 (5.7)
Ewha University Medical Center (EUMC)	34 (4.5)	9 (26.5)	25 (73.5)
Korea University Anam Hospital (KUAH)	35 (4.7)	11 (31.4)	24 (68.6)
Kyung Hee University Dental Hospital (KHUDH)	149 (19.9)	28 (18.8)	121 (81.2)
Kyungpook National University Dental Hospital (KNUDH)	44 (5.9)	35 (79.5)	9 (20.5)
Seoul National University Dental Hospital (SNUDH)	302 (40.3)	16 (5.3)	286 (94.7)
Wonkwang University Dental Hospital (WUDH)	36 (4.8)	18 (50.0)	18 (50.0)
Total	750	186 (24.8)	564 (75.2)

Values are presented as number (%).

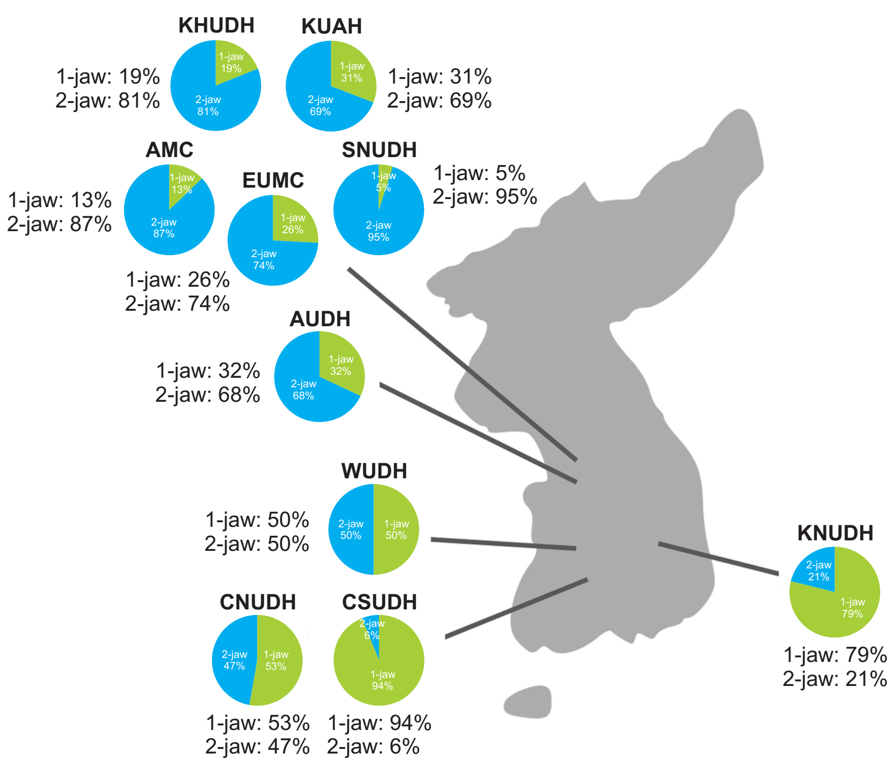

Figure 1. Frequency of 1J-OGS and 2J-OGS in 10 University Hospitals. AMC, AUDH, EUMC, KHUDH, KUAH, and SNUDH were categorized as the capital region hospitals, while CNUDH, CSUDH, KNUDH, and WUDH were categorized as the provincial region hospitals.
1J-OGS, one-jaw orthognathic surgery; 2J-OGS, two-jaw orthognathic surgery; AMC, Asan Medical Center; AUDH, Ajou University Dental Hospital; EUMC, Ewha University Medical Center; KHUDH, Kyung Hee University Dental Hospital; KUAH, Korea University Anam Hospital; SNUDH, Seoul National University Dental Hospital; CNUDH, Chonnam National University Dental Hospital; CSUDH, Chosun University Dental Hospital; KNUDH, Kyungpook National University Dental Hospital; WUDH, Wonkwang University Dental Hospital.

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007-003), KNUDH (KNUDH-2019-03-02-00), AMC (2019-0927), AUDH (AJIRB-MED-MDB-19-039), KUAH (2019AN0166), CNUDH (CNUDH-EXP-2021-001), WUDH (WKDIRB202010-06), EUMC (EUMC 2019-04-017-003), and CSUDH (CUDHIRB 1901 005). The requirement for patient consent was waived by the IRB Committee of each center.

Variables

Demographic characteristics (sex and operation age) and skeletodental characteristics were investigated. The dental patterns included overbite (normal overbite, deep bite, open bite) and maxillary arch length discrepancy (ALD) (crowding, spacing, no ALD). The skeletal patterns included vertical discrepancy (hyper-divergent, normo-divergent, hypo-divergent) and transverse discrepancy (presence of CPD or OP cant) (Table 2).

Statistical analysis

An independent t-test and a chi-square goodness of fit test were performed to compare the demographic and skeletodental characteristics between 1J-OGS and 2J-OGS groups and within each group. Binary logistic regression analysis was also performed to investigate the effects of the demographic and skeletodental characteristics on the decision for surgical modality (1J-OGS or 2J-OGS). The impact of each factor on the outcome variable was expressed as an odds ratio (OR) with a 95% confidence interval.

All statistical analysis was conducted using Statistical

Table 2. Criteria for the categorization of the dental and skeletal patterns

Dental patterns			Skeletal patterns		
Overbite	1–3 mm	Normal	Vertical discrepancy	SN-GoMe, > 39.0°	Hyper-divergent
	3 mm <	Deepbite		SN-GoMe, 29–39°	Normo-divergent
	< 1 mm	Openbite		SN-GoMe, < 29°	Hypo-divergent
Maxillary ALD	1 mm <	Crowding	Transverse discrepancy	CPD > 2°	Presence of CPD
	< 0 mm	Spacing		OP cant > 2 mm	Presence of OP cant
	0–1 mm	No ALD			

ALD, arch length discrepancy; SN, sella-nasion; Go, gonion; Me, menton; CPD, chin point deviation; OP, occlusal plane.

Table 3. Frequency of 1J-OGS and 2J-OGS in the capital and provincial regions

Region	1J-OGS group (n = 186)			2J-OGS group (n = 564)			Between the two groups
	n	%	Within group *p*-value	n	%	Within group *p*-value	*p*-value
Total (n = 750)	186	24.8	-	564	75.2		< 0.001***
Capital (n = 597)	80	13.4	< 0.001***	517	86.6	< 0.001***	< 0.001***
Province (n = 153)	106	69.3		47	30.7		

A chi-square goodness of fit test was performed.
1J-OGS, one-jaw orthognathic surgery; 2J-OGS, two-jaw orthognathic surgery.
***$p < 0.001$.

Table 4. Comparison of sex distribution within each group and between 1J-OGS and 2J-OGS groups

Sex	1J-OGS group (n = 186)			2J-OGS group (n = 564)			Between the two groups
	n	%	Within group *p*-value	n	%	Within group *p*-value	*p*-value
Male (n = 410)	104	55.9	0.107	306	54.3	0.043*	0.694
Female (n = 340)	82	44.1		258	45.7		

A chi-square goodness of fit test was performed.
1J-OGS, one-jaw orthognathic surgery; 2J-OGS, two-jaw orthognathic surgery.
*$p < 0.05$.

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Analysis System (version 12.0; SAS Institute, Cary, NC, USA), and a p-value less than 0.05 was considered statistically significant.

RESULTS

Frequency of 1J-OGS and 2J-OGS

Although 2J-OGS was more frequently performed than 1J-OGS in total (75.2 vs. 24.8%, $p < 0.001$, Table 3), there was a regional difference; 2J-OGS was more frequently performed in the capital regions, while 1J-OGS was in the provincial regions (1J-OGS vs. 2J-OGS; capital regions, 13.4 vs. 86.6%; provincial regions, 69.3 vs. 30.7%, all $p < 0.001$, Table 3, Figure 1).

Comparison of the sex distribution between the two groups and within each group

There was no significant difference in the sex distribution between the two groups (males and females; 1J-OGS group, 55.9 and 44.1% vs. 2J-OGS group, 54.3 and 45.7%; $p > 0.05$; Table 4). Within each group, males outnumbered females, which was statistically significant only in the 2J-OGS group (males vs. females; 54.3 vs. 45.7%; $p < 0.05$; Table 4).

Comparison of the mean operation age between the two groups and within each group

There was no significant difference in the mean operation age between the two groups (males and females; 1J-OGS group, 24.2 and 22.9 years vs. 2J-OGS group, 23.3 and 22.5 years; $p > 0.05$; Table 5). Within each group, the mean operation age of males was older than that of females, which was statistically significant only in the 2J-OGS group (male vs. females; 23.3 vs. 22.5 years, $p < 0.05$).

Comparison of the dental patterns between the groups and within each group

There was no significant difference in the distribution of overbite types between the two groups ($p > 0.05$,

Table 5. Comparison of the mean operation age within each group and between 1J-OGS and 2J-OGS groups

Operation age	1J-OGS group (n = 186)			2J-OGS group (n = 564)			Between the two groups
	Mean	SD	Within group *p*-value	Mean	SD	Within group *p*-value	*p*-value
Total (n = 750)	23.6	5.9	–	22.9	4.6	–	0.075
Male (n = 410)	24.2	5.3	0.121	23.3	4.1	0.040*	0.052
Female (n = 340)	22.9	6.6		22.5	5.1		0.546

An independent t-test was performed.
1J-OGS, one-jaw orthognathic surgery; 2J-OGS, two-jaw orthognathic surgery; SD, standard deviation.
$^{*}p < 0.05$.

Table 6. Comparison of the dental patterns within each group and between 1J-OGS and 2J-OGS groups

Dental pattern	1J-OGS group (n = 186)			2J-OGS group (n = 564)			Between the two groups
	n	%	Within group *p*-value	n	%	Within group *p*-value	*p*-value
Overbite							
Normal overbite	99	53.2	< 0.001*** Deep < (open, normal)	293	52.0	< 0.001*** Deep < open < normal	0.775
Open bite	76	40.9		229	40.6		
Deep bite	11	5.9		42	7.4		
Arch length discrepancy of maxilla							
No discrepancy	61	32.8	< 0.001*** Spacing < no discrepancy < crowding	152	27.0	< 0.001*** (No discrepancy, crowding) < spacing	< 0.001***
Crowding	98	52.7		184	32.6		
Spacing	27	14.5		228	40.4		

A chi-square goodness of fit test was performed.
1J-OGS, one-jaw orthognathic surgery; 2J-OGS, two-jaw orthognathic surgery.
$^{***}p < 0.001$.

Table 6). Within each group, the normal overbite was the most frequent, followed by open bite and deep bite (1J-OGS group, deep bite [5.9%] < open bite [40.9%], normal overbite [53.2%], $p < 0.001$; 2J-OGS group, deep bite [7.4%] < open bite [40.6%] < normal overbite [52.0%], $p < 0.001$, Table 6).

The distribution of maxillary ALD types was significantly different between the two groups ($p < 0.001$, Table 6). Crowding was the most frequently observed ALD type in the 1J-OGS group (spacing [14.5%] < no ALD [32.8%] < crowding [52.7%], $p < 0.001$, Table 6), while spacing was the most frequently observed in the 2J-OGS group (No ALD [27.0%], crowding [32.6%] < spacing [40.4%], $p < 0.001$, Table 6).

Comparison of the skeletal patterns between the two groups and within each group

There was no significant difference in the distribution of skeletal vertical patterns between the two groups ($p > 0.05$, Table 7). Within each group, the hyper-divergent type was the most prevalent, followed by the normo- and hypo-divergent types (1J-OGS group, hypo-divergent type [9.1%] < normo-divergent type [40.9%], hyper-divergent type [50.0%], $p < 0.001$; 2J-OGS group, hypo-divergent type [9.9%] < normo-divergent type [35.7%] < hyper-divergent type [54.4%], $p < 0.001$; Table 7).

In terms of the skeletal transverse patterns, there were no significant differences in the distribution of CPD types between the two groups ($p > 0.05$, Table 7). Within each group, the left-side CPD was the most prevalent, followed by right-side CPD, and no CPD (1J-OGS group, no CPD [19.9%] < right-side CPD [30.6%] < left-side CPD [49.5%], $p < 0.001$; 2J-OGS group, no CPD [17.2%] < right-side CPD [33.3%] < left-side CPD [49.5%], $p < 0.001$; Table 7).

There was no significant difference in the frequency of OP cant between the two groups and within each group ($p > 0.05$, Table 7), although OP cant was revealed in more than half of the patients in the 2J-OGS group and less than half of the patients in the 1J-OGS group (1J-OGS group, 49.5%; 2J-OGS group, 52.3%; all $p > 0.05$; Table 7).

Demographic and skeletodental characteristics as indicators for decision of orthognathic surgery modality

Four predictive variables including operation age, crowding, spacing, and normo-divergent pattern were selected after stepwise selection. Therefore, these variables were used in a binary logistic regression analysis. The result showed that spacing and crowding in the maxillary arch and normo-divergent skeletal pattern had a significant association with the decided surgical modality; the probability of 2J-OGS increased when the pa-

Table 7. Comparison of the skeletal vertical and transverse patterns within each group and between 1J-OGS and 2J-OGS groups

Skeletal pattern	1J-OGS group (n = 186)			2J-OGS group (n = 564)			Between the two groups
	n	%	Within group *p*-value	n	%	Within group *p*-value	*p*-value
Vertical							
Hyper-divergent (n = 400)	93	50.0	< 0.001*** Hypo < (normo, hyper)	307	54.4	< 0.001*** Hypo < normo < hyper	0.441
Normo-divergent (n = 277)	76	40.9		201	35.7		
Hypo-divergent (n = 73)	17	9.1		56	9.9		
Transverse							
CPD							
No CPD (n = 134)	37	19.9	< 0.001*** No < right < left	97	17.2	< 0.001*** No < right < left	0.645
Presence of CPD (n = 616)	149	80.1		467	82.8		
Right-side (n = 245)	57	30.6		188	33.3		
Left-side (n = 371)	92	49.5		279	49.5		
OP cant							
Absence of OP cant (n = 363)	94	50.5	0.883	269	47.7	0.274	0.501
Presence of OP cant (n = 387)	92	49.5		295	52.3		

A chi-square goodness of fit test was performed.
1J-OGS, one-jaw orthognathic surgery; 2J-OGS, two-jaw orthognathic surgery; CPD, chin point deviation; OP, occlusal plane.
***$p < 0.001$.

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Table 8. Demographic and skeletodental characteristics which demonstrated an association with the probability of 2J-OGS

Demographic and skeletodental characteristics	2J-OGS	OR	95% CI	*p*-value
Demographic	Operation age	0.973	(0.941, 1.005)	0.10
Dental patterns	Spacing in the maxilla	3.645	(2.236, 5.943)	< 0.001***
	Crowding in the maxilla	0.672	(0.462, 0.980)	0.04*
Skeletal patterns	Normo-divergent pattern	0.615	(0.429, 0.883)	0.01*

A binary logistic regression analysis was performed.
2J-OGS, two-jaw orthognathic surgery; OR, odds ratio; CI, confidence interval.
$^{*}p < 0.05$, $^{***}p < 0.001$.

tient had spacing in the maxillary arch (OR, 3.645; $p < 0.001$) and decreased when the patient had crowding in the maxillary arch (OR, 0.672; $p < 0.05$) and a normo-divergent pattern (OR, 0.615; $p < 0.05$) (Table 8).

DISCUSSION

Orthognathic surgery was indicated to correct basal bone discrepancies since all the subjects in this study had severe skeletal Class III malocclusions that could not be treated with orthodontic treatment alone.[1] 2J-OGS was performed for more than three-quarters of the study population (75.2%, Table 3). Although the dominance of 2J-OGS was coincident with the results of previous studies, the percentage of 2J-OGS in our study was somewhat higher than those reported in studies of other countries.[5-8] This could be attributed to the differences in ethnic features, since severe skeletal Class III malocclusions are more prevalent in the Asian population than in African Americans, Native Americans, and Hispanics populations.[16-18]

When compared with the previous studies on Korean patients, both similarities and differences could be noted in the results of this study. The reasons are as follows: (1) differences in the investigated time; a similar result of 2J-OGS dominance was demonstrated in a study that used comparatively recent data between 2015 and 2019,[12] while 1J-OGS dominance was observed in the studies that used old data from the late 1990s and early 2000s.[13,14] (2) the influence of the hospital's region; the data of capital region hospitals demonstrated 2J-OGS dominance (86.6%, $p < 0.001$, Table 3), while that of provincial region hospitals demonstrated 1J-OGS dominance (69.3%, $p < 0.001$, Table 3). Accordingly, previous Korean studies reported controversial results regarding the dominance of 1J-OGS and 2J-OGS between the provincial (Cheonju and Daegu) and the capital regions (Seoul).[9,12-14] The regional differences seem to originate from the culture of the metropolitan areas, which more highly value facial appearance and contains more patients with better economic situations.

There were no significant differences in demographic characteristics (sex and mean operation age) between the 1J-OGS and 2J-OGS groups (all $p > 0.05$, Tables 4 and 5). Within each group, the males outnumbered females, and their mean operation age was older (Tables 4 and 5). The result of male dominance was different from those of several previous studies,[3-11] and similar to a recent Korean study.[12] This male dominance might be due to the increased demand by males for the orthognathic surgery, who were previously unconcerned with their facial appearance. In addition, the older mean operation age of males than females could be because of the obligatory military service in Korea and the late completion of facial growth.

This study revealed statistically significant differences in sex distribution and mean operation age within the 2J-OGS group only (male and female, 54.3 and 45.7%, $p < 0.05$, Table 4; 23.3 and 22.5 years, $p < 0.05$, Table 5), although these differences might not be clinically significant (8.6% and 0.8 years). These significances might result from the difference in sample size between the 1J-OGS (n = 186) and the 2J-OGS groups (n = 564). Since a larger sample size results in more substantial statistical power to detect small differences,[29] caution is required in interpreting the statistical significance in the 2J-OGS group. In this study, this discrepancy between group sizes was inevitable since 2J-OGS was more extensively performed than 1J-OGS.

Among the dental characteristics, only maxillary ALD demonstrated a significant difference between the 1J-OGS and 2J-OGS groups. Crowding was the most frequently observed characteristics in the 1J-OGS group (52.7%, $p < 0.001$, Table 6), while spacing was the most frequent in the 2J-OGS group (40.4%, $p < 0.001$, Table 6). Furthermore, binary logistic regression analysis revealed that crowding and spacing in the maxillary arch significantly influenced the decision of the orthognathic surgery modality. The probability of 2J-OGS decreased when the patient had crowding in the maxillary arch

(OR, 0.672; $p < 0.05$; Table 8) and increased when the patient had spacing in the maxillary arch (OR, 3.645; $p < 0.001$; Table 8). This implies that 1J-OGS was chosen in patients with crowding in the maxillary arch since the proclined incisor and dental crowding could be concurrently resolved through tooth extraction while avoiding the invasive maxillary surgery.[25,26] In contrast, 2J-OGS was chosen in patients with spacing in the maxillary arch, for whom tooth extractions are generally contraindicated.[25,26] Therefore, the maxillary surgery involving posterior impaction might be performed to normalize the flat OP and the proclined maxillary incisors.[27]

The normal overbite (1J-OGS and 2J-OGS; 53.2 and 52.0%; Table 6) and hyper-divergent skeletal pattern (1J-OGS and 2J-OGS; 50.0 and 54.4%; Table 7) were the most frequently observed characteristics in both groups, while the deep bite (1J-OGS and 2J-OGS; 5.9 and 7.4%; Table 6) and hypo-divergent pattern (1J-OGS and 2J-OGS; 9.1 and 9.9%; Table 7) were least frequently observed. These mean that skeletal Class III with long face is the most prevalent, and extrusive dental compensation of the anterior teeth commonly occurred in these patients.

In both groups, more than 80% of the patients had CPD (1J-OGS and 2J-OGS; 80.1 and 82.8%; Table 7) and approximately 50% of the patients had OP cant (1J-OGS and 2J-OGS; 49.5 and 52.3%; Table 7), which could mean that approximately 30% of CPD manifests without OP cant. Therefore, in the patients with CPD and without OP cant, 1J-OGS with a rotational or bilateral differential mandibular setback might be indicated to correct the transverse discrepancies.[30]

Although some meaningful results were observed in this study, careful clinical implementation is needed due to the following limitations: (1) The geographic distribution of the hospitals was not fully equalized because some regional hub dental hospitals in the southeastern region in Korea were not included; (2) The sample sizes in each center were not the same. Since the subjects of the capital region comprised more than three-quarters of the total subjects, the larger sample size of the capital region could have affected the results. (3) A quantitative evaluation could not be performed because all the variables were categorical ones except operation age. This was inevitable because various analytical methods and cephalometric X-ray settings were used in the 10 centers. (4) All the subjects in this study were collected from the Department of Orthodontics in the university hospitals alone; none were included from the Department of Oromaxillofacial Surgery in the university hospitals nor private practice. Therefore, in future studies, it would be necessary to perform sophisticated statistical analyses guaranteeing regional and institutional equality, and include systematic data involving the orthodontic and surgical aspects.

CONCLUSION

- 2J-OGS was performed for more than three-quarters of the study population, despite regional differences.
- In both the 1J-OGS and 2J-OGS groups, males outnumbered females, and their mean operation age was older than females.
- The most frequent ALDs were crowding in the 1J-OGS group and spacing in the 2J-OGS group, while skeletal characteristics were not different between the 1J-OGS and 2J-OGS groups.
- Spacing in the maxillary arch increased the probability of 2J-OGS, while crowding in the maxillary arch and normo-divergent pattern decreased the probability of 2J-OGS.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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