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Investigate the oral health impact and quality of life on patients with malocclusion of different treatment needs

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ABSTRACT

Background: This study compared oral health impacts and QoL among patients with different malocclusion types and a normal population by using self-report questionnaires.
Methods: In this cross-sectional study, 214 healthy adults were divided into 3 groups: (1) Normal, control group; (2) ORTHO, patients who received orthodontic treatment; and (3) OGS group, patients who received orthognathic surgery (OGS). The timing of measurement were at the initial stage of the orthodontic therapy and before surgery. Two questionnaires and one additional item were used: the 36-item Short Form Health Survey (SF-36) for QoL, the 14-item Oral Health Impact Profile (OHIP-14) for oral health-related QoL (OHRQOL) and one additional item for aesthetic evaluation. Descriptive and inferential statistical analyses were used to compare the 3 groups. The effects of 3 malocclusion types, gender, age, and facial asymmetry in the OGS group were also evaluated.
Results: The ORTHO and OGS groups had higher negative impacts than did the Normal group in the OHIP-14, but not much difference in the SF-36. The item of aesthetics related to oral health impact was the lowest in the OGS group. The patients in the ORTHO group with a Class II malocclusion were most dissatisfied in the SF-36 and OHIP-14. In the OGS group, the women dissatisfied in the OHIP-14 and the aesthetic. The older patients had higher negative impacts in the OHIP-14 than the younger patients. The patients with facial asymmetry did not suffer higher negative impacts than did the patients with a symmetrical face in the SF-36 and OHIP-14.
Conclusions: The majority of the patients who required orthodontics or OGS reported a higher negative impact in the OHIP-14 compared with the normal controls, but not in the

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SF-36. Class II malocclusion suffered from highest psychological stress and aesthetic sensitivity than the other two subgroups in the ORTHO group.

At a glance of commentary

Scientific background on the subject

We evaluated the Quality of Life (QoL) by 36-item Short Form Health Survey (SF-36) and Oral Health-related Quality of Life (OHRQOL) by 14-item Oral Health Impact Profile (OHIP-14) among different malocclusion types and a normal population. The OHIP-14 is more effective than the SF-36 for reporting information regarding oral function and facial esthetics.

What this study adds to the field

The paper reported the QoL of individuals with different types of malocclusion and patients' characteristics. The current QoL assessment could present as a baseline standard to be compared in patients require subsequent orthodontic and orthognathic interventions. Specific patient groups should be cautious concerning the relation between QoL and treatment needs.

The factors that motivate individuals to undergo orthodontic treatment and orthognathic surgery (OGS) are oral health improvement, functional demands, and dentofacial aesthetics [1]. Treatment outcomes can be objectively evaluated using craniofacial image measurements, jaw motion analysis, electromyography, and various dentofacial aesthetic scales [2]. Recently, patients' subjective experience of surgical results has attracted the attention of many researchers and clinicians [3]. Patient-reported outcome assessments are on the rise and more emphasized currently. Simmons suggested that the quality measurement of clinical care should be based on patients' statements and that the final goal of this assessment is to improve patients' quality of life (QoL) [4].

QoL was defined in 1993 by the World Health Organization (WHO) as an individual's perception of their position in life in the context of culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns [5]. Oral health-related QoL (OHRQOL) was recognized by the WHO in 2003 as a principal part of the Global Oral Health Program [6]. Malocclusion and its treatment both affect OHRQOL [7]. The contents of QoL questionnaires in social science research mainly focus on collecting and analyzing the opinions, feelings, evaluations, attitudes, and behaviors of patients.

Several studies have investigated the effects of orthodontic treatment and OGS on patients' QoL by using questionnaires. In a systematic review, Soh et al. indicated that patients' QoL significantly improved after OGS. Furthermore, they highlighted 3 questionnaires to evaluate patients' QoL [8]: the Short Form Health Survey (SF-36) [9–11], the Oral Health Impact Profile (OHIP)-14 [12,13], and the Orthognathic Quality of Life Questionnaire (OQLQ) [14,15].

The SF-36 is a generic QoL questionnaire; therefore, it is widely used in various medical specialties and fields. However, for QoL in relation to some specific diseases, its discrimination is less ideal [9–11].

The OHIP-14 is a 14-item questionnaire. The OHIP was developed as a generic oral health tool by Slade and Spencer and initially included 49 questions (OHIP-49) [13]. A short form with 14 questions was subsequently developed by Slade. The OHIP-14 not only accounted for 94% of variance in the OHIP-49 but also had high reliability [12].

The OQLQ was developed by Cunningham as a condition-specific tool. The OQLQ has 22 items that specifically assess the effect of patients' dentofacial deformity on their QoL [14,15].

Most of the literatures compared the treatment effects with patients' QoL; however, researches explored the different types of malocclusion and patients' characteristics related to their QoL were limited. The aim of this study was to explore the types of malocclusions requirements for orthodontic and OGS related to subjective. This study compared the oral health impact and QoL among different malocclusion types and a normal population by using self-report questionnaires.

Methods

Study design

This cross-sectional study was conducted between August 1, 2015, and April 30, 2018, and comprised 278 Taiwanese individuals aged older than 18 years. The contents of the questionnaire fill out were screened, 214 valid questionnaires were included for analysis. The questionnaires with identical answers appeared in more than 10 consecutive questions or similar questions with extreme variation in answers were excluded. These adults were divided into 3 groups as follows.

(1) Normal group (n = 75): adults who subjectively have no treatment needs for orthodontic treatment and OGS. There was no medical evaluation on individual's malocclusion. The selection of the group was based on individual's subjective needs of treatment.

(2) ORTHO group (n = 69): adult patients who received full-mouth orthodontic therapy at the initiation stage of treatment; none of them required OGS and the borderline cases also had been excluded.

(3) OGS group (n = 70): adult patients with skeletal malocclusion with dentofacial deformities who required OGS; the time point of evaluation was before surgery. The
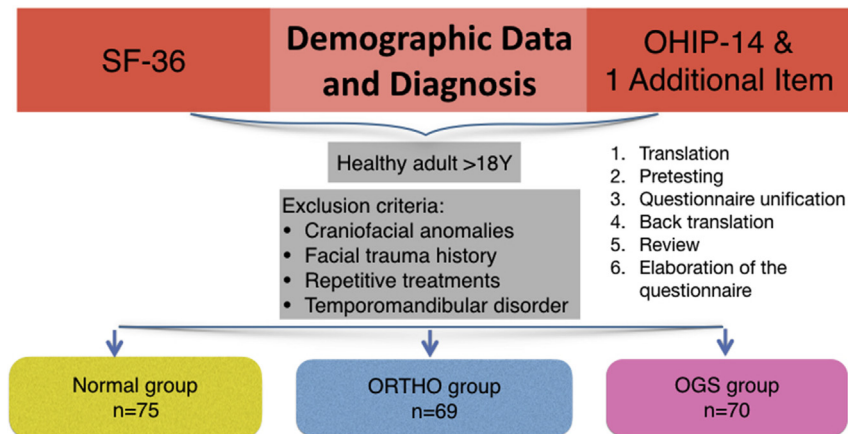
Fig. 1 The flow chart of the study.

exclusion criteria included facial trauma, congenital craniofacial anomalies, any temporomandibular disorder and repetitive treatments. All participants completed the SF-36 and OHIP-14 and one additional item [Fig. 1].

This study was approved by the Institutional Review Board and Medical Ethics Committee of Chang Gung Memorial Hospital (No. 103-7642A3), and all participants signed an informed consent agreement. The study followed the guidelines of the Helsinki Declaration.

Data collection and instruments

The data collection consisted of 2 parts: patient-reported assessment and physician assessment.

For the patient-reported assessment, patients were asked to fill out self-assessment questionnaires. The items on individual background information included gender, age, educational level, marital status, and occupation.

The SF-36 is a 36-item questionnaire corresponding to 8 health domains and is divided into 2 components: the physical component (PCS) includes physical functioning, role physical, bodily pain, and general health and the mental component (MCS) includes vitality, social functioning, role emotional, and mental health. The score ranges from 0 to 100, with 0 being extremely poor health and 100 being completely healthy. The Taiwanese version of the SF-36, which was translated by Lu RJ et al., in 2003, was used in this study [16].

The OHIP-14 has 7 domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Scores are recorded on a 5-point Likert scale. Respondents were asked to indicate their responses on a 5-point Likert scale, with the overall score ranging from 0 (best) to 56 (poor). Each domain consists of 2 questions, with a score ranging from 0 to 8 per domain. The OHIP-14 has been translated to various languages and widely used.

No Taiwanese version of the OHIP-14 was available at the inception of the study. Therefore, the entire OHIP-14 questionnaire was translated into Taiwanese by 2 expert clinicians and integrated by the third expert to complete the first draft of the Taiwanese version. The resulting document was then reversely translated by another 2 expert clinicians and integrated by the third expert to complete the English version of reverse translation. This back-translation version of the questionnaire was compared with the original OHIP-14 to ensure that any difference in meaning and verbiage were minimized. A trial run to test the reliability and validity, after which the final version of the Taiwanese edition was completed.

Aesthetics is a major concern in orthodontic treatment and orthognathic surgery. One question, "have you been dissatisfied with your facial aesthetics because of problems with your teeth, mouth or denture" was not included in OHIP-14. The question was added for aesthetic evaluation in the study. The score ranges from 0 (never) to 4 (fairly often) in OHIP-14.

The physician assessment, diagnosis, treatment modalities, and basic oral function evaluation were conducted by the same expert orthodontist. The ORTHO group was distinguished into Angle Class I, Class II, and Class III malocclusions based on first molar relation. The OGS group was classified into skeletal Class I, Class II, and Class III based on the relative position of participants' jaw bones. The presence of facial asymmetry was defined as deviation (horizontal chin deviation more than 4 mm) and nondeviation [17].

Statistical analysis

Descriptive statistics were performed to describe and compare the characteristics of the data. The summary of the scores of every domain for the SF-36 and OHIP-14 was measured according to their scoring algorithms. A one-way ANOVA further compared differences among the 3 groups and 3 malocclusion types. Student's t test was conducted to examine the effects of gender, age, and facial asymmetry on the OGS group. Spearman's correlation coefficient was used to evaluate the inter-relationship between the SF-36, OHIP-14 and the aesthetic question. The level of significance was set at 5% and considered significant when $p < 0.05$. The Statistical Package for Social Sciences (SPSS version 22.0; SPSS, Chicago, IL) was used to perform the analysis.

Table 1 Characteristics of the 3 groups (with percentages or standard deviations).

Variable	Normal	ORTHO	OGS
	(n = 75)	(n = 69)	(n = 70)
Gender (%)			
Women	37 (49.3)	48 (65.5)	45 (64.3)
Men	38 (50.7)	21 (34.5)	25 (35.7)
Mean age (SD)	24.20 (5.71)	25.49 (6.51)	23.36 (4.62)
Age (%)			
>=30 y/o	9 (12)	18 (26.1)	7 (10)
<30 y/o	66 (88)	51 (73.9)	63 (90)
Marriage (unmarried) (%)	70 (93.3)	63 (91.3)	69 (98.6)
Types of malocclusions (%)[a,b]			
Class I		32 (46.4)	3 (4.3)
Class II		26 (37.7)	9 (12.9)
Class III		11 (15.9)	58 (82.9)
Facial asymmetry (%)[c]			
Deviation			32 (45.7)
Nondeviation			38 (54.3)

[a] Types of malocclusions in the ORTHO group was based on first molar relation.
[b] Types of malocclusions in the OGS group based on the relative position of jaw bones.
[c] Facial asymmetry was defined as deviation (horizontal chin deviation more than 4 mm) and nondeviation.

Results

All 214 participants recruited in the study completed the questionnaires. The demographic information of the patients in the Normal, ORTHO, and OGS groups is listed in [Table 1].

Generic health-related QoL in the 3 groups

In the SF-36, the result was demonstrated in [Table 2]. The patients in the OGS group experienced lower pain than those did in the ORTHO groups. The subjects in the Normal group suffered more emotional problem than in the OGS group.

Oral health-related QoL in the 3 groups

The scores of the OHIP-14 overall and 7 domains and the thoughts regarding oral health-related QoL significantly differed among the 3 groups [Table 3]. Compared with the patients in the Normal group, the patients in the ORTHO and OGS groups were significantly less satisfied with their oral health-related QoL ($p < 0.001$).

Oral health-related aesthetics in the 3 groups

The patients in the ORTHO and OGS groups were significantly more sensitive to aesthetics related to oral health than did those in the Normal group ($p < 0.001$); the scores of the OGS group considerably exceeded those of the ORTHO group [Table 4].

Differences among the different types of malocclusions

In the ORTHO group (n = 69), there were 32, 26, and 11 patients had Angle Class I, Class II, and Class III malocclusions, respectively [Table 1]. The patients with a Class I malocclusion had better QoL in the SF-36 than the patients did with a Class II malocclusion ($p < 0.05$; [Table 5]).

Among the overall scores of the OHIP-14, the patients with a Class II malocclusion had poorer QoL than did those with a Class I malocclusion in the domains of psychological discomfort, psychological disability and handicap ($p < 0.05$). A significant difference ($p < 0.05$) was also observed in the aesthetic question. The patients with a Class II malocclusion were evidently more sensitive to the influence of oral health on aesthetics than the patients did with a Class I malocclusion.

In the OGS group (n = 70), there were 3, 9, and 58 patients presented with skeletal Class I, skeletal Class II, and skeletal Class III malocclusions, respectively [Table 1]. In the SF-36, the patients with a Class III malocclusion had better QoL than did those with a Class I malocclusion in the social functioning ($p < 0.01$). However, no significance was observed in the OHIP-14 among the different malocclusion types in the OGS group.

Influence of gender

The Normal group (n = 75) comprised 38 men and 37 women. The ORTHO group (n = 69) comprised 21 men and 48 women. The OGS group (n = 70) comprised 25 men and 45 women [Table 1].

Table 2 Comparison of the mean scores in the SF-36 among the 3 groups.

SF-36 [0—100]	Normal (SD)	ORTHO (SD)	OGS (SD)	p-value	scheffe
SF-36 overall	75.94 (12.53)	78.14 (10.66)	78.92 (10.51)	NS	
PCS	81.44 (6.13)	83.24 (4.95)	84.05 (5.29)	NS	
MCS	70.04 (7.52)	72.67 (7.23)	73.23 (7.21)	NS	
Physical functioning	95.13 (1.92)	96.90 (2.37)	97.03 (1.78)	0.05	
Role physical	90.89 (0.90)	93.47 (0.81)	94.50 (0.69)	NS	
Bodily pain	80.11 (1.33)	77.89 (1.58)	84.05 (1.30)	0.008	OGS > ORTHO
General health	69.88 (3.81)	73.64 (2.82)	72.80 (3.26)	NS	
Vitality	65.58 (3.32)	66.58 (3.19)	68.70 (2.92)	NS	
Social functioning	79.60 (1.21)	83.47 (1.19)	83.86 (1.27)	NS	
Role emotional	80.45 (1.32)	88.67 (1.09)	90.95 (1.00)	0.004	OGS > Normal
Mental health	68.31 (3.44)	70.92 (3.23)	70.23 (3.48)	NS	

Abbreviations: PCS: Physical Health Component; MCS: Mental Health Component.

Table 3 Comparison of the mean scores in the OHIP-14 among the 3 groups.

OHIP-14	Normal (SD)	ORTHO(SD)	OGS(SD)	p-value	scheffe
OHIP-14 score [0–56]	9.73 (6.91)	18.13 (8.02)	19.23 (9.91)	0.000	ORTHO > Normal OGS > Normal
Functional limitation [0–8]	1.24 (1.68)	2.53 (1.35)	2.57 (1.74)	0.000	ORTHO > Normal OGS > Normal
Physical pain [0–8]	1.27 (1.34)	3.94 (1.65)	3.66 (1.85)	0.000	ORTHO > Normal OGS > Normal
Psychological discomfort [0–8]	1.87 (1.78)	2.92 (1.78)	3.49 (2.26)	0.000	ORTHO > Normal OGS > Normal
Physical disability [0–8]	1.13 (1.30)	2.99 (2.15)	2.86 (2.03)	0.000	ORTHO > Normal OGS > Normal
Psychological disability [0–8]	1.57 (1.62)	2.61 (1.78)	3.13 (2.06)	0.000	ORTHO > Normal OGS > Normal
Social disability [0–8]	0.76 (1.09)	1.59 (1.43)	1.79 (1.68)	0.000	ORTHO > Normal OGS > Normal
Handicap [0–8]	0.91 (1.02)	1.54 (1.18)	1.74 (1.47)	0.000	ORTHO > Normal OGS > Normal

Table 4 Comparison of the mean scores of the Aesthetic question among the 3 groups.

	Normal (SD)	ORTHO(SD)	OGS(SD)	p-value	scheffe
Aesthetic [0–4]	0.87 (1.06)	1.48 (1.12)	2.54 (1.24)	0.000	OGS > ORTHO > Normal

No significant differences in the influence of gender were observed in the SF-36 or OHIP-14 and the aesthetic question in the ORTHO group.

In the OHIP-14, the women in the OGS group were influenced more by psychological discomfort ($p < 0.05$) and they were significantly more sensitive to aesthetics due to oral health than the men ($p < 0.01$; [Table 6]).

Facial asymmetry influence in the OGS group

The presence of facial asymmetry was defined as deviation (horizontal chin deviation more than 4 mm) and nondeviation [18]. In the OGS group (n = 70), 38 patients presented with nondeviation and 32 patients with deviation [Table 1].

In the SF-36, the patients with deviation were less influenced by role emotional problems and had better general health, vitality, social functioning, and mental health than the patients with nondeviation ($p < 0.05$; [Table 6]).

In the OHIP-14, the patients with deviation suffered lower negative impacts in the domains of functional limitation, physical pain, psychological discomfort and psychological disability than did the patients with a symmetrical face ($p < 0.05$; [Table 6]).

Age influence in the OGS group

In the OGS group (n = 70), 7 patients were 30 years or older and 63 patients were younger than 30 years [Table 1].

In the OHIP-14, the older patients were influenced by oral health in regard to social disability ($p < 0.05$; [Table 6]).

Correlation between the SF-36, OHIP-14 and aesthetic question

The total number of the patients in this study was 214. According to the data, the score of SF-36, OHIP-14, and the

Table 5 Comparison of the mean scores of the different types of malocclusions in the ORTHO group and OGS group.

ORTHO group[a]	Class I (SD)	Class II (SD)	Class III (SD)	p-value	scheffe
SF-36 [0–100]					
SF-36 overall	80.45 (8.19)	75.60 (11.54)	77.42 (12.10)	0.037	I > II
OHIP-14					
OHIP-14 [0–56]	15.25 (7.82)	22.12 (7.08)	17.09 (7.32)	0.003	II > I
Psychological discomfort [0–8]	2.34 (1.66)	3.69 (1.76)	2.82 (1.60)	0.014	II > I
Psychological disability [0–8]	1.93 (1.68)	3.46 (1.70)	2.55 (1.51)	0.004	II > I
Handicap [0–8]	1.19 (1.06)	2.00 (1.32)	1.45 (0.82)	0.030	II > I
Aesthetic [0–4]	1.19 (0.97)	1.96 (1.28)	1.18 (0.75)	0.018	II > I
OGS group[b]	**Class I (SD)**	**Class II (SD)**	**Class III (SD)**	**p-value**	**scheffe**
SF-36 [0–100]					
Social functioning	63.30 (2.08)	82.22 (1.02)	85.17 (1.58)	0.011	III > I

[a] Types of malocclusions in the ORTHO group was based on first molar relation.
[b] Types of malocclusions in the OGS group based on the relative position of jaw bones.

Table 6 Comparison of the mean scores of the influence in the OGS group (gender, facial asymmetry and age).

Gender influence	Men (SD)	Women (SD)	T-value	p-value
OHIP-14				
Psychological discomfort [0–8]	2.72 (1.88)	3.91 (2.35)	2.17	0.033
Aesthetic [0–4]	2.00 (1.00)	2.84 (1.26)	2.88	0.005
Facial asymmetry influence	**Non-deviation(SD)**	**Deviation (SD)**	**T-value**	**p-value**
OHIP-14				
OHIP-14 overall [0–56]	22.18 (9.89)	15.72 (8.87)	−2.86	0.006
Functional limitation [0–8]	3.18 (1.78)	1.84 (1.39)	−3.45	0.001
Physical pain [0–8]	4.10 (1.81)	3.12 (1.77)	−2.28	0.026
Psychological discomfort [0–8]	4.18 (2.38)	2.66 (1.81)	−2.98	0.004
Psychological disability [0–8]	3.66 (2.18)	2.50 (1.74)	−2.42	0.018
SF-36 [0–100]				
SF-36 overall	75.97 (9.67)	82.43 (10.37)	3.91	0.000
PCS	82.32 (5.19)	86.12 (5.06)	2.32	0.023
MCS	69.17 (6.77)	78.47 (6.11)	4.19	0.000
General health	69.68 (3.17)	76.52 (3.16)	2.25	0.028
Vitality	83.71 (2.73)	74.63 (2.52)	4.14	0.000
Social functioning	79.70 (1.15)	88.80 (1.24)	3.15	0.002
Role emotional	85.50 (1.14)	97.33 (0.63)	3.30	0.002
Mental health	66.77 (4.00)	74.37 (3.00)	2.73	0.008
Age influence	**>=30 (SD)**	**<30 (SD)**	**T-value**	**p-value**
OHIP-14				
Social disability	3.43 (2.149)	1.60 (1.53)	−2.87	0.005

Facial asymmetry was defined as deviation (horizontal chin deviation more than 4 mm) and nondeviation; PCS: Physical-Health Component Scores; MCS: Mental-Health Component Scores.

Table 7 Correlation between the SF-36, OHIP-14 and Aesthetic scores.

	SF-S6	SF-36 PCS	SF-36 MCS	OHIP-14	Aesthetic
SF-S6 overall	1	0.855***	0.921***	−0.297***	−0.166*
SF-36 PCS		1	0.587***	−0.241***	−0.09
SF-36 MCS			1	−0.284***	−0.193*
OHIP-14				1	0.634**
Aesthetic					1

Abbreviations: PCS: Physical-Health Component Scores; MCS: Mental-Health Component Scores.

*Significant at the level $p < 0.05$.
**Significant at the level $p < 0.01$.
***Highly significant at the level $p < 0.001$.

aesthetic question were highly negatively correlated ($p < 0.05$). Except for the relationship of SF-36 PCS and the aesthetic question. The higher negative impact in the OHIP-14, (higher scores in the OHIP-14), the worse quality is the SF-36 (lower scores in the SF-36; [Table 7]).

Discussion

In this cross-sectional study, the mean age of the Taiwanese patients who underwent orthodontic treatment and OGS was 25.5 and 23.36 years, respectively. The number of the women who consented to receive the treatment was twice than that of the men. More than 90% of the participants did not marry during treatment.

General questionnaires can be used to survey intercultural, cultural, and disease metrics, but they might not valid for an accurate measurement of specific health-related QoL. By contrast, specific questionnaires do not provide an accurate measurement of comprehensive and holistic QoL. Studies have included at least one questionnaire that was evenly combined with 2–3 questionnaires to achieve a specific objective.

According to the conditions of this study's design, we selected 2 questionnaires, the SF-36 to survey generic health and the OHIP-14 as a specific health-related questionnaire, to investigate the impact of oral health on QoL. A question related to the influence of aesthetics on oral health was added. The OQLQ is a condition-specific tool used to investigate a patient's need for OGS and was not adopted in this study, because it was not an appropriate method of detection for the Normal and ORTHO groups.

The ORTHO and OGS group didn't have a lower score compared to the normal group in the SF-36, but these two groups really suffered from higher negative impact in the OHIP-14. This result is similar to the report of Lee et al. that indicated no significant differences between the case group (with a dentofacial deformity that required OGS) and the control group (without a dentofacial deformity) in the SF-36 questionnaire's QoL scores [19]. Even in the psychological status, the orthognathic patients did not differ significantly from the control subjects [20].

Regarding the influence of oral health on aesthetics, the patients in the OGS group were significantly more sensitive to aesthetic related to oral health than those in the other 2 groups. In a study that explored the influence of oral health on aesthetics using the OQLQ questionnaire, the participants also felt a greater negative impact on aesthetics before surgery, and the patients who required

OGS had the greatest improvement in aesthetics after surgery [21—23].

In this study, the patient in the ORTHO group with an Angle Class II malocclusion suffered from highest psychological stress and aesthetic sensitivity than the other 2 subgroups. Most patients with an Angle Class II malocclusion in the ORTHO group had convex facial profiles, which were frequently associated with protrusive upper incisors, a large overjet, an open bite, and crowding in both arches. By contrast, the characteristics of an Angle Class III malocclusion are a concave facial profile, a prominent chin, a negative overjet, an anterior crossbite, and the poorest masticatory efficiency and ability [24]. The concave facial profile was thought less attractive than convex facial profile by laypeople and dental professionals in the Asian [25]. However, using the self-report questionnaire, the opposite phenomenon was revealed.

Studies have explored the influence of different malocclusion types undergoing orthognathic surgery. There are no significant differences between the Class II and Class III malocclusion groups before surgery in Finland and Korea [26,27]. Palomares et al. used the OQLQ questionnaire and found the characteristics of a concave profile and Angle Class III malocclusion were associated with a negative impact on the condition-specific health-related QoL in Brazil [21]. Baherimoghaddam et al. indicated that patients with a Class III malocclusion had higher negative impacts than that of patients with a Class II malocclusion in the OHIP-14 in Iran [28]. Kurabe et al. used the OHIP-J54 questionnaire and observed that patients with a skeletal Class II malocclusion experienced higher negative effects than did patients with a skeletal Class III malocclusion in Japan [29]. Currently, no clear evidence about QoL and OHRQOL among the types of malocclusions is available because a few comparative studies have been conducted and these studies have reported dissimilar results.

The dissimilar results from different studies might come from the prevalence of epidemiology. The prevalence of Class III malocclusion varies among populations [30]. Chinese populations have the higher incidence of Class III malocclusions compared with Caucasians [31]. It seems Class II malocclusion is more socially acceptable than Class III in Caucasians. In this study, no significance in the OHIP-14 among the different malocclusion types in the OGS group was observed. It could be assumed that the patients who sought OGS have enough skeletal discrepancy and facial asymmetry. They have serious feelings about function and aesthetics, regardless of which type of malocclusion.

In this study, the expectation of the women for OGS was greater than that of the men. Studies have also reported that women experienced more negative impacts than men before surgery [21,26,32]. However, there was no significant difference between women and men in this regard in the study of Kurabe et al. [29] Yu et al. reported that the major motivational factor for patients in China to undergo OGS was to improve their facial appearance. The women wanted more improvement in facial appearance than men. By contrast, compared with women, men paid more attention to occlusion [33].

In the literature review, horizontal chin deviation of 2 mm to the right and 4 mm to the left could not be clearly detected clinically [17]. Therefore, 4 mm chin deviation was defined as facial asymmetry. In the OGS group, the deviation subgroup did not experience a higher negative impact than did the nondeviation subgroup. Although facial symmetry is one criterion for receiving an OGS plan for orthodontics, it might not be one of the factors that affect patients' QoL. Jung's study indicated that the influence of facial asymmetry on OQLQ and Rosenber's self-esteem scale was not significant [34].

In the OGS group, the older subgroup had higher social disability than the younger subgroup. This can be interpreted that the younger patients look forward to solve their problems by orthognathic surgery before establishment of their identity [29]. However, Brunault et al. found that younger patients had poorer psychological and physical QoL on the WHOQOL-BREF questionnaire. Younger patients suffered from various stresses, such as their concerns about the opinions from their friends and family [35]. Bortoluzzi et al. pointed out that the increase of age produces more limitations due to physical health in the SF-36, but no significant difference in the OHIP-14 [36].

The limitation of this study, the participants in the three groups were similar in age, socioeconomic and marital status. However, the number of different types of malocclusion in the OGS group was not even, the number of the patients with a skeletal Class III malocclusion was higher than the other two types in this study. This also reflects that the main patient who needs OGS in Taiwan is skeletal Class III malocclusion with mandibular prognathism. The gender distribution was not equal, women's needs for treatment are higher than men's in both ORTHO or OGS groups.

In conclusion, the study design is to compare the case group with the control group, and the timing of measurement were at the initial stage of the orthodontic treatment and before surgery. The SF-36 score didn't show significant difference among different treatment needs of patients. The scores in the SF-36 and OHIP-14 had a highly negative correlation ($p < 0.05$) in this study. The SF-36 questionnaire could be a reference for a longitudinal study to compare patients' improvement after surgery. However, OHIP-14 is an efficient questionnaire on oral health-related QoL that can detect the differences. The majority of the patients who required orthodontics or OGS reported the oral health-related QoL were poorer, but the general health and psychological aspects didn't show much different compared with the normal controls. By using self-reported questionnaire, the patient with Class II malocclusion suffered from highest psychological stress and aesthetic sensitivity than the other two subgroups in the ORTHO group.

Conflicts of interest

There was no conflict of interest related to individual authors' commitments and any project support.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bj.2019.05.009.

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