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## **Assessment of the quality of life of orthodontic and surgical patients. Analysis of the factors that motivate the initiation of treatment within the masticatory system**

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### **Abstract**

#### **Introduction**

According to Angle's classification, a correct bite should have, inter alia, the following regularities: the median line of the face should coincide with the line between the central incisors of the upper and lower arches, the lower incisors should be overlapped by the incisal edges of the upper incisors, the top of the canine in the upper arch is inserted between the lower canine and the tangent premolar, each tooth is in contact with two opposing teeth, adjacent teeth both in the upper and lower arch are in contact with each other. Any deviation from these rules may indicate the presence of a malocclusion. We can distinguish here, for example: posterocclusion, open bite, retrusive occlusion, protrusive occlusion, supraclusion bite. They seem to be important not only in terms of functionality, but also psychology. Research shows that the correction of mandibular prognathism increases the level of self-confidence and self-acceptance, which may improve the quality of life of patients.

#### **Purpose of research**

The aim of the study was to check the quality of life of orthodontic and surgical patients as well as what factors motivate these people to start treatment in the area of the masticatory system.

#### **Material and methods**

208 people aged 18 to 55 participated in the survey. They were both people with malocclusion and no malocclusion, who constituted the control group. The questionnaire was created on the basis of standardized OQLQ and OHIP-14 questionnaires. It also included questions about the factors that motivate to start treatment in the masticatory system.

### Results

The most common malocclusion among the respondents was progenia (58.8%), followed by retrogenia (34.3%), then open bite (4%) and posteroclusion (2.9%). According to the OHIP-14 form, statistically significant ( $p < .0001$ ) higher quality of life was seen in people without a masticatory organ defect, compared to people with the malocclusion. A statistically significant difference ( $p < .0001$ ) between people with present or recent malocclusion ( $M = 54.29$ ,  $SD = 16.71$ ) and people without malocclusion ( $M = 31.93$ ,  $SD = 18.31$ ) was also visible in the study with using the OQLQ questionnaire.

### Conclusions

1. A malocclusion worsens the comfort and quality of life.
2. Incorrect bite, face and smile aesthetics as well as psychological aspects are the most important factors motivating to undertake surgical and orthodontic treatment.
3. Bruxism and facial pain are not factors prompting the initiation of treatment of malocclusion.

## Introduction

The development of the oral cavity and its organs begins at the end of the 2nd month of the fetal period. During this time, the jaw and mandible develop, and then the tongue and mimic muscles. Over the entire process of human development, the proportions and spatial arrangement of the bones that make up the masticatory system (MS) change dynamically. Very important activities that influence its development in the neonatal and infant period are: sucking, crying, laughing, screaming, breathing, and later in life, speech and chewing. Between the 14th day of life and the 12th month of life, there is a physiological posteroclusion, which is a natural phenomenon and you should not find a malocclusion here yet. Alternating breastfeeding during this period is essential for the symmetrical development of mimic muscles. Eventually, around the age of 13, the correct system of occlusal contacts, i.e. Angle I class, develops (Fig. 1). In practice, this means, inter alia, that:

- adjacent teeth both in the upper and lower arch are in contact with each other,
- the median line of the face should coincide with the line between the central incisors of the upper and lower arches, and the lower incisors should be overlapped by the incisal edges of the upper incisors,
- each tooth is in contact with two opposing teeth (this rule does not apply to the last molars in

the upper arch and central incisors in the lower arch),  
- the top of the canine in the upper arch is inserted between the lower canine and the tangent premolar.

Any deviation from the above indicators of normal occlusion may be evidence of the formation of a malocclusion [1].

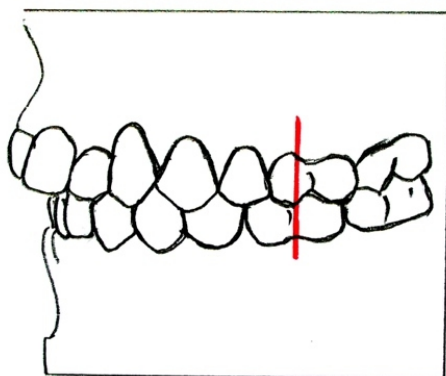


Fig. 1. Occlusion norm - Angle's I class. (Dr. Georg Risse, Angle KL 1, [https://commons.wikimedia.org/wiki/File:Angle\\_KL\\_1.JPG](https://commons.wikimedia.org/wiki/File:Angle_KL_1.JPG), access: 25.05.2021, licence: Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0), <https://creativecommons.org/licenses/by-sa/3.0/>)

Proper diagnosis of malocclusion makes it much easier to select the appropriate treatment methods. Therefore, it is extremely important to know the causes responsible for the occurrence of irregularities within the MS. We can divide them into general and local. The first group includes such aspects as: endocrine disorders, i.e. abnormal hormone levels, or extrinsic factors that may appear in the fetal life (e.g. incorrect position of the fetus, lack of certain vitamins, drugs used during pregnancy, as well as general and viral diseases experienced by the mother during the fetal life of the child) Inheritance is also an important general factor [2]. According to research, the occurrence of prognathism is more common when a family member also has this defect [3]. Rickets may also contribute to the development of abnormalities in the MS, as it causes disturbances in bone mineralization, which may result in skeletal deformation. Taking local factors into account, we can distinguish physiological dysfunctions, such as swallowing, chewing, speech, as well as injuries, dental caries and parafunctions. Incorrect position of the child during sleep may also affect the formation of malocclusion. It is related to the improper (too low or high) position of

the head, which may change the position of the mandible, the advantage of one group of muscles responsible for the movement of this bone over the group of antagonists, which may result in a defect. Unusual activities, i.e. parafunctions, can also contribute to the development of disorders. It should be mentioned here: biting nails, sucking pencils or lips, and grinding teeth [2].

Unusual activities, i.e. parafunctions, can also contribute to the development of disorders. It should be mentioned here: biting nails or lips and grinding teeth [2]. In relation to the medial plane, we can distinguish: crossbite, lingual occlusion, and lateral displacement of the mandible (one of the types is laterognathism). Considering the orbital plane, we can indicate anterior-posterior disorders, which include: posteroclusion and retrusive occlusion, including morphological retrusive occlusion, so-called retrognathism (class II malocclusion) (Fig.2), anterior occlusion and protrusive occlusion, including morphological protrusive occlusion, so-called prognathism (class III malocclusion) (Fig. 3,4). Taking into account the horizontal plane, we can indicate: open bite and supraclusion bite. Class II malocclusions are characterized by retraction or eversion of the lower lip and enlargement of the horizontal overlap between the incisors. Class III malocclusions are characterized by the smoothing of the mentolabial sulcus, the protrusion of the lower lip, and the positioning of the lower teeth in front of the upper teeth. Class II malocclusions make up about 45%, while class III malocclusions constitute 9% of all malocclusions. Considering lateral defects – they determine 12-14% of all malocclusions [4].

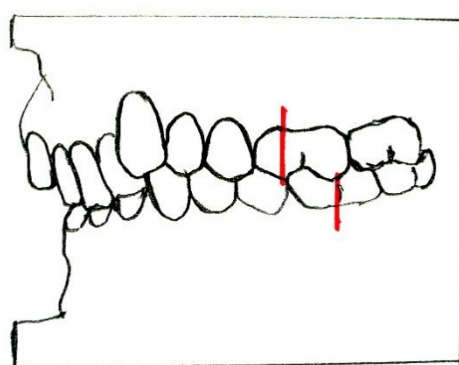


Fig. 2. Angle's II class (Dr. Georg Risse, Zahnfehlstellung Angle-Klasse II-2, [https://commons.wikimedia.org/wiki/File:Zahnfehlstellung\\_Angle-Klasse\\_II-2.jpg](https://commons.wikimedia.org/wiki/File:Zahnfehlstellung_Angle-Klasse_II-2.jpg), access: 25.05.2021, licence: Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0), <https://creativecommons.org/licenses/by-sa/3.0/>).

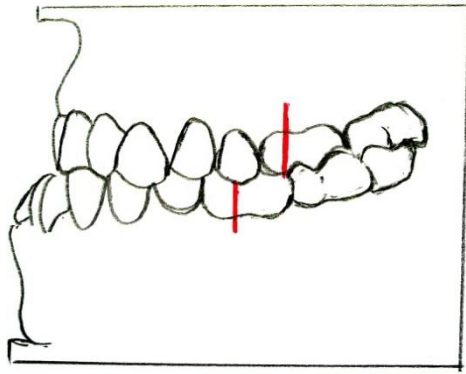


Fig. 3. Angle's III class (Dr. Georg Risse, Zahnfehlstellung Angle-Klasse III, [https://commons.wikimedia.org/wiki/File:Zahnfehlstellung\\_Angle-Klasse\\_III.jpg](https://commons.wikimedia.org/wiki/File:Zahnfehlstellung_Angle-Klasse_III.jpg), access: 25.05.2021, licence: Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0), <https://creativecommons.org/licenses/by-sa/3.0/>)

In the case of anterior malocclusions, the most frequently used surgical treatment is bilateral sagittal split osteotomy (BSSO). If the upper jaw is also operated on - the LeFort I osteotomy is indicated here [5,6]. BSSO is also used in the case of distocclusions, and as an alternative - intra-oral distraction osteogenesis. Mandibular distraction is also a commonly used procedure in this type of defect [7].



Fig. 4. Photograph of a person with mandibular prognathism before surgery and after BSSO (Source: own materials).

Malocclusion seems to be important not only in terms of functionality, but also psychology. According to the research, the correction of the mandibular prognathism significantly improved self-esteem and self-acceptance, which may indicate an increase in the

quality of life of the operated patients [8]. Young people with problems related to the aesthetics of a smile tend to feel sad more often than people without a defect [9]. As many as 75% of the respondents expect improvement of facial aesthetics after prognathism correction [10].

### Purpose of research

According to scientific reports, people with malocclusion may experience psychological discomfort related to the appearance of their face. According to research, the attractiveness of the face is influenced by such features as its symmetry or proportions [11, 12]. For this reason, in our study, we decided to check how the quality of life of orthodontic and surgical patients looks like, and also - what are the factors that motivate these people to start treatment in the MS.

### Material and methods

208 people aged 18 to 55 participated in the study. The respondents were divided into two groups - the study group, which included people with current or recent malocclusion (102 respondents), while the remaining people were a control group, i.e. without malocclusion (106 respondents) (Fig. 5).

STUDY GROUP		CONTROL GROUP
Characteristics of the group		People without malocclusion
People with current or recent malocclusion		
n	102	106
age [years]	$\bar{x}$	27,75 $\pm$ 7,11
	min.	18
	max.	55

Legend: n – group size,  $\bar{x}$  – mean, min - minimum, max - maximum.

Fig. 5. Group characteristics.

		STUDY GROUP	CONTROL GROUP
		n [%]	n [%]
<b>Gender</b>	Females	76,5	65,1
	Males	23,5	34,9
<b>Education</b>	Primary	3,9	2,8
	Secondary	37,2	42,5
	Vocational	2	3,8
	Higher	56,9	50,9
<b>Place of residence</b>	Village	20,6	8,5
	Town up to 50 000 inhabitants	13,7	17
	Town between 50 000 and 250 000 inhabitants	25,5	23,6
	Town over 250 000 inhabitants	40,2	50,9

Fig. 6. Socio-demographics characteristics.

As shown in Fig.6, women dominated in both groups (76.5% and 65.1% of the respondents). People with higher education constituted the highest percentage of both the study and control groups (56.9% and 50.9%, respectively). The respondents most often indicated a city with over 250,000 inhabitants as their place of residence.

The research method was a survey, made with the use of a questionnaire containing two standardized questionnaires, i.e. Orthognathic Quality of Life Questionnaire (OQLQ), in which a maximum of 88 points can be obtained, which proves a low quality of life [13, 14, 15] and Oral Health Impact Profile Questionnaire (OHIP-14), where a maximum of 56 points can be obtained, assuming that the greater number of points means the worse quality of life [16,17], as well as original questions about the factors motivating to start treatment orthodontic and surgical in the area of MO. The questionnaires were sent to the respondents via the Internet (e.g. through a group of people with malocclusion on a social networking site). The study group completed the entire questionnaire, while the control group filled in only the standardized questionnaires, due to the fact that their treatment aspect did not concern them. The participation of the control group in the study was necessary due to the fact that the results obtained in the research method did not have a standardized scale, therefore, in order to obtain reliable results, it was necessary to compare the scores of people with a malocclusion with the scores of those without a malocclusion. The statistics were calculated using R Studio Desktop 1.4.1106. The T-test was used to calculate statistical significance.

## **Results**

When analyzing the obtained data, first, the data on the characteristics of the malocclusion and the treatment process of the study group were presented (Fig. 7). The table below shows the percentages of the answers given by the respondents.



TYPE OF MALOCCLUSION		TIME OF ORTHODONTIC TREATMENT INITIATION		CORRECTION TREATMENT AND TYPE OF SURGERY	
Progenia	58,8%	More than 3 years ago	30,4%	Yes	33,3%
				Single-jaw surgery	67,6%
				Double-jaw surgery	23,5%
Retrogenia	34,3%	From two to three years ago	16,6%	No	66,7%
Posterooclusion	2,9%	From one to two years ago	15,7%		
Open bite	4%	Less than a year ago	21,6%		
		No treatment	15,7%		

Fig. 7. Characteristics of malocclusion and treatment process in the study group.

Among the respondents, the most common malocclusion was progenia (58.8%), followed by retrogenia (34.3%). On the other hand, the least frequent abnormalities among the respondents were posterooclusion (2.9%) and open bite (4%).

The highest percentage of people started orthodontic treatment more than 3 years ago (30.4%), slightly fewer respondents - 21.6% started cooperation with an orthodontist less than a year ago. The vast majority of people with a malocclusion have not yet undergone surgery

to correct the defect. It was as much as 66.7% of the respondents. Among people who have already undergone bite correction, as many as 80% have undergone the procedure less than a year ago, and 17.1% more than a year, and less than two years ago. The most common procedure performed was double-jaw surgery, and 67.6% of the respondents underwent it. The next procedure in terms of frequency was single-jaw surgery (23.5%) (Fig. 7).

The statistical analysis of the results obtained in the OQLQ and OHIP-14 scales is presented below.

	<b>OQLQ</b>	<b>OHIP-14</b>	<b>Maximum number of points to be obtained</b>
<b>STUDY GROUP</b>	$\bar{x} = 54,29$ pts SD = 16,71 pts	$\bar{x} = 22,27$ pts SD = 12,67 pts	88
<b>CONTROL GROUP</b>	$\bar{x} = 31,93$ pts SD = 18,31 pts	$\bar{x} = 9,26$ pts SD = 9,79 pts	56
<b>Statistical significance (T-test)</b>	p<.0001	p<.0001	-

Fig. 8. Scoring of the OQLQ and OHIP-14 questionnaires for the study and control groups.

A statistically significant difference was found in the assessment of the quality of life according to the OQLQ form,  $t(206) = 9.19$ ,  $p < .0001$ , 95% CI [17.56, 27.16] between people with current or recent malocclusion ( $M = 54.29$ ,  $SD = 16.71$ ), and people without a defect ( $M = 31.93$ ,  $SD = 18.31$ ). The above data prove that in people with a malocclusion there is a deterioration in the quality of life compared to people without a malocclusion.

Also, according to the OHIP-14 questionnaire, a statistically significant ( $t(206) = 8.30$ ,  $p < .0001$ , 95% CI [9.92, 16.10]) better quality of life was noted in patients without a defect

[M = 9.26, SD = 9.79] than in patients with the defect or shortly after its correction [M = 22.27, SD = 12.67].

#### Analysis of the factors that motivate to start treatment

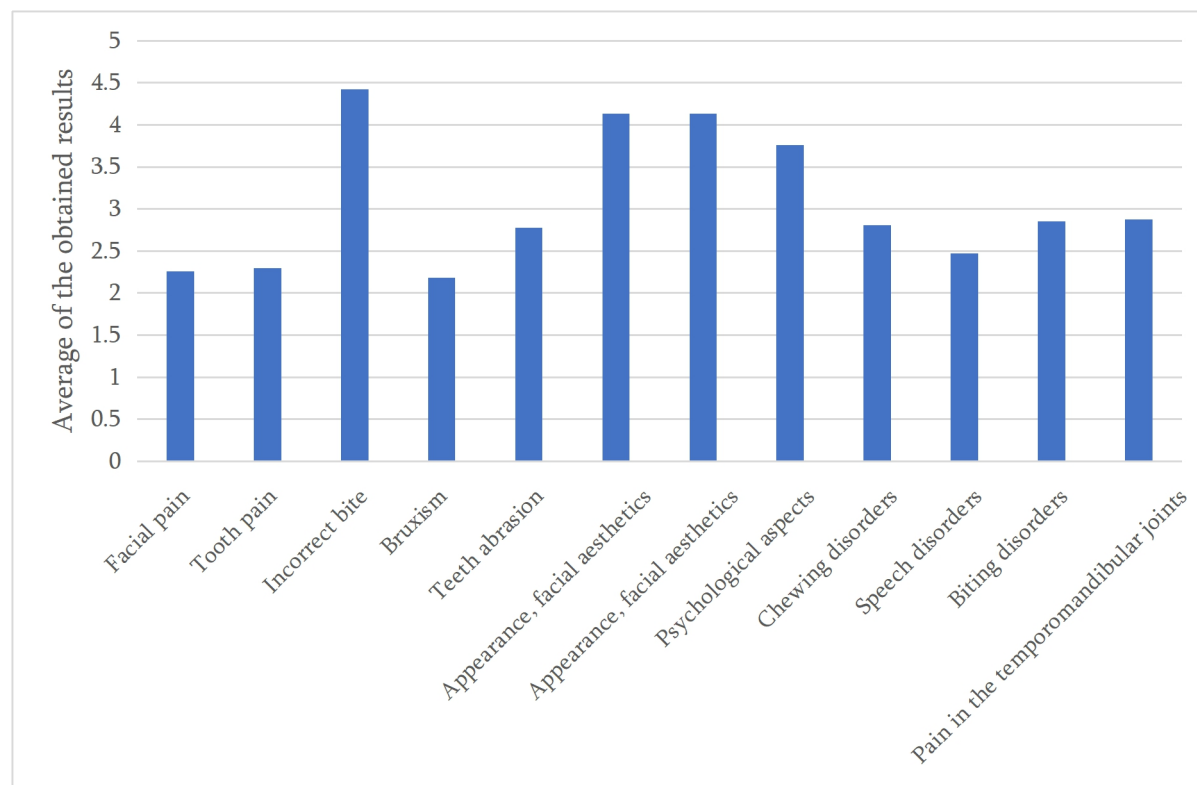


Fig. 9. Analysis of the factors that motivate to undertake orthodontic and surgical treatment in the area of the masticatory system.

The respondents considered the importance of these factors in making the decision to start treatment on a five-point Likert scale. When asked if a given aspect contributed to the initiation of treatment, the following symbols were used: 1 - definitely not, 2 -rather not, 3 - I don't know, 4 - rather yes, 5 - definitely yes. On the basis of the obtained results, the arithmetic mean for each factor was calculated, which is presented on the graph (Fig. 9).

The study showed that for the respondents, the most significant factor in making the decision to start treatment was an incorrect bite. The average result in this case was 4.42. The aesthetics of the face and the aesthetics of a smile were ranked second. Both the first and the second element obtained the average of 4.13. They were closely followed by psychological

aspects, i.e. negative feelings related to the perception of the defect, which were rated 3.76 on the Likert scale, so it turned out that this factor was also quite important.

The least important reasons for starting treatment were bruxism (mean 2.18) and facial pain (mean 2.26). Other factors that did not play a significant role in the decision to correct the defect were toothache (average 2.3) and speech problems (average 2.47), so it can be concluded that they did not cause problems in the daily functioning of people with the defect.

## **Discussion**

Masticatory system defects undoubtedly affect many aspects of life in patients. Often attention is paid to functional problems such as pain in the temporomandibular joints, toothache, bruxism, or the correct chewing mechanism. These are factors that can motivate to treat the defect - from the physiological and anatomical grounds, or from the biomechanical perspective. Their improvement may indicate the success of the operation. However, the psychological aspect of people with deformities cannot be forgotten. According to research, the treatment brings about a significant improvement in the chewing function and the appearance of people with morphological front jaw in the perspective of 10-15 years after the procedure. The mental sphere of patients' lives is also improved, as a significant improvement is observed in the level of their self-confidence [18].

Psychological care seems to be necessary in many cases of patients with malocclusion. The face of such people differs from generally understood norms, by which we understand as an attractive face one that is symmetrical and proportional [19]. In the case of people, e.g. with progenia or retrogenia, these proportions are disturbed for at least several years until the corrective procedure is performed. Therefore, patients may feel less attractive in relation to people without malocclusion, which may reduce the level of quality of life [20].

Another problem that should be considered is stress in its broadest sense. When a person does not accept himself, and thus - has problems with self-esteem or with interpersonal relations, we can assume that these factors are notorious for his nervous system, which makes him constantly stimulated. Considering human as a biopsychosocial being, we must bear in mind that in order to maintain health, he should function properly in the biological, mental and social spheres. Often all these areas are disturbed in patients with malocclusion, therefore their quality of life and health may be reduced [21, 22, 23]. Current scientific knowledge indicates that psychosocial disorders can become somatized, causing further secondary pain problems. For this reason, appropriate, multidimensional therapy of craniofacial

morphological changes seems to be important for the long-term preservation of high quality of life by the patient [24].

Considering the positive aspects of the correction of the morphological front jaw, one should also take into account the functional changes that occur after the correction surgery. Research shows that corrective surgery for progenia improves the chewing function. We can see here not only a direct impact on increasing the quality of life in everyday life, but also translating into the improvement of social functions. It is natural to increase the comfort of eating meals in company after getting rid of problems with chewing food [25].

When looking at the negative consequences of the surgical correction of malocclusion, it should be remembered that surgical intervention does not guarantee improvement in every case. It happens that no significant changes are noticed after the surgery, compared to the state before the surgery. People who undergo correction must also be aware that their face will take on a new, unknown look, for which they may not be fully prepared. Based on our own experience and available sources, we can conclude that there is a risk that patients may find it difficult to accept their new face after surgery and will need a lot of time to get used to it. It may happen that they will not be satisfied with their new appearance and will have difficulties adapting for the rest of their lives [26]. From the perspective of this problem, it seems important to develop and widely implement 3D modeling as one of the elements of patient preparation for surgery. Visualization of changes introduced by the surgical correction allows the patient to get used to his new appearance, and consequently increases the satisfaction with the results of the procedure [27].

Surgery in the craniofacial area as well as osteosynthesis with implants is also associated with a number of potential intraoperative and postoperative complications. We can include here: nerve damage and related disorders or local loss of superficial sensation, dysfunction of the temporomandibular joint, infections and fractures [28].

Complications	Percentage
Nerve injuries	19,03%
TMJ dysfunctions	11,17%
Infections	2%
Fracture	1,5%
Others complications	0,41%

Fig. 10. Incidence of complications after orthognathic surgery [28].

Referring to both the positive and negative consequences of the corrective surgery, it should be remembered to approach each patient individually. It is imperative to consider all potential benefits and risks when making a conscious decision about treatment in order to potentially increase the level of satisfaction with the procedure.

## Conclusions

1. A malocclusion worsens the comfort and quality of life.
2. Incorrect bite, face and smile aesthetics as well as psychological aspects are the most important factors motivating to undertake surgical and orthodontic treatment.
3. Bruxism and facial pain are not factors prompting the initiation of treatment of malocclusion.

## Limitations

The MS defects, in particular progenia and retrogenia, are quite niche dysfunctions, therefore it was not possible to collect the appropriate number of people after corrective surgery as a control group. For this reason, the control group consisted of people without maxillo-mandibular dysfunctions, both now and in the past. Additionally, taking into account that people who recently underwent bite correction surgery had been struggling with the defect for at least over a dozen years, the research team decided to include these people in the study group as aware of the problems of people with MS defects.

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