Prevention of malocclusion and the importance of early diagnosis in the Italian young population

S. Saccomanno[1], S. Saran[2], M. De Luca[3], P. Fioretti[4], G. Gallusi[1]

[1]*Department of Health, Life and Environmental Science, University of L'Aquila, L'Aquila, Italy*
[2]*Department of Human Sciences, Innovation and Territory, School of Dentistry, Postgraduate of Orthodontics, University of Insubria, Como-Varese, Italy*
[3]*Dental School, Catholic University of the Sacred Heart, Rome, Italy*
[4]*Department of Medicine and Surgery, Hygiene and Public Health Section, University of Perugia, Italy*

e-mail: sabinasaccomanno@hotmail.it

DOI 10.23804/ejpd.2022.23.03.02

Abstract

Aim Malocclusion is an alteration of the normal relationships between skeletal, muscle and dental structures that can lead to impaired functionality as well as aesthetic alteration of the stomatognathic system. Functional alteration can affect various aspects, ranging from chewing ability to respiratory disorders. Paediatricians and dentists are called to prevent and diagnose these conditions as early as possible in order to preserve the patient's health. The purpose of this research is to study the incidence of malocclusion and its relationship with Obstructive Sleep Apnea Syndrome (OSAS) in a young population. Also, the role of paediatricians and dentists in prevention and early diagnosis of this condition was evaluated.

Methods An anonymous survey was given through Google form to 300 Italian children (139 males and 161 females) from different private dental practices in Italy. No personal information that identifies the individuals was collected, and the data was analysed in aggregate form only. All data was collected and statistically analysed.

Results Three hundred Italian subjects (139 male and 161 female) were surveyed; 82% of them lived in Central Italy. The average age of the patients is about 10 years old, with the youngest patient being 1 year old and the oldest one 19 years old. Most of the participants had their first dental visit before they turned 6 years old, meaning that in the majority of cases, the subjects underwent a dental visit for a check-up. In 13.4% of cases the reason for the visit was malocclusion. Furthermore, the presence of malocclusion was found in 40.4% of subjects. Most patients are treated by private clinicians, in particular 53.4% by general dentists and 33.9% by orthodontists. Almost no one in the survey has difficulty in chewing food. The majority of subjects do not have trouble breathing either. Only 9 people suffer from sleep apnoea; 81.1% do not snore; and 36,7% move a lot while sleeping. The majority do not wake up during sleep, and learning problems are not common. Enuresis was reported in 3.7% of the sample. The majority of the sample do not sleep with their mouth open (71.5%). Out of the whole sample, 40.9% reported an improvement of sleeping or learning problems after orthodontic therapy. Half of the sample states that breathing has improved with orthodontics. 61.3% of the sample believes that their paediatrician give the correct importance to dental health.

Conclusion The data highlight the patients' good attitude towards dental check-ups, which help to intercept malocclusions. Unlike the past, the knowledge of the importance of oral health and dental occlusion is high among young patients, parents and paediatricians. This study underlines the role of paediatricians as key players in the prevention of dental health problems.

KEYWORDS Malocclusion, Paediatrician, Dentist, Sleep disorders.

Introduction

Malocclusion is an abnormal dental and/or jaws relationship that can affect aesthetic appearance, function, and facial harmony. The aetiology of malocclusion is multifactorial and can develop for a variety of reasons, examples being hereditary factors, environmental factors, or a combination of the two [Zou et al., 2018; Egić, 2022]. Even bad habits such as finger sucking, prolonged use of a baby bottle or a pacifier can negatively affect the skeletal relationship of the jaws and the occlusal harmony. Other factors that can favor the onset of malocclusion are mouth breathing, atypical swallowing, and pathological posture of the tongue [Quinzi et al., 2020; Gelb et al., 2021; Wang et al., 2021].

Malocclusion can cause various discomforts. From an aesthetic point of view, a dental-facial disharmony can affect the person's self-esteem and social life [Martins-Júnior et al., 2012; Taghavi Bayat et al., 2019]. From a functional point of view, however, malocclusions can lead to difficulties in chewing, changes in posture, as well as predisposition to dental trauma and respiratory disorders [Magalhães et al., 2010; Gelb et al., 2021]. Significant evidence of respiratory problems, including sleep disorders associated with occlusal alterations, has been observed [Castilho et al., 2020]. Sleep disorders have also increased in the paediatric population recently. In particular, Obstructive Sleep Apnea Syndrome (OSAS) is a chronic condition characterised by a collapse of the pharynx during sleep [Daurat et al., 2016]. The general incidence of OSAS in the paediatric population is reported to be about 2% [Marcus et al., 2012]. The most frequent symptoms are daytime sleepiness, recurrent headaches, nasal speech, hyperactivity, inattention, depression, mood instability, irritability, and aggressiveness [Beebe, 2006; Beebe et al., 2012]. Nocturnal symptoms include snoring, witnessed apnoea, oral breathing, paradoxical thoracic movements, nightmares, sleepwalking, and nocturnal enuresis [Marcus et al., 2012; Paduano et al., 2019; Giuca et al., 2021]. Moreover, sleep-related breathing disorders lead to concomitant alterations in the CNS and cardiovascular systems [Zhang and Si, 2012].

Prevention and early diagnosis are crucial to avoid progression of malocclusions and their consequences. The dentist and the paediatrician play a key role in this process, and the collaboration between these two figures is of fundamental importance in

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal weight	253	84.3	84.6	84,6
	Underweight	17	5.7	5.7	90,3
	Overweight	29	9.7	9.7	100,0
	Total	299	99.7	100.0	
Missing		1	.3		
Total		300	100.0		

TABLE 1 Weight of subjects.

Count				
		Presence of malocclusion		Total
		No	Yes	
Gender	F	81	55	136
	M	93	63	156
Total		174	118	292

*Cross-tabulation of malocclusion - Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000a	1	.992		
Continuity Correctionb	.000	1	1.000		
Likelihood Ratio	.000	1	.992		
Fisher's Exact Test				1.000	.543
N of Valid Cases	292				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 54.96.					
b. Computed only for a 2x2 table					

TABLE 2 Gender

Count				
		Presence of malocclusion		Total
		No	Yes	
Where do you reside?	Central Italy	143	98	241
	Northern Italy	10	14	24
	Southern Italy	21	6	27
Total		174	118	292

* Cross-tabulation of malocclusion

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.917a	2	.031
Likelihood Ratio	7.141	2	.028
N of Valid Cases	292		
0 cells (0,0%) have expected count less than 5. The minimum expected count is 9,70.			

TABLE 3 Where do you reside?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Braces	1	.3	.3	.3
	Fallen from bed and chattered teeth	1	.3	.3	.7
	Fall on one of the two upper incisors	1	.3	.3	1.0
	Check-up	185	61.7	63.8	64.8
	Never been visited by a dentist yet	1	.3	.3	65.2
	Malocclusion	39	13.0	13.4	78.6
	Reverse bite	1	.3	.3	79.0
	Never been visited	1	.3	.3	79.3
	Narrow palate	2	.7	.7	80.0
	Narrow palate and malocclusion	1	.3	.3	80.3
	To have no concern in the future	1	.3	.3	80.7
	For dental health problems (tooth decay. toothache. lack of teeth)	50	16.7	17.2	97.9
	To remove milk tooth	1	.3	.3	98.3
	Re-entry of incisors due to fall	1	.3	.3	98.6
	III class	1	.3	.3	99.0
	Tooth trauma	1	.3	.3	99.3
	A milk tooth that did not fall out	1	.3	.3	99.7
	Routine check-up	1	.3	.3	100.0
	Total	290	96.7	100.0	
No answer		10	3.3		
Total		300	100.0		

TABLE 4 Reason for the visit.

regards to the safeguarding of the patient's health [Yamashita et al., 2008]. Until today the general dentist played the master role in the early diagnosis and prevention of malocclusions. This can be attributed to a widespread information failure, causing a large part of the population to lack knowledge regarding the role of the orthodontist. For this reason, it is very important for general dentists to be able to recognise a malposition of the teeth and misaligned jaws. In addition to this, paediatricians should be concious of the importance of referring young patients to dentists and orthodontists in order to diagnose and intercept malocclusions, as early intervention and correct treatment timing can be crucial in certain patients. With these assumptions in mind, it is critical to educate general dentists, paediatricians and even families about the need for children to undergo dental check-ups as soon as possible, and if necessary, to refer them to an orthodontist.

The aim of this study is to evaluate the incidence of malocclusion and its relationship with respiratory disorders. Moreover, the role of the paediatrician, the orthodontist, and the general dentist in the prevention and diagnosis of malocclusions is investigated.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	174	58.0	59.6	59,6
	Yes	118	39.3	40.4	100,0
	Total	292	97.3	100.0	
No answer		8	2.7		
Total		300	100.0		

TABLE 5 Presence of malocclusion.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General dentist	59	50.0	50.9	50,9
	Orthodontist	47	39.8	40.5	91.4
	Paediatrician	10	8.5	8.6	100.0
	Total	116	98.3	100.0	
No answer		2	1.7		
Total		118	100.0		

TABLE 6 Who diagnosed the malocclusion.

Material and methods

An anonymous survey, available in two languages (Italian and English), Google form (Google LLC 1600 Amphitheatre Parkway, Mountain View, California, U.S.), was sent to 300 young Italian patients (139 males and 161 females) selected from different private dental practices. For those under the age of 18, parents were asked to complete the survey.

It was specified that the purpose of the questionnaire was to find ways for clinicians to improve their methods of curing patients. It was ascertained that each patient answered one questionnaire only. The patients were asked to complete the questionnaire without any compensation or benefit. The questionnaire was specially devised for this study. All participants provided informed consent and accepted the privacy policy for the protection of personal data before completing the survey. No personal information that identifies the individuals was collected, and the data was analysed in aggregate form only. All responses were collected on an anonymous basis, using the Google Form service. The resulting data file, used for data analysis, did not contain any identifier, including email and IP address, or other electronic identifiers. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. The following details were asked in the questionnaire.

- Age.
- Gender.
- Residence..
- Weight
- Age at first dental visit.
- Reason for the first dental visit.
- Presence of malocclusion.
- Who diagnosed the malocclusion.
- Chewing difficulties.
- OSAS diagnosis.
- OSAS symptoms.
- Post-orthodontic improvement of symptoms.

Results

Three hundred Italian subjects (139 male and 161 female) were surveyed; 82% of them lived in Central Italy. The average age is about 10 years. The youngest patient is 1 year old and the oldest one 19 years. The majority of the patients are of regular body weight (Table 1).

We proceeded with the chi-square test to assess a possible relationship between gender and presence of malocclusion. We obtained a high p-value hence, the null hypothesis is accepted: there is no association between the two variables (Table 2).

Another chi-square test was done for the possible association between malocclusion and residence. This time the p-value was less than 0.05, thus resulting in a rejection of the null hypothesis, and the finding that there is an association between the place of residence and the presence of a malocclusion (Table 3). It should be underlined that most of the participants reside in Central Italy.

Most of the participants had the first dental visit before the age of 6 years. In most cases, the population analysed underwent a dental visit to carry out a check-up. In 13.4% of cases the reason for the visit was malocclusion (Table 4). The presence of malocclusion was found in 40.4% of the population interviewed (Table 5). This condition is generally suspected by the patient's parents, and in most cases diagnosed by the general dentist. In a smaller percentage the diagnosis was made by the orthodontist and only in 8.6% of cases by the paediatrician (Table 6). A total of 38% of the participants declared to be under orthodontic treatment, and 30.7 % of them uses fixed devices. Most of the patients are treated by private clinicians, in particular 53.4 % by the general dentist and 33.9% by the orthodontist. Almost no one in the survey has difficulty in chewing food. The majority do not have breathing problems. Only 9 patients suffer from sleep apnoea; 81.1% do not snore, and 36,7% move a lot while sleeping. The majority do not wake up during sleep (Fig. 1). It is not very common to have learning problems (Table 7). Cases of enuresis were found in 3.7% of the subjects, and 71.5% sleep with a closed mouth (Table 8); 40.9% state that sleeping or learning problems have

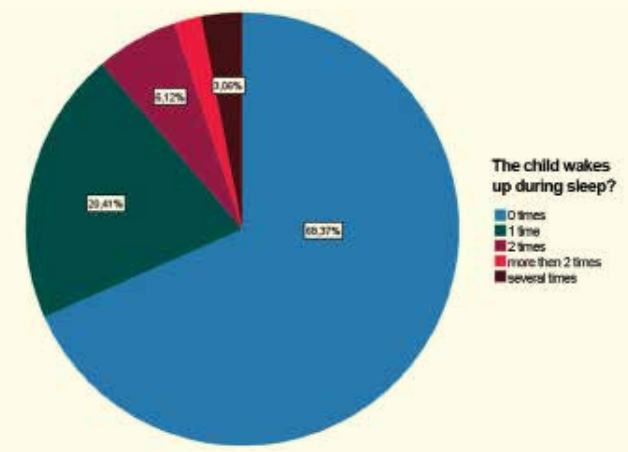

FIG. 1 Does the child wake up during sleep?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	255	85.0	86.1	86,1
	Yes	41	13.7	13.9	100,0
	Total	296	98.7	100.0	
No answer		4	1.3		
Total		300	100.0		

TABLE 7 Do you have learning/attention problems?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	276	92.0	92.9	92,9
	Yes	21	7.0	7.1	100,0
	Total	297	99.0	100.0	
No answer		3	1.0		
Total		300	100.0		

TABLE 8 Does the child breathe with his/her mouth open during the day?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	13	31.7	59.1	59,1
	Yes	9	22.0	40.9	100,0
	Total	22	53.7	100.0	
No answer		19	46.3		
Total		41	100.0		

TABLE 9 Sleep or/and learning disorders improved with orthodontics.

improved with dental treatment. Half of the sample states that breathing has improved with orthodontics (Table 9). Another investigation conducted is a multiple correspondence analysis to explore the association between nominal variables. We observed the relations among the presence of malocclusion and sleep disorders, namely:

- sleeping with open mouth;
- snoring;
- moving while sleeping;
- sleep apnoea;
- waking up while sleeping.

From the plot we can see that there is an association between:

- Answer "No" to "Does the child sleep with an open mouth?" and to "Presence of malocclusion" and to "Does the child snore?";
- The answer "No" to "Does the child wake up during the night?" and to "Does the child suffer from sleep apnoea?";
- The answer "No" to "Does the child wake up during the night?" and to "Does the child move during sleeping time?" (Fig. 2).

Finally, 61.3% of respondents believe that paediatricians give proper importance to dental health (Table 10).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	114	38.0	38.3	38,3
	Yes	184	61.3	61.7	100,0
	Total	298	99.3	100.0	
No answer		2	.7		
Total		300	100.0		

TABLE 10 Do you think paediatricians give the right importance to dental health?

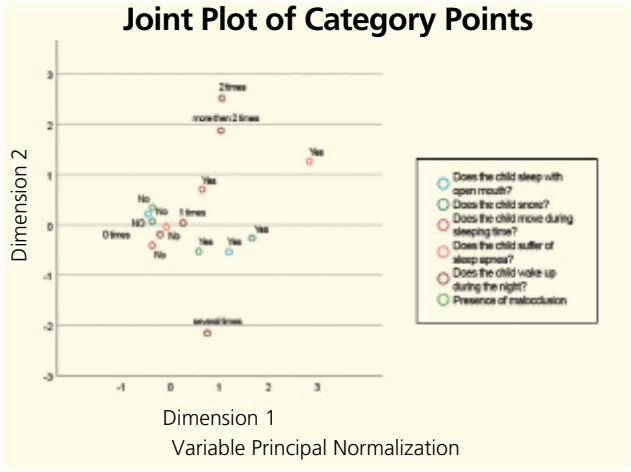

FIG. 2 Sleep disorders.

Discussion

The survey showed that about 40.4% of the participants had a malocclusion. Statistical analysis did not indicate a correlation of this condition with gender, however, there is a correlation with place of residence, but this data is certainly influenced by a limitation of this study since the large part of the sample lives in Central Italy. It would be useful to conduct further studies to see if environmental factors can affect malocclusion. The majority of the subjects do not have weight problems and, accordingly, OSAS was reported in only few subjects of the sample. This confirms the literature findings on this topic; patients who do not suffer from obesity usually do not have severe OSAS even if they may present a malocclusion. Apart from a small percentage of patients with diagnosed OSAS (3%), symptoms related to sleep disturbances were also not found in a high percentage of the interviewed sample. There is a statistically significant correlation between malocclusion, snoring and sleeping with an open mouth; that means that correcting malocclusion can be very helpful in improving the quality of night rest. Furthermore, there is a reasonable and statistical correlation between sleep apnoea and the tendency to wake up during the night. However, it is important to note that, even considering the limits of a self-administered questionnaire, a high percentage (40.9%) of those with sleep and learning disorders who have undergone orthodontic treatment reported an improvement in these conditions.

Many patients underwent a dental check-up before 6 years old. It appears that parents gave good attention to dental health care and occlusion, which is a welcomed change from the past. The general dentist is the healthcare professional most frequently involved in diagnosis (50%), but orthodontists also have an important role (39.8%). Paediatricians appear to play a minor role in the diagnosis of dental malocclusion but are of great efficacy in sending the young patients to a specialist for an early dental check. In fact, a large part of patients think that paediatricians give the proper attention to dental health. The importance of a cooperative attitude between paediatricians and dentists or orthodontists is very clear, since paediatricians have a continuous contact with young patients, and they can refer them to a dentist. In this way, it is very important that these specialists are aware of the relationship between dental health and the general health of the child.

Conclusion

The present study highlights important details regarding the Italian paediatric population. Samples was mostly of normal weight and the presence of malocclusion, does not tend to develop sleep apnoea. However, it is evident from the results that treating malocclusion improves the quality of nocturnal

rest and reduces the habit of open mouth sleeping that can lead to further complications and problems. The research also highlighted the good attitude of the patients towards periodical dental check-ups. Differently from the past, it seems that the knowledge about the importance of oral health and dental occlusion in young patients has increased among parents and paediatricians. It is known that early checks help avoid malocclusions, subsequent orthodontic treatments, and the consequences of an improper relationship between jaws and teeth that can have negative effects in various areas of a patient's health. This study evidenced the importance of the paediatrician, who can play a key role in oral prevention. The solution is collaboration between the paediatrician, the orthodontist and the patient's family. Therefore, it can be very useful to raise the awareness of paediatricians about oral health, dental occlusion, and the relationship between the stomatognathic system as well as the general wellbeing of the young population.

References

- Beebe DW, Rausch J, Byars KC, Lanphear B, Yolton K. Persistent snoring in preschool children: Predictors and behavioral and developmental correlates. Pediatrics 2012;130(3):382-389.
- Beebe DW. Neurobehavioral morbidity associated with disordered breathing during sleep in children: A comprehensive review. Sleep 2006;29(9):1115-1134.
- Boyd KL, Saccomanno S, Paskay LC, Quinzi V, Marzo G. Maldevelopment of the cranio-facial-respiratory complex: A Darwinian perspective. Eur J Paediatr Dent 2021; 22(3):225-229.
- Castilho RL, Matsumoto LH, Castilho GL, Weber SAT. The interface between dentistry and respiratory sleep disorders in children. Sleep Sci 2020;13(4):220-223.
- da Silva RM, Mathias FB, da Costa CT, da Costa VPP, Goettems ML. Association between malocclusion and the severity of dental trauma in primary teeth. Dent Traumatol 2021;37(2):275-281.
- Daurat A, Sarhane M, Tiberge M. Obstructive sleep apnea syndrome and cognition: A review. Neurophysiol Clin 2016;46(3):201-215.
- Egić, B. Prevalence of orthodontic malocclusion in schoolchildren in Slovenia. A prospective aepidemiological study. Eur J Paediatr Dent 2022; 23(1):39-43.
- Gelb M, Montrose J, Paglia L, Saccomanno S, Quinzi V, Marzo G. Myofunctional therapy Part 2: Prevention of dentofacial disorders. Eur J Paediatr Dent 2021; 22(2):163-167.
- Giuca MR, Carli E, Lardani L, Pasini M, Miceli M, Fambrini E. Pediatric Obstructive Sleep Apnea Syndrome: Emerging Evidence and Treatment Approach. Scientific World Journal 2021 Apr 23;2021:5591251.
- Magalhães IB, Pereira LJ, Marques LS, Gameiro GH. The influence of malocclusion on masticatory performance: A systematic review. Angle Orthod 2010;80(5):981-987.
- Manfredini D, Castroflorio T, Perinetti G, Guarda-Nardini L. Dental occlusion, body posture and temporomandibular disorders: Where we are now and where we are heading for. J Oral Rehabil 2012;39(6):463-471.
- Marcus CL, Brooks LJ, Draper KA, Gozal D, Halbower AC, Jones J, Schechter MS, Sheldon SH, Spruyt K, Ward SD, Lehmann C, Shiffman RN, American Academy of Pediatrics. Diagnosis and management of childhood obstructive sleep apnea syndrome. Pediatrics 2012;130(3):576-584.
- Martins-Júnior PA, Marques LS, Ramos-Jorge ML. Malocclusion: Social, functional and emotional influence on children. J Clin Pediatr Dent 2012;37(1):103-108.
- Paduano S, Paduano FP, Aiello D, Barbara L, Zampogna S, Pujia R, Malara C, Cantile T, Ferrazzano GF. OSAS in developing age: Screening of a Southern Italy population. Eur J Paediatr Dent 2019 Dec;20(4):302-305.
- Quinzi V, Nota A, Caggiati E, Saccomanno S, Marzo G, Tecco S. Short-term effects of a myofunctional appliance on atypical swallowing and lip strength: A prospective study. J Clin Med 2020; 9(8):1-10.
- Taghavi Bayat J, Huggare J, Akrami N. Distinguishing between global and dental self-esteem in evaluating malocclusions. Acta Odontol Scand 2019;77(6):452-456.
- Wang Z, Feng J, Wang Q, Yang Y, Xiao J. Analysis of the correlation between malocclusion, bad oral habits, and the caries rate in adolescents. Transl Pediatr 2021; 10(12):3291-3300.
- Yamashita H, Yotsuya K, Takeuchi T, Oda S, Hara A, Sekiguchi H, Yakushiji M. Awareness of malalignment and malocclusion in children and their guardians. Bull Tokyo Dent Coll 2008;49(1):7-13.
- Zhang W, Si LY. Obstructive sleep apnea syndrome (OSAS) and hypertension: Pathogenic mechanisms and possible therapeutic approaches. Ups J Med Sci 2012;117(4):370-382.
- Zicari AM, Albani F, Ntrekou P, Rugiano A, Duse M, Mattei A, Marzo G. Oral breathing and dental malocclusions. Eur J Paediatr Dent 2009;10(2):59-64.
- Zou J, Meng M, Law CS, Rao Y, Zhou X. Common dental diseases in children and malocclusion. Int J Oral Sci 2018; 10(1).