



## Prevalence of Malocclusions and Oral habits in a preschool Albanian children population: A cross-sectional study

Francheska Vinjolli<sup>1</sup>, Evisi Nastasi<sup>2</sup>, Sara Ghanim<sup>3</sup>, Arianna Malara<sup>4\*</sup>, Ines Nurja<sup>5</sup>, Paola Cozza<sup>6</sup>, Giuseppina Laganà<sup>7</sup>

### Abstract

**Aim:** Malocclusions represent a significant concern in pediatric dentistry, affecting craniofacial growth, masticatory function, and overall well-being. Understanding their prevalence and associated risk factors is crucial for implementing effective public health interventions. This study aimed to assess the prevalence of malocclusions and oral habits among preschool children in Albania and examine their interrelationship.

**Materials and Methods:** A cross-sectional study was conducted on a sample of 1213 preschool children aged 3 to 6 years from eight districts in Albania. Clinical orthodontic examinations and parental questionnaires were employed to assess malocclusion types and oral habits. Data were analyzed using SPSS version 27.0, and statistical significance was determined using Chi-square tests.

**Results:** Malocclusions were observed in 52% of the studied population, with vertical anomalies, particularly increased overbite being the most prevalent. Non-nutritive sucking habits, especially pacifier use (47.8%), were commonly reported. While no significant gender differences in malocclusion prevalence were noted, variations across different age groups were evident. A significant correlation was established between oral breathing and anterior open bite.

**Conclusions:** The findings highlight the necessity of early orthodontic evaluation and targeted public health strategies to mitigate malocclusion development. Preventive measures addressing deleterious oral habits should be integrated into pediatric dental care to support optimal craniofacial development.

**Keywords:** Epidemiological study; Malocclusions; Oral habits; Non-nutritive sucking; Pediatric orthodontics; Early intervention.

### Introduction

Malocclusion is a disorder of the craniofacial complex that affects physiological conditions by disrupting the development of the dental and maxillofacial regions, as well as masticatory function [1]. To effectively prevent and manage different malocclusions, it is essential to know their prevalence in the society. Numerous studies have investigated the prevalence of malocclusions in primary dentition across various countries and groups, revealing prevalence rates between 21.0% to 88.1% [2-9]. Epidemiological studies are essential for delivering comprehensive data on a population's health, allowing each nation to formulate targeted public health initiatives [10,11]. Many Authors indicate that specific primary occlusion traits and anomalies are frequently manifested in or even intensified by the permanent

### Affiliation:

<sup>1</sup>Department of Medical Science, Catholic University Our Lady of Good Counsel, 1000 Tirana, Albania

<sup>2</sup>Private Orthodontic Practice, 69-71 Banbury Road, Oxford, United Kingdom

<sup>3</sup>Private Practice, Albania and Italy

<sup>4</sup>Private Practice, Rome and Latina, Italy

<sup>5</sup>Department of Economics and Finance, University of New York, Tirana, Albania

<sup>6</sup>Unicamillus Saint Camillus International University of Health Sciences Rome, Italy

<sup>7</sup>Department of Life Sciences, Health and Healthcare Professions, Link Campus University, 00165 Rome, Italy

### \*Corresponding author:

Arianna Malara, Private Practice, Rome and Latina, Italy

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dentition, owing to the impact of primary dentition on the permanent occlusion developing process [12]. Persistent non-nutritive sucking practices beyond the initial three years of life are often correlated with posterior crossbite and anterior open bite [12].

Diastemas in the anterior region, normal overbite and overjet, a straight or mesial step molar connection, and Class I canine relationship are good indicators of favorable development of permanent occlusion. Pacifier use and digit or thumb sucking are prevalent soothing activities, particularly among infants. These actions are usually termed "non-nutritive sucking habits" and their impact on the development of dental malocclusion is unquestionable [13].

Many Authors indicate that oral habits and mouth breathing grow more common with the increasing severity of malocclusion. Furthermore, anterior open bite, posterior crossbite, and increased overjet are significantly correlated with oral habits and mouth breathing [14,15].

Albania lacks national oral health surveys or studies regarding the prevalence of malocclusion in preschool children.

Therefore, this epidemiological study aims to evaluate the prevalence of malocclusions, oral habits, and their correlation within a preschool-aged Albanian population.

## Materials and Methods

### Study Design and Population Selection

A multistage, stratified sampling approach was employed to obtain a representative sample of preschool-aged children across eight districts (Tirana, Shkoder, Durres, Vlore, Kruje, Elbasan, Pogradec, and Korce) in Albania. These districts were selected using probability proportional to size (PPS) sampling to ensure adequate representation of varying socio-economic conditions. The final study cohort comprised n. 1.213 children (628 males, 585 females) aged 3 to 6 years, mean age of 4.65 years, recruited from 20 kindergartens in alignment with the World Health Organization's basic methods for oral health surveys [16]. To be eligible for inclusion, children were required to have a complete set of primary canines and second molars, with no history of dental anomalies, orthodontic treatment, syndromes or craniofacial anomalies.

Written informed consent was obtained from the parents or legal guardians prior to the clinical examination of every child. The study protocol was approved by the Ethical Committee of the Catholic University "Our Lady of Good Counsel" Tirana, Albania (Approval No. 251/2023).

### Clinical Examination

The orthodontic assessment was conducted by three expert examiners (F.V., E.N., S.G.) who completed a training

program in orthodontic diagnosis prior to data collection. The training emphasized the methodology to perform a comprehensive clinical examination specifically designed for young children. To ensure diagnostic accuracy and standardization of procedures, the examiners participated in a pilot study involving 60 children before the main investigation. Statistical analysis revealed no significant differences in the results from the pilot study ( $P > 0.05$ ), indicating the consistency and reliability of the examination process.

A registration chart was developed for each participant, incorporating an anamnestic questionnaire (Figure 1) which provided pertinent information regarding the oral habits of every child, inquiring about pacifier use, digit sucking, oral breathing, and bruxism and clinical oral examination measurements, with the exclusion of radiographic imaging.

Additional questions were included regarding the duration of these habits, as prolonged habits tend to have a more severe impact on dentition.

The oral examination (Figure 2), conducted in adherence to the World Health Organization (WHO) guidelines [16], was performed within an approximate duration of about 10 minutes per child. Examinations were carried out during the school year 2023-2024, on-site at the kindergarten, facilitating accessibility for preschool-aged participants and the following parameters were recorded:

- Sagittal anomalies: Canine and molar relationships (Class I, II, III)
- Vertical anomalies: Overbite, anterior open bite
- Transversal anomalies: Posterior crossbite, midline displacement
- Space discrepancies: Crowding, spacing

### Statistical method

All collected data were entered into a Microsoft Excel program, from where they were then exported to SPSS (IBM SPSS Statistics, NY, USA) 27.0, a program in which all statistical analysis was performed. The analysis performed was descriptive and consisted of generating frequency tables, cross-tabulations and percentages and inferential data. The variables were created based on the studies' criteria, and their distribution across the entire population was considered.

## Results

The distribution of the examined sample is presented in table 1: most participants reside in Tirana, the largest city in Albania.

The allocation of subjects according to malocclusion type is presented in table 2. At least one issue in the sagittal, vertical, or transverse plane was identified to determine the presence of malocclusion. The frequency of malocclusion

### Child Questionnaire

All data collected from this questionnaire will be kept confidential in compliance with Law No. 9887, dated 10.03.2008.

Your participation in this project is entirely voluntary. We hope for your contribution. The objective of this study is to provide an overview of the current situation in the population and is often considered in the development of policies in favor of citizens.

The following information should be completed for the child:

- Last Name: \_\_\_\_\_
- First Name: \_\_\_\_\_
- Gender: \_\_\_\_\_
- Date of Birth: \_\_\_\_\_
- Height (cm): \_\_\_\_\_
- Weight (kg): \_\_\_\_\_

Please answer the following questions to complete this questionnaire, aimed at identifying the health characteristics of the child for study purposes. Mark an "X" in the box of the chosen answer or write the response in the appropriate place.

1. Has your child been breastfed?

- ☐ Yes
- ☐ No

If yes, until what month of life did they drink breast milk? .....

2. Has your child used a pacifier/bottle?

- ☐ Yes
- ☐ No
- ☐ Don't know

If yes, until what month of life did they use a pacifier/bottle? .....

3. Has your child sucked their thumb?

- ☐ Yes
- ☐ No
- ☐ Don't know

If yes, until what month of life? .....

4. Does your child have the habit of sucking/biting the lower lip?

- ☐ Yes
- ☐ No
- ☐ Don't know

If yes, how often?

- ☐ Rarely
- ☐ Often
- ☐ Always
- ☐ When stressed

5. Does your child grind or clench their teeth?

- ☐ Yes
- ☐ No
- ☐ Don't know

If yes, when?

- ☐ At night
- ☐ During the day
- ☐ Both day and night

If yes, on average, how many times a day? .....

6. Do you think your child needs orthodontic treatment? (treatment that deals with the alignment of teeth and bite correction)

- ☐ Yes
- ☐ No
- ☐ Don't know

If yes, where?

- ☐ At the teeth level
- ☐ At the jaw level
- ☐ At both teeth and jaw levels
- ☐ Don't know

Please answer the following questions regarding your child's habits during sleep and wakefulness. These questions refer to your child's habits over the past month. Circle the correct answer by responding with Yes, No, or Don't Know.

When your child is asleep	Yes	No	Don't Know
Does your child snore more than half of the night?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child always snore?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child snore loudly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child have heavy and noisy breathing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child have difficulty or problems breathing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have you noticed your child stopping breathing during the night?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

During the day	Yes	No	Don't Know
Does your child have a tendency to breathe through their mouth during the day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child wake up with a dry mouth in the morning?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child occasionally wet the bed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child wake up not feeling well-rested in the morning?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child feel sleepy during the day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has the teacher ever informed you that your child appears sleepy during the day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is it difficult to wake your child up in the morning?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child wake up with headaches in the morning?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has your child ever stopped growing regularly for a period of time?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is your child overweight?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Behavioral Observations	Yes	No	Don't Know
Does your child often seem like they are not listening when spoken to?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child have difficulty organizing tasks or activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child get easily distracted by external stimuli?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child move their hands or feet a lot while seated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is your child always in motion (hyperactive)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child interrupt or intrude in conversations or games?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Table 1:** Regional distribution of normal occlusion and malocclusion in various urban centers.

City	Normal Occlusion (%)	p	Malocclusion (%)	p
		0.000*		0.000*
Durres	5.80%		4.80%	
Elbasan	6.00%		3.70%	
Fushe Kruje	13.10%		3.70%	
Korce	8.20%		12.50%	
Pogradec	7.30%		4.60%	
Shkoder	0.30%		0.30%	
Tirane	53.30%		65.30%	
Vlore	6.00%		5.10%	

exhibits little gender variation, however significant differences are observed across various age groups. Malocclusions were observed in 52% of the sample. Malocclusions were observed in 52% of the sample.

Table 3 displays the prevalence of sagittal abnormalities, which indicates that class II malocclusion is the most prevalent in the sample under investigation. Specifically, 19.1% of cases are classified in the canine Class II and 19% in the second molar class (distal step). Normal occlusion was observed in 76.8% of the canine class I and 77.2% of the molar class I, vertical terminal plane, 1.6% of the subjects exhibited

**Figure 1:** Anamnestic Questionnaire including details on child's oral habits.

### Dental Formula

Kindergarten \_\_\_\_\_  
First Name: \_\_\_\_\_  
Last Name: \_\_\_\_\_  
Age: \_\_\_\_\_

5.5	5.4	5.3	5.2	5.1		6.1	6.2	6.3	6.4	6.5
8.5	8.4	8.3	8.2	8.1		7.1	7.2	7.3	7.4	7.5

1.6	1.5	1.4	1.3	1.2	1.1	2.1	2.2	2.3	2.4	2.5	2.6
4.6	4.5	4.4	4.3	4.2	4.1	3.1	3.2	3.3	3.4	3.5	3.6

Presence of Baby Bottle Syndrome (BBS) Yes ☐ No ☐

C – Decayed O – Filled A – Missing P – Present

Extraoral Analysis				10. Crossbite without lateral shift		11. Overjet	
1. Facial Asymmetry		2. Mandibular Asymmetry		o Yes		o Normal	
o Yes		o Yes		o No		o Increased	
o No		o No		o Not evaluated		o Decreased	
o Not evaluated		o Not evaluated		12. Coincident median lines		13. Overbite	
o Yes		o No		o Yes		o Normal	
o No		o No		o No		o Increased	
o Not evaluated		o Not evaluated		o Not evaluated		o Decreased	
1. 3. TMJ Dysfunction		4. Labial Incompetence		14. Anterior crossbite		15. Open Bite	
o Yes		o Yes		o Yes		o Yes	
o Noise		o No		o No		o No	
o Pain		o Not evaluated		o Not evaluated		o Not evaluated	
o Not evaluated		o Not evaluated		o Not evaluated		o Not evaluated	
16. Crowding > 2 mm				o Yes			
o No				o No			
o Not evaluated				o Not evaluated			
Intraoral Analysis				17. Diastemas		18. Supernumerary teeth	
5. Canine Class Right		6. Canine Class Left		7. Molar Class Right		19. Atypical Swallowing	
o 1		o 1		o 1		o Yes	
o 2		o 2		o 2		o No	
o 3		o 3		o 3		o Not evaluated	
o Not evaluated		o Not evaluated		o Not evaluated		o Not evaluated	
8. Molar Class Left		9. Lateral Crossbite with Shift		20. Presence of Plaque		21. Presence of tartar	
o 1		o Yes		o Yes		o Yes	
o 2		o No		o No		o No	
o 3		o Not evaluated		o Not evaluated		o No	
o Not evaluated		o Not evaluated		o Not evaluated		o No	
22. Healthy Gum		23. Gingivitis		o Yes		o Yes	
o Yes		o No		o No		o No	
o No		o No		o No		o No	
o Not evaluated		o Not evaluated		o Not evaluated		o Not evaluated	

**Figure 2:** Clinical oral examination including the intraoral and extraoral analysis.

**Table 2:** Descriptive analyses of demographic characteristics of the sample.

Age and Gender	n	Normal Occlusion			Malocclusion		
		n	%	p	n	%	p
<b>Age (Years)</b>				0.01			0.016
3	124	62	50%		62	50%	
4	390	163	42%		227	58%	
5	488	258	53%		230	47%	
6	211	104	49%		107	51%	
<b>Gender</b>				0.781			0.658
Females	585	279	47.60%		306	48.60%	
Males	628	308	52.40%		320	51.40%	
<b>Total</b>	<b>1213</b>	<b>587</b>	<b>48%</b>		<b>626</b>	<b>52%</b>	

**Table 3:** Composition and prevalence of sagittal occlusal characteristics.

Sagittal Occlusal Characteristics	Age 3 (Year)		Age 4 (Year)		Age 5 (Year)		Age 6 (Year)		Total		p
	n	%	n	%	n	%	n	%	n	%	
<b>Canine Relationship</b>											<b>0.03*</b>
Normal (class I)	101	81.50%	291	74.00%	382	77.20%	169	78.20%	943	76.80%	
Distal (class II)	22	17.70%	78	19.80%	97	19.60%	38	17.60%	235	19.10%	
Mesial (Class III)	0	0.00%	6	1.50%	7	1.40%	7	3.20%	20	1.60%	
Asymetric	1	0.80%	18	4.60%	9	1.80%	2	0.90%	30	2.40%	
<b>Molar Relationship</b>											<b>0.63</b>
Flush terminal plane	101	81.50%	295	75.10%	381	77.00%	171	79.20%	948	77.20%	
Distal terminal plane	22	17.70%	75	19.10%	99	20.00%	37	17.10%	233	19.00%	
Mesial terminal plane	0	0.00%	6	1.50%	6	1.20%	6	2.80%	18	1.50%	
Asymetric	1	0.80%	17	4.30%	9	1.80%	2	0.90%	29	2.40%	
<b>Overjet</b>											<b>0.68</b>
Normal	89	72.40%	281	71.50%	376	76.30%	159	74.00%	905	73.90%	
Reduced	5	4.10%	22	5.60%	36	7.30%	20	9.30%	83	6.80%	
Increased	29	23.60%	90	22.90%	81	16.40%	36	16.70%	236	19.30%	
<b>Anterior Crossbite</b>	0	0.00%	6	1.50%	7	1.40%	4	1.90%	17	1.40%	<b>0.54</b>

**Table 4:** Composition and prevalence of vertical, transversal and space occlusal characteristics.

Vertical Occlusal Characteristics	Age 3 (Year)		Age 4 (Year)		Age 5 (Year)		Age 6 (Year)		Total		p
	n	%	n	%	n	%	n	%	n	%	
<b>Overbite</b>											<b>0.00*</b>
Normal	96	78.00%	261	66.60%	363	73.60%	156	72.60%	876	71.60%	
Reduced	3	2.40%	21	5.40%	37	7.50%	24	11.20%	85	7.00%	
Increased	24	19.50%	110	28.10%	93	18.90%	35	16.30%	262	21.40%	
<b>Open Bite</b>	9	7.30%	12	3.10%	18	3.70%	17	7.90%	56	4.60%	<b>0.15</b>
<b>Transversal Occlusal Characteristics</b>											
Midline displacement	5	4.10%	41	10.70%	40	8.20%	28	13.90%	114	9.50%	<b>0.017*</b>
Unilateral posterior crossbite	2	1.60%	7	1.80%	13	2.60%	5	2.30%	27	2.20%	0.813
Bilateral posterior crossbite	0	0.00%	8	2.00%	9	1.80%	4	1.90%	21	1.70%	0.482
<b>Space discrepancies</b>											
<b>Crowding</b>	6	4.80%	34	8.70%	16	3.30%	23	10.60%	79	6.40%	<b>0.000*</b>
<b>Physiological Spacing</b>	121	97.60%	343	87.30%	466	94.10%	193	89.40%	1123	91.40%	<b>0.000*</b>



**Table 5:** Composition and prevalence of oral habits.

Oral habits	Total	Males		Females		p
		n	%	n	%	
Lower lip sucking	41	20	7.50%	21	8.30%	0.786
Teeth clenching	173	99	35.90%	74	28.40%	<b>0.014*</b>
Mouth breathing	87	46	16.40%	41	15.80%	0.967
Thumb Sucking	45	17	6.10%	28	10.60%	0.104
< 12 Months	30	10	22.70%	20	45.50%	
12 - 36 Months	9	5	11.40%	4	9.10%	
36 - 48 Months	4	1	2.30%	3	6.80%	
> 48 Months	1	0	0.00%	1	2.30%	
Pacifier	260	137	48.80%	123	46.90%	0.673
< 12 Months	111	60	23.10%	51	19.60%	
12 - 36 Months	144	74	28.50%	70	26.90%	
36 - 48 Months	5	3	1.20%	2	0.80%	

**Table 6:** Correlation between oral habits and occlusal traits.

	CCII	CCIII	Increased Ovj	Increased Ovb	Open Bite	UPC	BPC	Crowding
Mouth breathing	17	1	25	24	10	2	2	11
p	0.097	0.261	0.112	0.155	0.046	0.46	0.762	0.113
Thumb Sucking ≥ 12 months	5	0	6	7	3	19	0	2
p	0.401	0.378	0.222	0.214	0.42	. <sup>a</sup>	0.378	0.841
Pacifier ≥ 12 months	35	5	47	52	19	1	6	27
p	0.562	0.766	0.288	0.495	0.233	0.575	0.547	0.634

CCII- canine class II. CCIII-canine class III. Ovj-overjet. Ovb- overbite. UPC -unilateral posterior crossbite. BPC-Bilateral posterior crossbite  
a. No statistics are computed because CrossbiteLateralConShift is a constant.

canine Class III, while 1.5% of the subjects exhibited molar Class III (mesial advance).

Furthermore, 2.4% of the sample exhibited asymmetric malocclusion. The overjet and anterior crossbite were also assessed on the sagittal plane, with a 19.43% increased overjet and a 6.8% reduced overjet. Anterior cross bite was observed in 1.4% of the cases.

Table 4 offers a comprehensive summary of the space characteristics, as well as the issues in the vertical and transversal dimensions. Deep bite is the most prevalent issue in the vertical plane, afflicting 21.4% of participants. The proportion of subjects with an open bite has increased from three to six years, representing 4.6% of all cases. There was a statistically significant difference in the distribution of various overbite. The transversal problems associated with lateral crossbite with and without shift are 2.2% and 1.7%, respectively. The most prevalent issue in the transversal plane is the absence of midline coincidence, which occurs in 9.5% of cases and has a heightened tendency to occur during growth. Furthermore, age-related classic diastemas are present in 91.4% of patients, while 6.4% have dental crowding.

The questionnaires assessed the presence of oral habits, using responses provided by parents for 543 subjects, representing 44.7% of the total sample. The most prevalent oral habits reported by parents in the questionnaire that was administered prior to the clinical assessment are summarized in table 5, classified by gender. Pacifier feeding was the most prevalent non-nutritive habit in this study group, and it was discontinued by 36 months of age. Teeth clenching and mouth breathing were the next most common non-nutritive habits observed. Thumb suckling, an additional non-nutritive habit that was observed in this sample, is also prevalent during the first three years of life and is only rarely observed after this age.

The correlation between the most prevalent oral habits and occlusal traits is illustrated in table 6. There is a significant correlation between oral respiration and open bite.

No significant correlations were discovered between occlusal characteristics and other oral habits.

## Discussion

The purpose of the present study was to evaluate the prevalence of malocclusion and oral behaviors in a cohort

of children aged 3 to 6 years attending kindergartens throughout Albania. Tirana, the capital of the nation, is home to a substantial number of the study participants and has the highest population density. The research provides a comprehensive examination of the prevalence and distribution of malocclusions in various urban areas, demographic groups, and types of occlusions.

In Albania, this is the first nationwide investigation that has specifically addressed this age group, to the best of our knowledge.

Kongo et al. conducted a recent study that investigated the connection between dental caries and the prevalence of malocclusion in a limited sample of individuals from a single Albanian city. Their results indicated a substantial correlation between the presence of malocclusions and dental caries [17].

It is crucial to comprehend the occlusal alterations that occur during the transition to permanent dentition, as the development of malocclusion starts with primary teeth. In this sample 52% of the individuals exhibited at least one type of malocclusion.

This prevalence is consistent with the results of prior research, including Tschill et al. [18] and Shen et al. [19], who reported that 37.4% and 45.5% of the Chinese population, respectively, have at least one type of malocclusion.

Nevertheless, other studies demonstrated higher prevalence rates, such as 70%, as demonstrated by Dimberg et al [20], which surpassed the results of our investigation. Malocclusion is more likely to deteriorate as individuals age in this sample. Proffit et al. [21] assert that "the progression of malocclusion is associated with changes in bone structure and dental growth over time." This emphasizes the significance of early intervention in the prevention of long-term complications.

The most prevalent malocclusion in this sample was deep bite (21.40%), with class II malocclusion (19.1%) and increased overjet (19.3%) following closely behind. In their investigation, Shen et al. [19] documented a prevalence of 33.6%. Although the deep bite in the primary dentition may be temporary and may resolve on its own, as a result of vertical mandibular growth and the eruption of permanent molars, class II malocclusion and increased overjet are likely to persist or worsen over time [22].

This is consistent with a longitudinal study conducted by Baccetti et al. [23], which bolsters the concept of deep bite correction. In this sample, the flush terminal plane was observed in 77.2% of cases, which is the optimal molar position in mixed or deciduous dentition. The distal terminal plane was observed in 19% of cases, while the mesial terminal plane was present in 1.5% of the cases.

Malocclusions and oral practices have been the subject of

previous research in Tirana, in distinct age groups. Laganà et al. assessed the prevalence of malocclusions and oral habits within a developing Albanian population by conducting a study that involved 2.617 subjects aged 7-15 years [24,25]. Their results suggested that 88.3% of the subjects necessitated orthodontic treatment which is a higher prevalence than that observed in our sample. This implies that the frequency of malocclusions tends to rise as individuals mature.

In addition, the prevalence of deep bite class II and class III malocclusions appears to be quite consistent among different populations. In a study conducted by Esperancinha et al. [26], the Portuguese population's most prevalent occlusal trait was identified as a deep bite. The study also reported a high prevalence of distal step and increased overjet. In the interim our findings were in accordance with those of another study conducted by Golovachova et al. which also demonstrated a higher prevalence of distal step but a lower prevalence of mesial step [27].

A discernible shift in midline displacement is observed in instances of transversal discrepancies. This displacement may be the consequence of skeletal functional or dental factors. It is intriguing that one-quarter of the patients in this sample also exhibited unilateral posterior crossbite. The most common type of posterior crossbite is unilateral frequently accompanied by a functional mandibular displacement toward the side of the crossbite. This condition is frequently observed in children between the ages of three and twelve and it is typically caused by a narrow maxillary arch [28].

The crossbite side of patients with functional posterior crossbite (FPXB) frequently displays a partial or full Class II molar relationship, whereas the non-crossbite side typically exhibits a Class I relationship because of rotational closure of the mandible [29]. Asymmetric posterior occlusion (2.4%) and unilateral posterior crossbite (2.2%) were observed in our sample, which was indicative of this pattern. It is imperative to identify these issues at an early stage in order to prevent the development of more severe complications in the future. During subsequent craniofacial development a functional unilateral posterior crossbite leads to increased growth on the non-crossbite side while the crossbite side experiences impaired growth [30], potentially resulting in facial asymmetry [31].

There were 543 children aged 3 to 6 years whose parents collaborated by completing questionnaires regarding the presence of oral practices, with 264 females and 279 males participating. Pacifier sucking was the most prevalent tendency, as evidenced by 47.8% of cases. Teeth clenching was observed in 31.8% of cases, and thumb sucking was observed in 8.2% of cases. Oral habits were observed in 85.0% (n. 2.707) of the entire sample examined in Tirana by Laganà [24,25]. The pacifier was the most frequently used oral habit (30%). same as in our study.

The prevalence of anterior open bite was considerably higher among infants with pacifier habits of 48 months or longer, as indicated by Warren et al., and the ideal age to discontinue oral habits is approximately 24 months [32]. The protracted use of the pacifier resulted in substantial modifications to the parameters of the dental arch and occlusal tracts, such as an increase in the width of the mandibular arch and a higher prevalence of the posterior crossbite and the anterior open bite. The duration and frequency of thumb sucking are significant determinants in the development of an asymmetrical anterior open bite [33]. In this investigation, a decreased prevalence of non-nutritive habits, particularly those associated with non-nutritive swallowing behaviors has been observed. The most significant discovery in this sample is the rarity of non-nutritive habits, such as thumb sucking or pacifier swallowing, after 36 months of age. This may account for the absence of statistically significant associations between the presence of these behaviors and occlusal issues. The severity of the deformity is directly proportional to the duration, frequency, and intensity of the habit, which can result in deformities in both the fingers and dental occlusion if these habits persevere with high intensity [34]. Nevertheless, we discovered a statistically significant correlation between the presence of oral breathing and the occurrence of open bites [35]. This finding indicates that a higher index degree is associated with a higher prevalence of deleterious oral habits and mouth breathing, which suggests that these factors are associated with greater malocclusion severity. The second most prevalent oral habit in this sample is teeth clenching, which is observed in 31.8% of the cases. It is a prevalent parafunctional habit in children between the ages of three and six, with a multifactorial etiology that includes occlusal interferences, tension, and airway obstruction. It is frequently regarded as physiological at this stage, as it facilitates neuromuscular development and occlusal adjustment. Nevertheless, dental attrition, muscle tension, or temporomandibular joint issues may result from persistent clenching. The necessity of early identification and monitoring is further underscored by its association with oral respiration and sleep disorders. Assessment of whether it is a temporary habit or necessitates additional intervention necessitates regular dental check-ups and parental awareness.

## Conclusion

The results of this cross-sectional study on a preschool Albanian population highlighted the necessity of improving public health programs for orthodontic prevention and screening to organize the resources in this country.

Some results such as deep bite, increased overjet and class II malocclusion prevalence indicate that the necessity of early orthodontic evaluation and targeted public health strategies to mitigate malocclusion development is urgently needed.

Other findings, as the correlation between the presence of

an open bite and the tendency of mouth breathing, highlight the importance to start clinical evaluation at three years of age in order to be able to prevent future more severe malocclusions. Preventive measures addressing deleterious oral habits should be integrated into pediatric dental care to support optimal craniofacial development.

Further longitudinal studies are recommended to better understand the progression of malocclusions over time and assess the effectiveness of early interventions.

## Declaration

**Ethics approval and consent to participate:** This study followed the principles laid down by the World Medical Assembly in the Declaration of Helsinki 2008 Helsinki Declarations on medical protocols and ethics and received positive response by the Ethical Committee of the Albanian Catholic University "Our Lady of Good Counsel" (Approval No. 251/2023)

**Consent for publication:** Written consent was obtained for each subject of the study from parents/guardians.

**Availability of data and materials:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing interests:** The authors declare that they have no competing interests.

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**Authors' contributions:** F.V., E.N., S.G. performed the experimental analysis and analyzed the data, A.M. contributed to writing the manuscript, G.L. and P.C. supervised the project and contributed to write and revise the manuscript, I.N. performed the data statistical analysis. All Authors have read and approved the manuscript.

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