

Early orthodontic treatment need in paediatric age: a prospective observational study in Italian school-children



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Abstract

Aim This study evaluates the prevalence of Interceptive Orthodontic Treatment Need (IOTN) in Italian school-children.

Study Design A prospective observational study was conducted to assess the prevalence of IOTN in patients undergoing a first visit at the Santa Chiara Hospital Paediatric Dentistry Unit in Pisa, Italy. Two thousand, one hundred ninety-nine subjects met the inclusion criteria and were enrolled in the study; data on age, gender and concomitant systemic pathologies were collected from medical records. All participants were examined for individual IOTN: the presence of anterior and/or unilateral/bilateral crossbite with or without midline deviation, bad habits (finger, sucking habits, mouth breathing, and tongue thrust), overjet > 3 mm, lack of space for 1.2 and 2.2 eruption were investigated. The presence of one of the above mentioned parameters was considered positive for IOTN. Chi-square test was used to evaluate any statistically significant difference ($p < 0.05$).

Results The prevalence of IOTN was 35.5%, being unilateral posterior crossbite the most represented (36.3%). Bad habits were found in 29.5% of IOTN children.

Conclusions The study confirms the presence of a significant percentage of paediatric patients who need IOTN; early treatment is highly recommended to reduce malocclusion outcomes in the adult population.

KEYWORDS Interceptive orthodontic treatment need (IOTN); Bad habits; Crossbite.

Introduction

International guidelines in paediatric dentistry highlight the importance of early evaluation of occlusion and dentition development in children, [American Academy of Paediatric Dentistry Clinical Affairs Committee-Developing Dentition Subcommittee, 2008-2009]. The aetiology of a malocclusion may be due either to dental components or to skeletal causes: craniofacial growth pattern [Defabianis et al., 2022], duration of bad habits, concomitant presence of systemic pathologies, early diagnosis, timing of orthodontic treatment and parental support [American Academy on Paediatric Dentistry Clinical

Affairs Committee-Developing Dentition Subcommittee, 2008-2009; Ackerman, 2004] are all factors with high impact on skeletal growth and treatment outcome. In this regard paediatricians and paediatric dentists play a key role in the early interception of malocclusions to reduce their high prevalence during growth, as delayed interventions often result ineffective [Kamdar et al., 2015]. Many cephalometric studies reported in literature have demonstrated how an orthodontic treatment carried out during the pubertal growth peak may have a serious impact on skeletal development [Baccetti et al., 2000; Giuca et al. 2020]. Furthermore, histological studies confirm that from the age of 10 the median palatine suture begins to form the first interdigitations, which reduces progressively the skeletal effects on maxillary expansion. This may be responsible of the failure of orthopaedic expansion of the palate in teenagers [Melsen et al., 1972].

In Italy, more than 75% of the paediatric population is affected by malocclusion [Grippaudo et al., 2013; Grippaudo, 2008; Ferro et al., 2017] but, while in USA about 90% of children are examined in the first year of life, when deciduous teeth erupt, in Italy this happens later, at the age of 3 to 4 years, when the eruption of deciduous teeth has completed [Bubna et al., 2012]. According to the recent clinical recommendations in odontostomatology, published in 2017 Italian ministerial guidelines, the first dental visit should take place at the age of 18–24 months, regardless of the presence of evident dental problems [Wolfe et al., 2006]. The aim is to intercept growth pattern alteration and/or dental anomalies that may lead to systemic problems (such as breathing disorders and subsequent obstructive sleep apnea problems) and provide clinical solutions and oral hygiene and alimentary recommendations to be adopted from the first years of life [Gluca et al., 2021].

The term “interceptive orthodontic treatment” refers to any orthodontic treatment performed in young patients. Childhood is the ideal time to correct a malocclusion: treatment is less invasive, less expensive, faster, has a short duration, the devices used are generally simple, easy to apply, well-tolerated by patients also for long periods, with no interference with daily activities. Furthermore, as mixed dentition is the ideal time for treatment, deciduous teeth are used as anchorage, preventing the risk of onset of caries and/or periodontal problems in the permanent teeth.

The purpose of this study was to evaluate, among patients

MEDICAL RECORDS

Pisa,

Surname _____ Name _____

Address _____ City _____

Date of birth Birthplace _____ FISCAL CODE _____

Phone number _____ e-mail _____ Paediatrician _____

Medical History

- How long has it been since your last dental check-up or treatment? _____
- Have you already undergone orthodontic treatment? _____
- Have you ever had any hospitalizations or any noteworthy illnesses in the past few years? _____
- Do you suffer from:
 - Lung diseases? _____
 - Blood pressure alterations? _____
 - Cardiac disease? _____
 - Blood disease? _____
 - Ocular disease? _____
 - Diabetes? _____
 - Asthma or allergic diseases? _____
 - Allergy to nickel or acrylic resins? _____
 - Viral hepatitis? _____
 - Epilepsy? _____
 - Orthopaedic problems? _____
 - Other pathologies? _____
- Have you ever had any particular consequences following the intake of anaesthetics, antibiotics or other drugs? _____
- Have you ever been warned not to take any medication or medicine in particular? _____
- Have you ever had anaesthesia? _____
- Are you currently taking any medication? _____
- Do you bleed abnormally when injured? Do you have bruises or swell easily? Do you have frequent bleeding? Do you heal easily? _____
- Have you had any x-ray examinations or irradiation therapy? _____
- Are you easily prone to infections? _____
- Do you suffer from: frequent colds? _____ frequent sore throats? _____
frequent earache? _____ hypoacusis? _____
- Have you had trauma to the face, mouth or teeth? _____
- Do you have speech problems? _____
- Do you breathe with your mouth? _____ a)at night _____ b)during the day _____
- Do you snore when you sleep? _____
- Have you ever had surgery? _____
- Have you ever had: Adenoidectomy _____ Tonsillectomy _____
- Have you been breastfed? _____ Up to what age? _____
- Have you ever sucked your thumb? _____ Up to what age? _____
- Have you ever fed with a baby-bottle? _____ Up to what age? _____
- Have you ever sucked the pacifier? _____ Up to what age? _____
- Do you eat your nails? _____
- Do you clench your teeth? _____ a) at night _____ b) during the day _____
- Do you have problems with your "jaw joints"? _____
- Foot number _____ height _____

Signature of the parents or legal guardian _____

ORTHODONTIC RECORDS

IOTN index

- unilateral or bilateral crossbite with or without midline deviation
- anterior crossbite (negative overjet; class III malocclusion)
- bad habits
 - sucking habits
 - mouth breathing
 - tongue thrust
- protrusion of the upper incisors greater than 3mm (overjet > 3 mm; class II malocclusion)
- lack of space for 1.2 and 2.2 eruption

FIG. 1 Medical records form used for the study.

belonging to the Unit of Paediatric Dentistry of the Santa Chiara Hospital in Pisa, the prevalence of subjects needing an interceptive orthodontic treatment (IOTN).

Study Design

A prospective observational study was conducted to assess the prevalence of IOTN in patients undergoing a first visit at the Unit of Paediatric Dentistry of the Santa Chiara Hospital in Pisa from April 2015 to February 2021. Only children aged 4–10 with good compliance and no systemic disease were included in the study. Data on age, gender and concomitant systemic pathologies were collected from medical records. All participants were examined for individual IOTN: the presence of anterior and/or unilateral/bilateral crossbite with or without midline deviation, bad habits (sucking habits, mouth breathing, and tongue thrust), overjet > 3 mm, and lack of space for 1.2 and 2.2 eruption were investigated (Fig. 1). All patients were examined by the same operator to minimise bias related to inter-operator variable. The patients were all examined with the same instruments (probe, mirror) and in the same lighting conditions. The presence of one of the above mentioned parameters was considered positive for IOTN. Chi-square test was used to evaluate any statistically significant difference (p < 0.05).

STATISTICAL ANALYSIS

All data reported were evaluated through statistical tests with the use of a suitable statistical program SPSS 26.0 (SPSS Inc., Chicago, Ill., USA). Frequencies and percentages of malocclusions found in the study sample were calculated and the Chi-square test was used to evaluate any statistically significant difference (p < 0.05).

A comparative analysis was carried out between patients who had malocclusion that required interceptive orthodontic treatment (IOTN Group) and those who did not need orthodontic therapy.

Then, it was evaluated which malocclusion was the most prevalent and if there were differences related to gender.

Results

Two thousand, six hundred eighty-three patients aged 4–10 years were enrolled in the study, but only 2199 (1104 males and 1095 females, mean age 6.74 for males and 6.63 for females) met the inclusion criteria (Fig. 2).

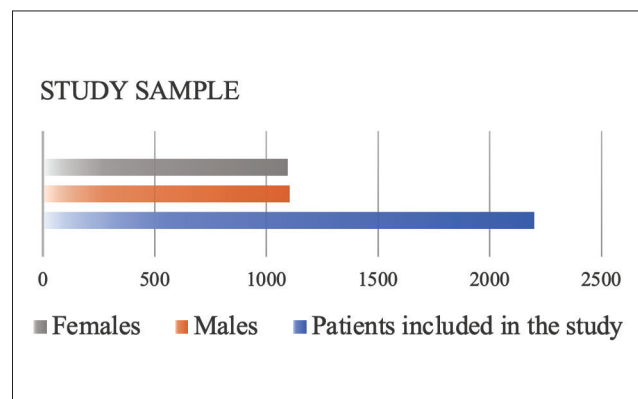


FIG. 2 Patients included in the study, divided by gender.

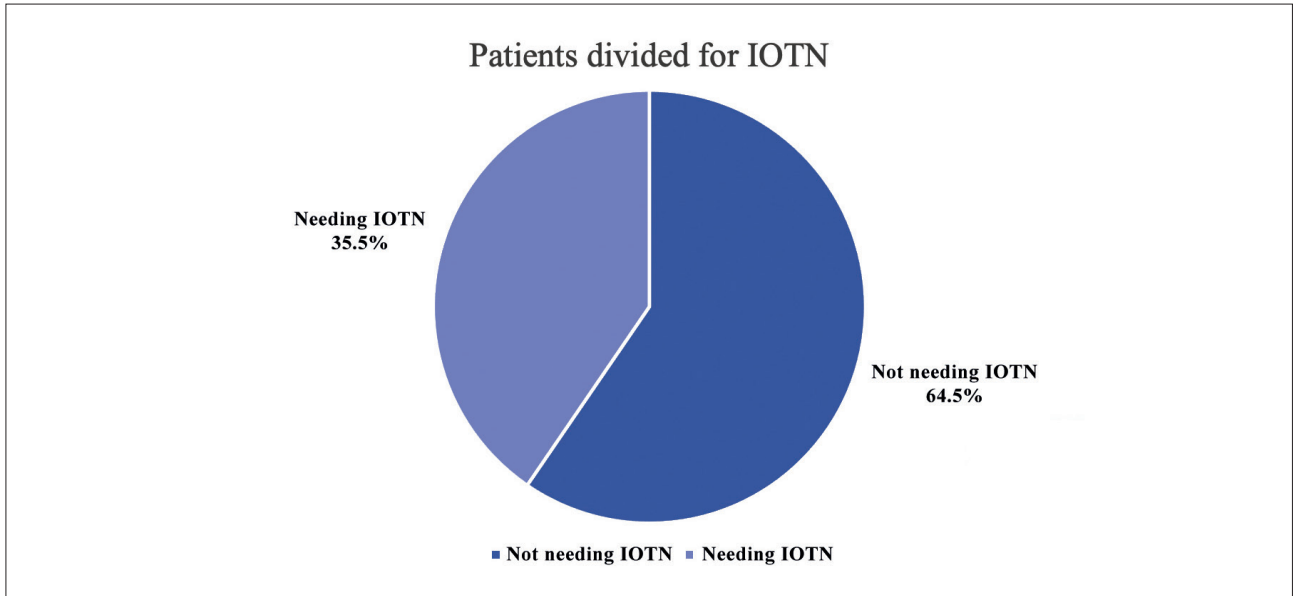


FIG. 3 Patients divided by Interceptive Orthodontic Treatment Need (IOTN).

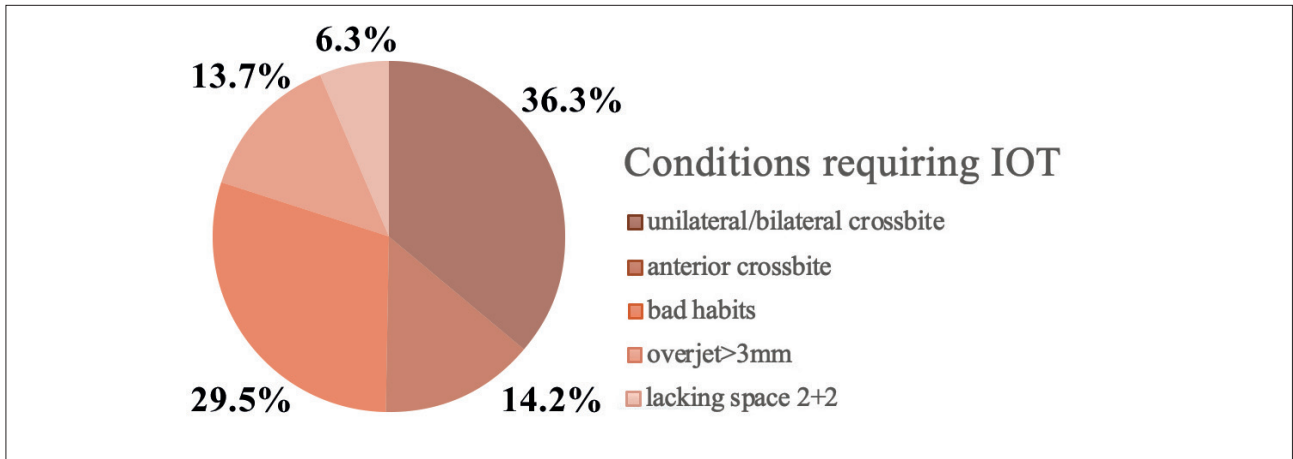


FIG. 4 Distribution of the conditions requiring IOT within the IOTN group.

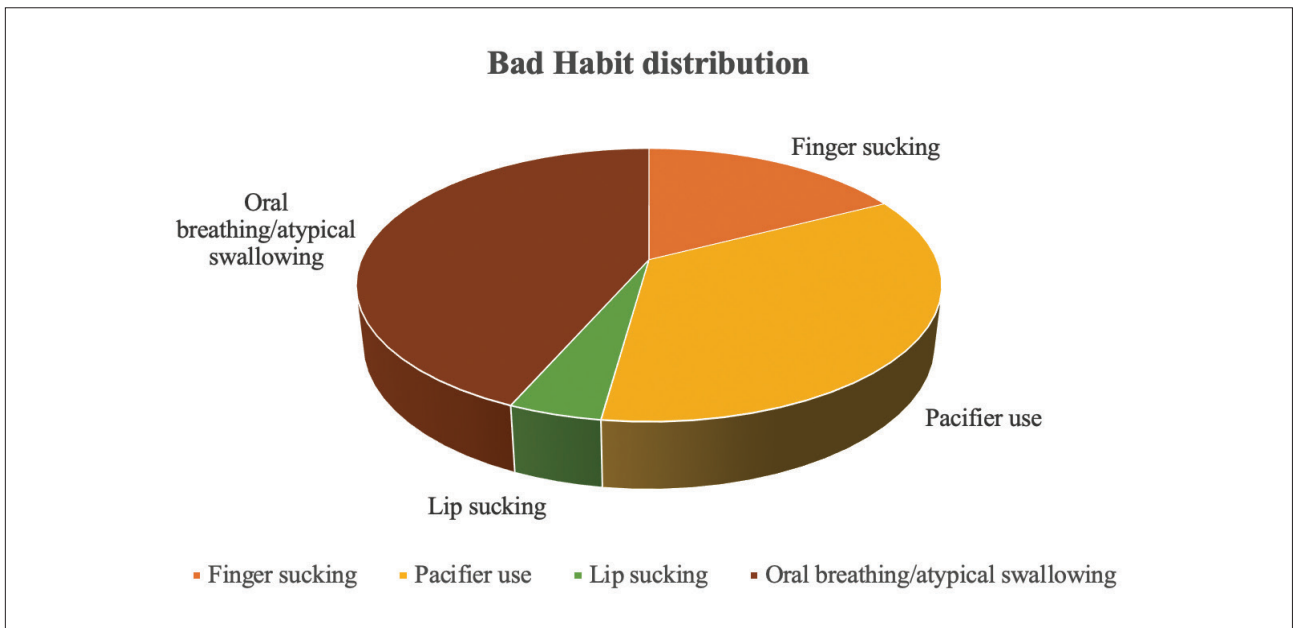


FIG. 5 Bad habit distribution in the bad habit children of IOTN group.

Age	Pacifier use	Finger sucking	Lip sucking	Oral breathing / atypical swallowing
4	61.2%	25.0%	20.0%	36.0%
5	20.0%	32.5%	30.0%	29.0%
6	13.7%	12.5%	10.0%	13.0%
7	3.80%	7.50%	0%	8.00%
8	0%	5.00%	30.0%	5.00%
9	1.30%	10.0%	10.0%	7.00%
10	0%	7.50%	0%	2.00%

TAB. 1 Percentage of bad habits by age.

Patients needing interceptive orthodontic treatment were 780/2199 (35.47%) (Fig. 3), and females showed a statistically significant higher need for treatment ($p < 0.0001$, $p < 0.05$), 283/780 (36.3%) showed unilateral/bilateral crossbite; bad habits were found in 230/780 (29.5%); anterior crossbite in 111/780 (14.2%); overjet > 3 mm in 107/780 (13.7%); lack of space 2+2 in 49/780 (6.3%) ($p < 0.001$, $p < 0.05$) (Fig. 4).

In case of unilateral and anterior crossbite, females were significantly more represented than males ($p < 0.001$, $p < 0.05$ and $p = 0.008$, $p < 0.05$, respectively). A statistically significant difference was also observed regarding bad habits and increased overjet ($p < 0.001$, $p < 0.05$ respectively,) being females prevalent ($p = 0.02$, $p < 0.05$).

In addition, 230/780 patients with bad habits were further investigated: tongue thrust and/or mouth breathing was observed in 100/780 (43.5%) of patients, the pacifier use in 80/780 (34.7%), finger sucking in 40/780 (17.4%) and lip sucking in 10/780 (4.4%) of the children enrolled (Fig. 5). No significant differences were observed for tongue thrust/mouth breathing and pacifier use ($p = 0.05$), while finger and lip sucking were significantly less represented ($p < 0.001$, $p < 0.05$).

Moreover, a statistical analysis was performed to compare patients aged 4–6 and 7–10 years to assess whether there were significant differences in the prevalence of bad habits (Table 1).

Discussion

The aim of this study was to evaluate the prevalence of subjects with IOTN in an Italian population of children aged 4–10 years. The results showed that 35.5% of the patients enrolled needed interceptive orthodontic treatment (IOTN) as reported by Bishara et al. [1988]. Given that as malocclusions is a condition involving dental arches, bones, and muscles, early intervention is essential to reduce the incidence in the paediatric population. In our study, unilateral/bilateral crossbite with or without midline deviation was the most frequent malocclusion observed ($p < 0.001$, $p < 0.05$), affecting 36.6% of the patients enrolled. Data reported in literature confirm a prevalence of 5 to 23% [Carvalho et al., 1998; Dimberg et al., 2015; Negri et al., 2021; Ferro et al., 2016] with a prevalence of females affected [Ferro et al., 2016]. Early treatment is strongly indicated in these cases as the timing of treatment is crucial to reduce the prevalence during growth, while delayed interventions often result ineffective [Kamdar et al., 2015; Cenzato et al., 2021].

Furthermore, as malocclusion is the result of an interaction

between genetically-controlled cell proliferation and environmental influences [McIver et al., 2007], genetics and oral habits can influence the presence of transverse discrepancy [Larsson et al., 2001]. In our study bad habits were observed in 29.5% of IOTN children: tongue thrust and mouth breathing were observed in 43.5% of the patients, pacifier use in 34.7%, finger sucking in 17.4% and lip sucking in 4.4%. Bad habits were statistically more significant in children aged 4–6 years and decreased later, probably because older children stop sucking habits once grown-up [Ferro, 2014; Larsson et al., 1985]. Tongue thrust and mouth breathing were more frequently observed in younger patients, even if it is not clear if they are themselves the primary cause of malocclusion or if their onset is a compensatory mechanism due to dental malposition [McIver et al., 2007]. Children with anterior crossbite (negative overjet, Class III malocclusion) were observed in 111/780 IOTN patients (14.2%).

In Caucasians, prevalence of Class III malocclusion is around 5% and increases to 12% in the Asian populations [Ngan et al., 2005; Mucedero et al., 2008]. In this malocclusion, mandibular protrusion is generally associated to maxillary retrusion and dentoalveolar compensation [Tollaro, 2007; Carli et al., 2021]. Very often patients with mouth breathing and tongue thrust develop a Class III malocclusion, due to the low position of the tongue in the oral cavity, which, with its continuous propulsive action on the mandible and no morphogenetic action on the palate, impacts the growth of the jaws [Benedetti, 2010]. In these patients too, early treatment is highly recommended and is focused on the correction of the lingual function on the maxilla.

An overjet > 3 mm was found in 107/780 (13.7%) of our patients and according to what reported in literature, it is advisable to perform an early treatment to reduce it, as the risk of traumatic fracture of the incisors increases by 13% for each additional mm of overjet [Italian guidelines for the prevention and management of dental trauma in children. Ital J Pediatr. 2019, Artun et al., 2005]

Conclusion

The present study confirms the presence of a significant percentage of paediatric patients who need early interceptive orthodontic treatment. These patients must be treated as soon as possible, as in early childhood it is easier to impact on dentoskeletal growth thanks of the higher rate of compliance compared with teenagers. Interceptive treatments are less invasive, less expensive, faster, and often reduce the need of other treatment.

The findings of our study contribute to the understanding of the importance of early orthodontic treatment in young subjects and, in this perspective, early orthodontic evaluation in young patients must be encouraged. Moreover, the study showed how bad habits are represented in the paediatric population and how they affect the incidence of malocclusion in different age groups. Further studies are needed to evaluate bad habits prevalence in children aged 0–4, who were excluded from the present work.

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