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## Prevalence of cross-bite in a sample of Italian preschoolers

### ABSTRACT

**Aim** To clinically evaluate the prevalence of cross-bite in a sample of 1960 children in our Local Health Unit n°15 Alta Padovana (Veneto region, Northeast Italy).

**Methods** Study design: A cross-sectional study was carried out in the area of Health District n. 15, Veneto region, including 7,364 children from 3 to 5 years, attending a total of 88 nursery schools. A convenience sample of 27 nursery schools (30% of total) was randomly selected, for a total of 2,603 eligible children; of these, 1960 children formed our study base (76%). The day of examination 566 children were absent and 77 did not meet the inclusion criteria by age (less than 3 or more than 5 years old). Anterior cross-bite was considered when one or more primary or permanent mandibular incisors occluded labially to their antagonists. Posterior cross-bite (uni- or bilateral) was considered when the buccal cusps of one or more maxillary teeth was lingual to the buccal cusps of the mandibular teeth of the primary dentition. In this definition, edge to edge occlusion is not regarded as cross-bite. The examination was carried out by two calibrated dentists with children sitting on a dental chair with good operative lighting. The data were recorded in a special clinical chart.

**Results** The prevalence of cross-bite was 3.7%. We observed a slight prevalence of cross-bite in females, but with no overall statistical significance.

**Conclusion** The prevalence of cross-bite in this area was low compared with European and American data.

**Keywords** Cross-bite; Malocclusion; Orthodontic treatment need; Preschoolers.

## Introduction

The demand for orthodontic treatment is increasing in most countries. Therefore, rational planning of orthodontic measures on a population basis is essential in assessing the resources required for such a service, especially in the public service. As malocclusion is considered a public health problem [Draker, 1960] the prevalence of occlusal anomalies, the need and demand for orthodontic treatment should be ascertained within a given community, so that appropriate arrangements could be made for the allocation of staff and financial resources [Tulloch et al. 1984; Stephens et al. 1985]. This stresses the importance of epidemiological studies in order to obtain knowledge about the prevalence of different types of malocclusions and the orthodontic treatment need. The prevalence of posterior cross-bite in the deciduous dentition varies between 8% and 16%, with predominance for unilateral cross-bite [Foster and Hamilton, 1969; Hanson et al., 1970; Helm, 1970; Holm, 1975; Jarvinen, 1981; Kisling and Krebs, 1976; Kutin and Hawes, 1969; Kohler and Holst, 1973; Larsson, 1975; Rasmussen and Helm, 1975; Ravn, 1975; Holm and Arvidsson, 1974; Infante, 1976; Melsen et al., 1979]. Posterior cross-bite has been reported to be one of the most prevalent malocclusions observed in primary dentition, higher in Caucasian children than in African and Asian populations [Heikenheimo and Salmi, 1987; Jamsa et al., 1988; Hannuksela et al., 1988; Egermark-Eriksson et al., 1990; Kerosuo, 1990].

A posterior cross-bite is defined as an abnormal bucco-lingual relationship between opposing molars, premolars, or both, in centric occlusion [Moyers, 1988]. Posterior cross-bite can present as unilateral or bilateral malocclusion of primary, mixed or permanent dentition. Canine involvement is often seen and considered part of a posterior cross-bite even though canines are not, by definition, posterior teeth. Nomenclature is based on the position of maxillary teeth. Posterior lingual cross-bite, the most common type of posterior cross-bite, exists when the buccal cusp of the maxillary teeth are lingual to the buccal cusps of the mandibular teeth. Posterior buccal cross-bite (or scissors bite) occurs when the lingual cusps of the maxillary teeth are buccal to the opposing buccal cusps of the mandibular teeth [Marshall et al., 2005]. A transverse relationship resulting in a posterior cross-bite may be skeletal or dental in origin, or often a combination of both. A posterior cross-bite is generally established during eruption of the primary canines, when a maxillary occlusal relationship develops and the mandible undergoes functional adaptation, deviating either to the right or to the left [Svedmyr,

1979; Myers et al., 1980; Adair et al., 1995; Warren and Bishara, 2002]. Transverse anomalies in primary dentition can also lead to occlusal interferences, particularly in the canine region, which may then lead to a functional shift of mandible anteriorly or laterally [Malandris et al., 2004]. Anterior cross-bite can be a major aesthetic and functional concern during the early stages of dental development. Anterior cross-bite is defined as a situation in which one or more primary or permanent mandibular incisors occlude labially to their antagonists (or when one or more maxillary incisors are lingual to their antagonists) [Daskalogiannakis, 2000]. Cross-bite has a reported incidence of 4–5% and usually becomes evident during the early mixed dentition period [Hannuksela and Vaananen, 1987; Heikinheimo et al., 1987; Major and Glover, 1992]. It results from a variety of factors such as palatal eruption of the maxillary incisors, trauma to the primary incisors, supernumerary anterior teeth, overretained primary teeth, odontomas, crowding in the incisor region, and inadequate arch length [Valentine and Howitt, 1970; McEvoy, 1983; Bayrak and Tunc, 2008]. Differential diagnosis of dental versus skeletal anterior cross-bite is essential in determining clinical treatment. This can be achieved by attempting to guide the mandible into centric relation and evaluating the molar and incisor relationship: If the molars are in a Class I relationship and the incisors in an edge-to-edge relationship, a dental correction can be undertaken [Park et al., 2009]. Anterior and posterior cross-bites in the early mixed dentition are believed to be transferred from the primary to the permanent dentition and can have long-term effects on the growth and development of the teeth and jaws [McNamara, 2002]. Spontaneous correction of such malocclusion has been reported to be too low to justify non-intervention [Kutin and Hawes, 1969; Schroder and Schroder, 1984; Lindner et al., 1986], and the rate of self-correction was shown to range from 0% to 9% [Kutin and Hawes, 1969; Thilander et al., 1984]. Therefore, interceptive treatment is often advised to normalise the occlusion and create conditions for normal occlusal development. The aim of the study is to evaluate clinically the prevalence of cross-bites in primary dentition in a sample of 1960 children randomly selected, male and female, attending nursery schools, in order to evaluate the orthodontic interceptive treatment need in the area of Health District n°15 - Veneto Region, in north east of Italy.

## Methods

A cross sectional study was carried out from October 2010 to May 2011 on a sample of 3-4-5 year-old children in our Health District (Veneto region - Northern Italy). In this area, nursery schools represent the ideal setting, being attended by more than 90% of the study population. In fact, within a population of 254,750 inhabitants (at 12-31-2010) in 28 municipalities, there were 88 kindergartens offering a preschool programme in a population of 8,328 children (2,793 aged 3 yrs; 2,787 aged 4 yrs; 2,748 aged 5 yrs). Following random selection of the institutions to be included in the survey, the relevant managers were contacted in turn. The Directors were contacted by a letter explaining the aims and objectives of the survey. All nursery schools selected agreed to participate in our descriptive cross-sectional survey. Parents of the children were informed about the study by a letter and then invited to give their written consent to the evaluation of the oral health of their children, following the ethical principles defined by World Medical Association Declaration of Helsinki.

A total of 1960 children, from a sample of 27 kindergartens, formed our study population from a total of 2603 children (76%), because 566 children were absent in the day of examination and 77 did not meet the inclusion criteria by age (younger than 3 or older than 5 years). The population of the area is Caucasian. The percentage of non-Caucasian children is less than 2%, so it was considered non-significant, and did not influence the data. The data were collected by 2 calibrated dentists. The level of agreement between examiners was recorded in a simulation of the examinations. The reproducibility was tested examining 20 children simultaneously (inter-examiner) and then re-examining the children 4 weeks after the initial examination. Kappa values of 0.81 (inter-examiner) and 0.84 (intra-examiner) were recorded. The data were recorded on a clinical chart for detection of orthodontic status to verify the presence of cross-bite (right- and left posterior, bilateral posterior). The clinical examination was performed on a portable dental chair, that was brought in every school. Caps, masks, gloves, and gauze were used to comply with infection control. Occlusion was considered in habitual position (intercuspidation). A posterior cross-bite was recorded when one or more of the maxillary teeth occluded palatal to the buccal cusp of the opposing mandibular teeth.

	total % (95% CI)	gender % (95% CI)		age % (95% CI)		
		boys	girls	3	4	5
crossbite ant.	3.3 (2.5-4.2)	3.2 (2.2-4.4)	3.5 (2.4-4.9)	2.7 (1.5-4.5)	3.8 (2.5-5.5)	3.3 (2.1-4.9)
crossbite post. dx	3.7 (2.9-4.6)	2.8 (1.9-4.0)	4.7 (3.4-6.3)	4.0 (2.5-6.1)	4.1 (2.7-5.8)	3.0 (1.9-4.5)
crossbite post. sn	2.9 (2.2-3.7)	2.4 (1.6-3.5)	3.4 (2.34.8)	2.9 (1.6-4.7)	3.0 (1.8-4.5)	2.8 (1.7-4.2)
crossbite bil	0.6 (0.3-1.1)	0.6 (0.2-1.2)	0.7 (0.2-1.5)	1.0 (0.3-2.2)	0.6 (0.2-1.4)	0.4 (0.1-1.2)

TABLE 1 Results.

An anterior cross-bite was recorded when one or more primary or permanent mandibular incisors occlude labially to their antagonists. Descriptive statistics are expressed as a percentage ( $\pm$  confidence interval) or mean  $\pm$  standard deviation, according to the nature of the variable. Comparisons between groups were made using Pearson chi-squared test. Data was analysed with Stata rel. 11.0 [Stata Corporation, College Station, TX, USA].

## Results

We observed a slight excess of cross bite occurrence in females, but with no overall statistical significance; same findings apply to differences through ages, too (Table 1).

## Discussion and conclusion

This was the first Italian cross-sectional study on the prevalence of cross-bite in full deciduous dentition.

The results were compared with recent and storial studies conducted in USA with a prevalence of 5%-8% [Matthews, 1966; Kutin and Hawes, 1969] and in Europe with a range within 4% to 23% [Foster and Hamilton, 1969; Thilander and Myrberg, 1973; Kuroi and Bergland, 1992; Modeer et al, 1982; Kerosuo et al, 1991; Dimburg et al, 2013]. The range of the reported prevalence in Europe was within 5% to 23% (unilateral) and within 3% to 6% (bilateral). The higher European prevalence was possibly associated with prolonged digit-dummy sucking habits in the study populations. [Bell and Kiebach, 2014]. The study conducted in the nursery-schools in our Local Health Unit No. 15 (Veneto region, northern Italy) was actually randomised and absolutely not pre-selected. The elimination of the bias selection inevitably lead to a lowering of the percentage of cross bite in population. The sample size (1,960 subjects) allowed to have a realistic prevalence of this kind of malocclusion in the population, and avoided the formal error of the sample of convenience (non-convenience sample).

In the same area, during the scholar year 2007–2008, a cross-sectional survey in a population of 14-year-olds ( $n = 444$ ) reported a prevalence of cross-bites of 5% [Ferro et Al., 2016]. These data, though referred to a totally different sample, suggest that malocclusion patterns are related to orofacial functions at an early stage of dental development and maintained through later development [Ovsenik et al., 2007]. In our survey, the differences among the detected percentages of prevalence, even if showing a light limiting trend with increasing age, were not statistically significant.

In our sample, the prevalence of cross-bite in the deciduous dentition was low. Cross-bite is one of the more common malocclusions in young patients and, if untreated, may lead to the development of more severe malocclusion. For this reason, the knowledge of its

prevalence enables the Public Dental Service to allocate resources for orthodontic treatment need at an early age.

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