

Prevalencia de infraoclusión en molares primarios de niños de 7 y

8 años, Valdivia, Chile, 2019

Prevalence of infraocclusion in primary molars of children aged 7 and 8,

Valdivia, Chile, 2019

Prevalência de infraoclusão em molares decíduos de crianças de 7 e 8

anos, Valdivia, Chile, 2019

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Resumen:

Objetivo: Determinar la prevalencia de infraoclusión en molares primarios de niños de 7 y 8 años, Valdivia, Chile.

Material y método: Estudio descriptivo de corte transversal. Se examinaron niños de 7 y 8 años en establecimientos educacionales de Valdivia. Fue evaluada la presencia y severidad de infraoclusión en molares primarios utilizando la clasificación de Brearley & McKibben.

Para establecer diferencias estadísticas entre sexo y presencia de infraoclusión fue realizada la prueba de chi-cuadrado. Además un análisis de ANOVA fue utilizado para establecer diferencias entre la localización de la infraoclusión y el grado de severidad. El nivel de significancia estadística se estableció con un valor de $p < 0,05$.

Resultados: Fueron evaluados 359 niños y un 41,78% presentó infraoclusión. Según grado de severidad, 82,1% fueron leves, 15,3% moderadas y 2,7% severas. No se encontraron diferencias significativas entre sexo y presencia de infraoclusión. Se evidenciaron diferencias estadísticamente significativas al evaluar localización y grado de severidad ($p < 0,05$).

Conclusión: Existe una alta prevalencia de infraoclusión en niños de 7 y 8 años en Valdivia, Chile.

Palabras claves: Infraoclusión; Diente Anquilosado, Molares primarios; Prevalencia.

Abstract:

Objective: To determine the prevalence of infraocclusion in primary molars of children aged 7 and 8 in Valdivia, Chile.

Material and method: Descriptive cross-sectional study. Children aged 7 and 8 were examined in educational institutions in Valdivia. The presence and severity of infraocclusion in primary molars was evaluated using the Brearley & McKibben classification. The chi-square test was performed to establish statistical differences between sex and presence of infraocclusion. In addition, an ANOVA test was used to establish differences between infraocclusion location and degree of severity. The level of statistical significance was established at $p < 0.05$.

Results: Of 359 children evaluated, 41.78% had infraocclusion. As per degree of severity, 82.1% of cases were mild, 15.3% moderate and 2.7%

severe. No significant differences were found between sex and presence of infraocclusion. Statistically significant differences appeared when assessing location and degree of severity ($p < 0.05$).

Conclusion: There is a high prevalence of infraocclusion in children aged 7 and 8 in Valdivia, Chile.

Keywords: infraocclusion; ankylosed tooth; primary molars; prevalence

Resumo:

Objetivo: Determinar a prevalência de infraoclusão em molares decíduos de crianças de 7 e 8 anos, Valdivia, Chile.

Material e método: Estudo transversal descritivo. Crianças de 7 e 8 anos foram examinadas em estabelecimentos de ensino em Valdivia. A presença e gravidade da infraoclusão em molares decíduos foram avaliadas pela classificação de Brearley & McKibben.

Para estabelecer diferenças estatísticas entre sexo e presença de infraoclusão, foi realizado o teste do qui-quadrado. Além disso, uma análise ANOVA foi usada para estabelecer diferenças entre a localização da infra-oclusão e o grau de gravidade. O nível de significância estatística foi estabelecido com um valor de $p < 0,05$.

Resultados: 359 crianças foram avaliadas e 41,78% apresentaram infra-oclusão. De acordo com o grau de gravidade, 82,1% eram leves, 15,3% moderados e 2,7% graves. Não foram encontradas diferenças significativas entre sexo e presença de infra-oclusão. Diferenças

estatisticamente significantes foram evidenciadas na avaliação da localização e do grau de gravidade ($p < 0,05$).

Conclusão: Existe uma alta prevalência de infra-oclusão em crianças de 7 e 8 anos em Valdivia, Chile.

Palavras-chave: Infraoclusão; Dente anquilosado, molares decíduos; Prevalência

Introduction

Infraocclusion is a developmental variation that disrupts tooth eruption⁽¹⁻²⁾ and results in a tooth being located below the occlusal plane⁽³⁻⁵⁾. Most infraoccluded teeth erupted into the normal occlusion plane and then stopped doing so while adjacent teeth have continued. As a result, the affected tooth remains in a static retention state, while eruption and alveolar growth continue in adjacent areas⁽⁶⁾.

This alteration is also known as *incomplete eruption, impaction, shortened or submerged tooth, intrusion* and *secondary retention*. However, the correct and most commonly used terms are *infraocclusion* and *ankylosed tooth*⁽⁷⁾. The prevalence in primary dentition is variable, ranging from 1.3% to 38.5%, and is detected mainly in children aged between 7 and 8, making it a clinical situation that pediatric dentists have to face frequently⁽⁷⁻¹²⁾.

The biological mechanism underlying infraocclusion is not well-known; many theories have been proposed to explain its etiopathogenesis, in which genetic, epigenetic and environmental factors come into play. These

factors are likely to have a major role in determining the etiology, clinical expression, and severity of infraocclusion. Localized ankylosis between the root and alveolar bone may explain failed eruption before, during, or after full eruption. However, although infraocclusion is often associated with ankylosis, this is not always the cause of infraocclusion, as a tooth may be infraoccluded but not necessarily ankylosed. In addition, infraocclusion may coexist and be related to other dental abnormalities such as hypodontia, ectopic canines, and peg lateral incisor^(1,13-14).

Previous studies have reported that this alteration mainly affects primary mandibular molars⁽¹⁵⁾, without sex preference, and it is more often mildly severe⁽⁹⁾. On clinical examination, the affected tooth may lack mobility, emit a metallic sound upon percussion, and is located below the occlusal plane⁽⁴⁻⁵⁾.

It can lead to various complications, which are directly related to the degree of severity and may include tilting of adjacent teeth, loss of space in the dental arch, extrusion of the antagonistic dentoalveolar process, lateral open bite, collapse of the alveolar ridge, ectopic eruption or impaction of the successor premolar^(4,16-17) and risk of developing carious lesions, as it is difficult to implement adequate oral hygiene⁽¹⁸⁾. In addition, this alteration has been related to agenesis of the permanent successor⁽¹⁹⁻²⁰⁾.

Therefore, this study aims to determine the prevalence of infraocclusion in primary molars of children aged 7 and 8 in the city of Valdivia, Chile 2019.

Materials and method

A descriptive cross-sectional study was conducted between March and April 2019 in the city of Valdivia, Chile, in which children aged 7 and 8 were selected through random sampling by cluster according to educational institution (public, subsidized and private). Of the 29 schools in the commune, a total of 17 were included to select children for the sampling. Data from the 2017 CENSUS were considered to establish the sample size. The data show that there are 4,258 children aged 7 and 8 in Valdivia (National Institute of Statistics), and an expected prevalence of 12.87%⁽⁷⁾. The confidence level was set at 95% ($Z_{1-\alpha} = 1.96$) and the expected error at 5%. The minimum sample size was determined at 170, and the final sample was 359 children.

This study was approved by the Ethics Committee of the Health Services of Valdivia (Resolution No. 520/2019). Parents and/or guardians signed the corresponding informed consent, and the child's consent was requested at the time of the examination.

All diagnoses were performed by two examiners (V.C and K.G), who underwent the calibration process led by an expert in the area (F.D). The degree of agreement, both intra- and inter-observer, was higher than 0.8 by Kappa index.

All clinical examinations were conducted in each educational institution, implementing universal protective barriers, such as clinical handwashing and the use of disposable gloves and masks. Each child was positioned facing the researcher, under artificial lighting and with maximum mouth

opening. The clinical examination was conducted using basic intraoral exploration instruments and an endodontic ruler. During the examination, infraocclusion was considered present when a tooth was below the occlusal plane compared to neighboring teeth when it should have reached occlusion⁽³⁻⁵⁾. An endodontic ruler was used to determine the occlusal plane by projecting a line from the mesial marginal ridge of the first permanent molar to the cusp tip of the primary canine. The position of the mesial marginal ridge of the first permanent molar was determined by verifying the position of the base of the ridge of the mesiobuccal cusp, as in the study conducted by Odeh et al. ⁽¹³⁾. If there was infraocclusion, the degree of severity was established using the classification proposed by Brearley & McKibben⁽¹¹⁾ (Table 1). The following molars were excluded, as suggested by Zúñiga-Tertre et al.⁽⁹⁾: extensive crown destruction, mesio-occlusal-distal fillings and stainless steel crowns, or an additional condition that did not allow the professional to determine occlusal height. In addition, data were recorded on sex, number of infraoccluded molars, affected molars, degree of severity (mild, moderate and severe), location of infraocclusion (maxillary, mandibular or both) and unilateral or bilateral involvement. The dental nomenclature used in this study is that proposed by the World Dental Federation (FDI).

When an examiner had doubts regarding the infraocclusion diagnosis or the degree of severity, a joint decision was made.

All the data were recorded in a Google Sheets document designed specifically for this study. The document was then exported to comma-

separated values (.csv) format, and the data were analyzed using statistical R software (v.3.4.1) by applying descriptive statistics. Chi-square testing was performed to establish statistical differences between sex and infraocclusion. In addition, an ANOVA test was used to establish differences between infraocclusion location and degree of severity. The level of statistical significance was established at a p-value <0.05.

Results

Of the 359 children examined, 184 were female (51%) and 175 male (49%). Regarding the presence of infraocclusion, 41.78% of children were affected, of which 54% were female and 46% were male (Table 2). Table 3 shows the percentage distribution of the presence of infraocclusion by sex and number of affected teeth.

Regarding the degree of severity, 247 teeth (82.06%) had mild infraocclusion, 46 (15.28%) moderate infraocclusion and 8 (2.66%) severe infraocclusion. The ANOVA test revealed a statistical significance for this parameter ($p < 0.05$). Figure 1 shows distribution according to the degree of severity.

Regarding the distribution of affected teeth, tooth number 75 had the highest frequency of infraocclusion, with 30.56%, followed by tooth number 85 with 29.2%. Table 4 shows detailed information by affected teeth.

Considering infraocclusion location, 121 cases (80.7%) affected the mandible, 15 (10%) the maxilla and 14 (9.3%) both (Fig. 2). The ANOVA test revealed statistical significance when evaluating this parameter ($p < 0.05$). In addition, 65 (43.3%) cases were unilateral and 85 (56.7%) bilateral.

When performing the chi-square test to establish differences between the presence of infraocclusion by sex, no statistically significant differences were found ($p > 0.05$).

Discussion

The etiological mechanism of infraocclusion is unclear; it is believed that the main mechanism could be ankylosis. A theory suggests that this alteration follows a family pattern since this anomaly was found in members of the same family without sex differences. Kurol and Olson suggest that infraocclusion is an inherited anomaly, which occurs through multiple factors, either with polygenic inheritance or controlled by a single environmentally sensitive gene⁽²¹⁻²²⁾. Other authors suggest that there may be other factors involved in the etiology of infraocclusion, such as altered local metabolism, trauma and local infection, chemical or thermal irritation, bone growth failure, abnormal tongue pressure, alteration in bone tissue resorption and normal apposition, systemic diseases (congenital syphilis, endocrine disorders, etc.), abnormal germ position and direction, and lack of space⁽¹⁷⁾.

This study included direct visual clinical examination to detect infraocclusion since this is the best-suited diagnostic method^(7-8,11). This alteration can also be diagnosed with a radiographic test^(8-9,13), but its drawback is that it provides a two-dimensional image of a three-dimensional structure, which causes the structures to overlap. This factor combined with technique sensitivity, and therefore with image distortion, makes it difficult to assess the severity of the infraocclusion⁽²³⁻²⁴⁾.

The prevalence of primary molar infraocclusion obtained in this study was 41.78%, thus proving that it is a frequent alteration in the population studied. However, other studies reached different results, such as Kuroi's⁽⁷⁾, which evaluated 1,059 Swedish children aged between 3 and 12, with a general prevalence of 8.9% and 12.87% in children aged 7 and 8. Other studies, such as those of Zúñiga-Tertre et al.⁽⁹⁾ and Cardoso et al.⁽⁸⁾, reported a prevalence of 10.48% in children aged 3 to 12 and 23.1% in children aged 6 to 9 respectively. Zúñiga-Tertre et al.⁽⁹⁾ reported a 24.7% prevalence in the 7-8 age range. In contrast, Steigman et al.⁽¹²⁾, who evaluated 1,042 Israeli children aged 3 to 6, reported a 38.5% prevalence. This variability in results could be explained by differences in the diagnostic criteria and/or methodology used, ethnic differences and the age ranges considered^(7-8,10-11).

Regarding infraocclusion severity, most cases were mild (81.9%), a figure higher than the results of Brearley and McKibben⁽¹¹⁾ and Cardoso et al.⁽⁸⁾, who found 61% of cases were mild. Severe infraocclusion cases were the

least common, as in the study by Odeh et al. ⁽¹³⁾, where only three cases were observed.

In terms of the number of infraoccluded teeth per individual, it was more frequent to observe one or two affected primary molars, similar to the results reported by Zúñiga-Tertre et al. and Brearley & McKibben^(9,11).

According to Kuroi⁽⁷⁾, the first primary mandibular molar is the most commonly affected tooth in children under nine; after this age, infraocclusion of the second primary molar predominates. Zúñiga-Tertre et al. ⁽⁹⁾ reported similar results, finding that the most affected primary molar was the right mandibular first molar (40.1%), followed by the left mandibular first molar (27.7%). This study found that the second left mandibular molar was the most affected one (30.5%), followed by the second right mandibular molar (29.2%).

In the sample, there was no definite infraocclusion pattern regarding the right or left sector, or the location being unilateral or bilateral, as reported by Kuroi⁽⁷⁾ and Brearley and McKibben⁽¹¹⁾.

It is generally agreed that infraocclusion is mainly located in the mandibular molars⁽⁸⁻¹³⁾ up to ten times more often than in the maxillary molars as recorded by Kuroi⁽⁷⁾, similar to what was found in our sample.

Additionally, although infraocclusion was more common among girls, there were no statistically significant differences when assessing the presence of infraocclusion and sex, as reported by Zúñiga et al.⁽⁹⁾ and Cardoso et al.⁽⁸⁾.

The reduced age range compared to other studies is one of the limitations of this study⁽⁸⁻⁹⁾. This prevents us from establishing whether the population studied is the most affected group in Chile. In addition, although the inter-examiner agreement reached in the study was high, precision when determining severity could be improved when using plaster models; this should be taken into consideration for future research.

In conclusion, the prevalence of primary molar infraocclusion in the studied population is high, it being frequent among children aged 7 and 8. It mostly appears in its mild and moderate versions and affects mainly mandibular molars. It is recommended that interceptive measures be developed for early diagnosis and appropriate interdisciplinary management.

Table 1: Infraocclusion severity classification

Severity	Definition
Mild	The occlusal surface is located approximately 1 mm below the occlusal plane.
Moderate	The occlusal surface is located approximately at the contact point with the adjacent tooth.
Severe	The occlusal surface is located below the contact point or equator of the adjacent tooth.

Table 2. Distribution of infraocclusion by sex

Sex	N	%
Female	81	54
Male	69	46
Total	150	100

Table 3. Percentage of individuals with infraocclusion by sex and number of teeth affected

Number of teeth	1	2	3	4	5	6	Total
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Sex							
		40.74					100.00
Female	%	30.86%	14.81%	12.35%	0.00%	1.23%	%
		37.68					100.00
Male	%	43.48%	8.70%	7.25%	0.00%	2.90%	%

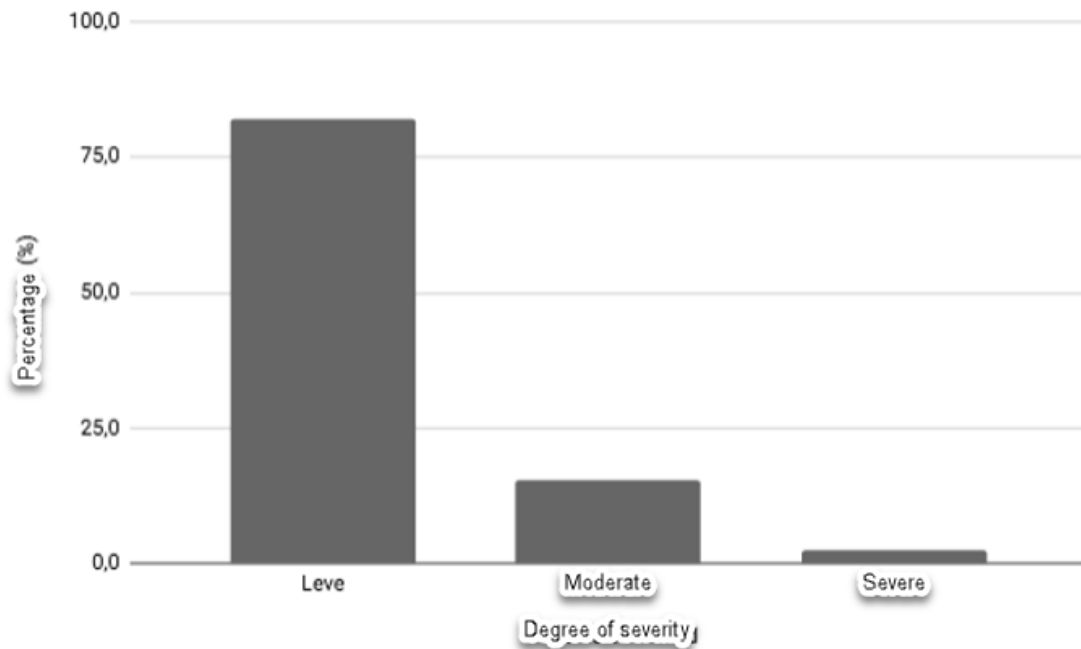


Fig 1. Infraocclusion according to degree of severity (p<0.05)

Table 4. Infraocclusion by affected tooth according to severity

Severity	Tooth								
	55	54	65	64	75	74	85	84	Total
Mild	14	2	13	3	81	33	76	25	247
Moderate	2	1	4	0	7	13	11	8	46
Severe	0	0	0	0	4	0	1	3	8
Total	16	3	17	3	92	46	88	36	301

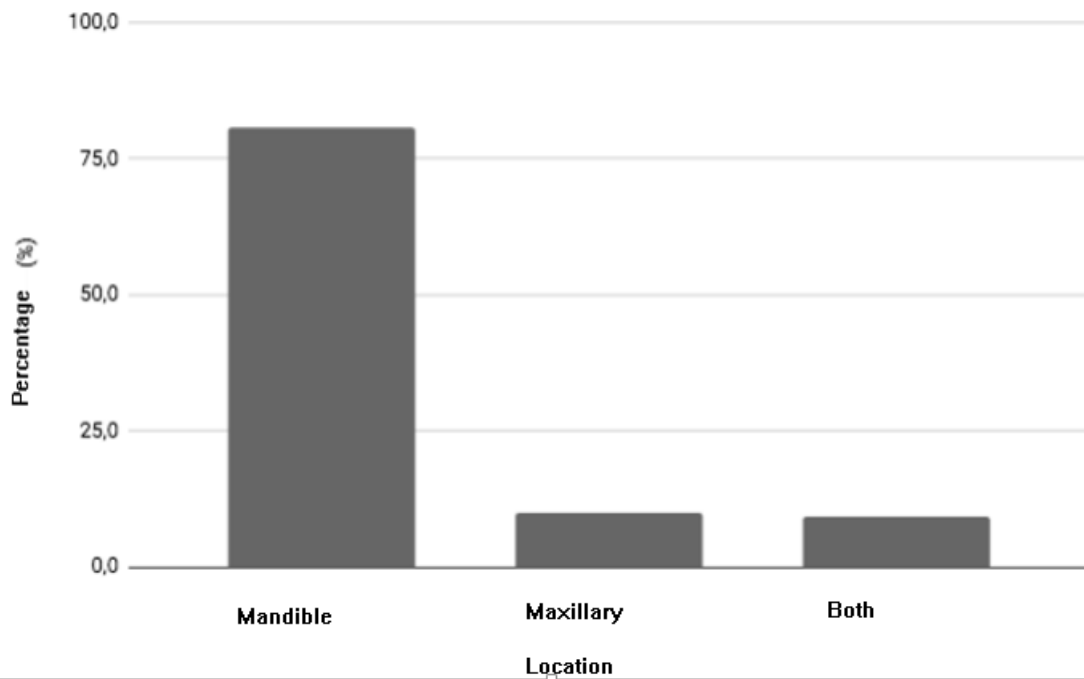


Fig 2. Distribution of infraocclusion by location ($p < 0.05$)

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CONFLICT OF INTEREST

The authors declare they have no conflict of interest regarding the authorship and/or publication of this paper.

Authorship contribution

- 1) Conception and design of study
- 2) Acquisition of data
- 3) Data analysis
- 4) Discussion of results
- 5) Drafting of the manuscript
- 6) Approval of the final version of the manuscript.

F.D.S has contributed in: 1, 4, 5, 6.

F.A.M has contributed in: 1, 3, 4, 5, 6.

V.C.P has contributed in: 1, 2, 4, 5, 6.

K.G.G. has contributed in: 1, 2, 4, 5, 6.

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