

# Maternal Education, Dental Visits and Age of Pacifier Withdrawal: Pediatric Dentist Role in Malocclusion Prevention

Pérez-Suárez V\*/ Carrillo-Díaz M\*\*/ Crego A\*\*\*/ Romero M\*\*\*\*

**Objective:** Although discouraged, pacifier usage is widespread and often practiced beyond two years of age. The current study explored the effects of maternal education and dental visits on the age of pacifier withdrawal. **Study design:** The dental histories of 213 children (53.1% male) attending a primary school in Madrid were obtained along with maternal education level and age at pacifier withdrawal. Data were analyzed by using independent samples t-test, one-way ANOVA two-way ANOVA and a complementary non-parametric approach was also used. **Results:** There was a significant effect of maternal education on the age of pacifier withdrawal; the higher the maternal education, the younger the age of withdrawal. The frequency of dental visits influenced the relationship between maternal education and the age of pacifier withdrawal. Dental visits considerably shortened pacifier use among children with low- and medium- educated mothers. **Conclusions:** Pediatric dentists play a critical role in the correction of unhealthy oral habits such as prolonged pacifier use. The educational component of pediatric dentistry could reverse the lack of knowledge or misinformation among high-risk groups (e.g. low maternal education). As a consequence, we recommend that children start dental visits at an early age and maintain visits with a high frequency.

**Keywords:** pacifier use, maternal education, dental visits, malocclusion prevention.

## INTRODUCTION

The use of pacifiers to satisfy the sucking instinct is a widely extended practice.<sup>1,2,3</sup> Recent studies on non-nutritive sucking-behaviors, such as pacifier use and digit sucking, have reported prevalence rates ranging from 47% to 90%,<sup>2,4</sup> with pacifier use cited as the most predominant of these habits in early childhood.<sup>4</sup> Some authors consider that non-nutritive sucking is a manifestation of the innate biological drive for sucking, which would justify the high prevalence of this behavior. According to these authors, digits, pacifiers, or toys could serve primarily to satisfy instinctive needs.<sup>2,4</sup> While pacifier use at 4 years or older is considered an extended habit, several studies have pointed out prevalence rates between 11%-55% at this age.<sup>4,5</sup> The World Health Organization and the American Academy of Pediatrics have condemned pacifier use due to the negative impact on breastfeeding and child health.<sup>6</sup>

Previous research<sup>7</sup> has reported that the use of pacifiers may be associated with “nipple confusion”, early weaning, risk of otitis

and other infections, and malocclusions. On the positive side, pacifiers may protect against sudden infant death syndrome (SIDS).<sup>7,8</sup> Others, have suggested that pacifier use improves a child’s ability to breathe through the mouth if the nasal airway becomes obstructed. Furthermore, it has been argued that sucking on a pacifier requires forward positioning of the tongue, which could reduce the risk of oropharyngeal obstruction.<sup>8</sup>

Depending on the intensity, frequency, and length of pacifier use,<sup>9</sup> occlusal development may be impaired. Previous research has indicated that the recommended age to wean from the pacifier in order to prevent dental problems is two years of age.<sup>10</sup> The use of a pacifier beyond two years of age, can lead to jaw and dental arch malformation.<sup>10</sup> The narrowing of the superior dental arch, especially at the area of the canine teeth, along with the enlargement of the inferior dental arch is a characteristic problem of children with extended pacifier use. To explain this result, a study suggests that, while the child is sucking a pacifier, the tongue stays in a more inferior position in the oral cavity<sup>11</sup> Posterior cross-bite, anterior open-bite increased overjet and canine and molar class II are the most frequent malocclusions due to prolonged pacifier use.<sup>10-15</sup> Together with skeletal and dental deformities, the persistence of pacifier use can lead to several myofunctional impairments, such as labial incompetence, lip entrapment, and reduced tongue or lip muscle tone<sup>11</sup> Moreover, a study reports that the habit of pacifier sucking past two years of age has been found to be a significant risk factor for caries development in children. Ollila<sup>16</sup> suggested that a pacifier may reduce oral sugar clearance, in a similar way as removable dentures do, which would prolong conditions of low pH in plaque and favour the selection of aciduric micro-organisms. Moreover, pacifiers could also increase the available surface for microbial adhesion. However, the association between pacifier use and caries is not clearly established.<sup>17</sup>

\* Victoria Pérez-Suárez, Professor, Faculty of Health Sciences, Department of Paediatric Dentistry.

\*\* María Carrillo-Díaz, Professor, Faculty of Health Sciences, Department of Paediatric Dentistry.

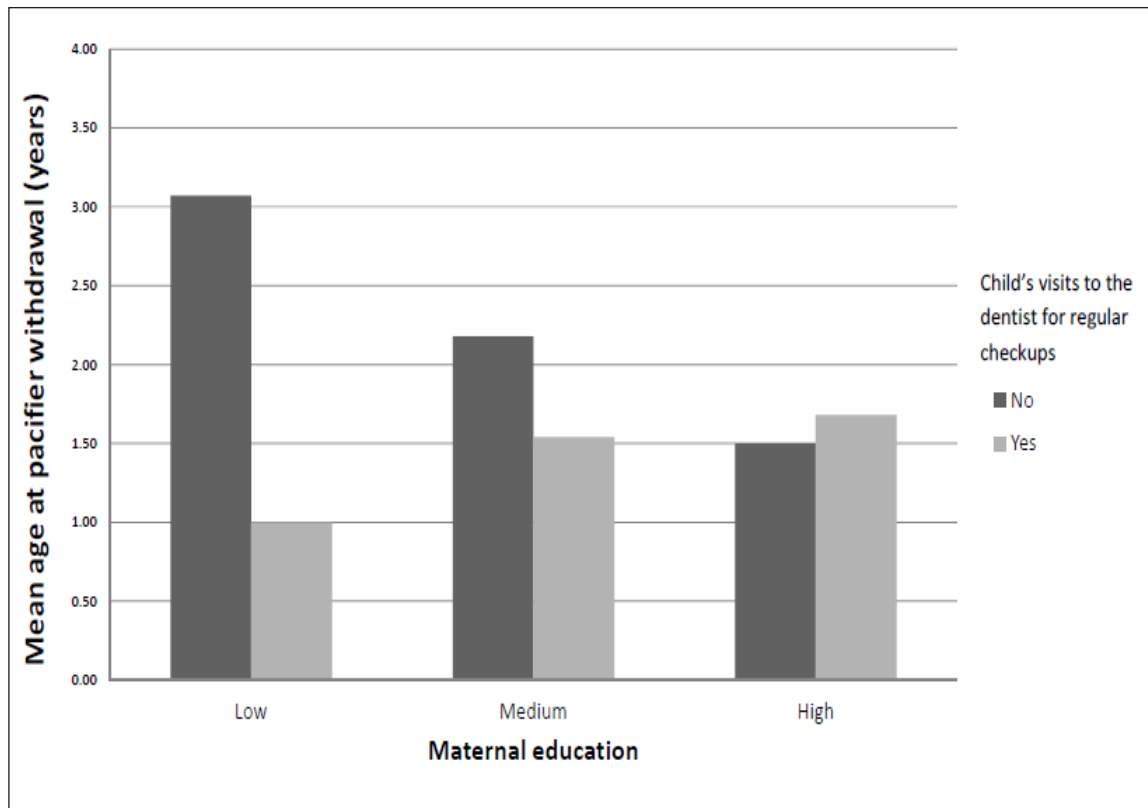
\*\*\* Antonio Crego, Professor, Faculty of Health Sciences, Department of Psychology.

\*\*\*\* Martín Romero, Professor, Faculty of Health Sciences, Department of Paediatric Dentistry.

Send all correspondence to: Prof. Victoria Pérez-Suárez, Faculty of Health Sciences, Rey Juan Carlos University, Avda. de Atenas s/n E28922-Alcorcón (Madrid), Spain

Phone: 0034914889018

E-mail: victoria.perez@urjc.es



**Figure 1.** Interaction effects of pediatric dental check-ups and maternal education on the children's age at pacifier withdrawal.

Zhang *et al*<sup>18</sup> explained that mothers tend to be more involved than fathers in child care. Maternal education may play a vital role in the improvement of oral health habits.<sup>19</sup> Prior research has found an association between lower socioeconomic status and a lack of oral health knowledge and subsequently poor dental habits. For example, North *et al*<sup>20</sup> found that mothers with a minimal education level were more than twice as likely to give their child a pacifier compared to mothers with a university degree. However, there are contradictory studies showing that a higher parental<sup>21</sup> or maternal<sup>4</sup> education was associated with a prolonged pacifier habit.

Previous research has found that maternal education significantly affects the use of dental care services and child dental health.<sup>22</sup> Children of mothers with a low education level tend to visit the dentist less frequently. It is therefore possible that maternal lack of knowledge about oral habits and lack of access to professional information may work together.<sup>19</sup> The present study aims to analyze both the separate and combined influences of maternal education level and visits to the dentist on prolonged pacifier use.

**MATERIALS AND METHOD**

The parents of 213 children (53.1% male) filled out questionnaires pertaining to their child's oral health habits and dental history. The average child's age at the time of survey was 5.91 years (*SD* = 1.37), ranging from four to eight years. All children were students at state schools in Madrid, Spain.

Informed consent was obtained from parents and approval of study procedures was obtained from the Rey Juan Carlos Committee for Ethics in Research.

Parents completed a structured questionnaire including socio-demographic items (age, gender, educational level) and questions about their child's dental history and oral health habits (frequency of dental checkups, age of pacifier withdrawal, oral health problems). Before launching the survey, a pilot administration of the questionnaire was conducted in order to guarantee that the items were correctly understood. Then the staff of the participating schools sent the questionnaires to the parents together with instructions for completion. After completing the questionnaire at home, parents sent the questionnaires back to the school.

*Mother's educational level* was characterized as low, medium or high based on the highest official academic degree obtained by the mother.

*The child's visit to the dentist for regular checkups* was assessed by a yes/no question ("Did you bring your child to the dentist for periodical check-ups?")

The age at which the child stopped using the pacifier was indicated by the parents, that were asked "How old (years and months) was your child at the age of pacifier withdrawal?"

**Statistical analyses**

Descriptive (means and standard deviations) and inferential statistics were calculated. Data were analyzed by means of common procedures of comparisons of means, such as Analysis of Variance (ANOVA) and t-tests. These techniques allow determining whether the observed differences between groups in the age at which the children stopped using the pacifier were statistically significant. From the participants' responses three groups of maternal educa-

**Table 1.** Descriptive statistics (mean and standard deviation) for age at pacifier withdrawal by maternal education level.

Maternal education	N	Children's age at pacifier withdrawal	
		Mean	SD
Low	19	2.53	1.57
Medium	102	1.71	0.97
High	92	1.67	0.98
Total sample	213	1.77	1.06

tion were formed: low, medium and high educational level. Children's were grouped on the basis of their pattern of dental visits: regular and irregular attendance. Levene's test confirmed that the assumption of homogeneity of variances, required for using these techniques, was met. The effect of maternal education on the age at which pacifier usage was stopped was assessed with a one-way Analysis of Variance (ANOVA). To further analyze possible differences between groups, post-hoc test (Scheffé, Tuckey HSD and Bonferroni's correction) were conducted. Differences in the mean age of pacifier withdrawal between children who regularly visited the dentist and those who did not were analyzed by independent samples t-tests. A two-way factorial ANOVA was used to explore the interaction between maternal education and dental check-ups on the age of pacifier withdrawal.

As the groups that were compared in our analyses presented different sizes, a complementary non-parametric approach was also used in order to guarantee that the obtained results were robust. The Kruskal-Wallis' test was used as an alternative to one-way ANOVA tests, whereas Mann-Whitney's U and Wilcoxon's W were computed as an alternative to independent samples t-tests.

IBM SPSS.19 software for statistical analysis (IBM, Armonk, NY, USA) was used for analyses.

**RESULTS**

A one-way ANOVA showed that the age of pacifier withdrawal was significantly affected by maternal education level [ $F(2, 210) = 5.54, p < 0.01$ ]. Non-parametric Kruskal-Wallis' test, however, yielded a result that was marginally significant ( $\chi^2=5.90, df=2, p=0.05$ ). As shown in Table 1, the mean age of pacifier withdrawal decreased as maternal education level increased. Post-hoc tests (Scheffé, Tuckey HSD, Bonferroni) confirmed a significant difference ( $p < 0.01$ ) in the age of pacifier withdrawal between children of mothers with a low education level and children of mothers with medium and

**Table 3.** Two-way ANOVA for the effects of maternal education and regularity of dental check-ups on the children's age at pacifier withdrawal

Variable	F	p-value
Maternal education level	0.784	0.458
Check-up regularity	11.166	0.000
Interaction between maternal education and check-up regularity	5.074	0.007

Dependent Variable: Children's age at pacifier withdrawal  
R2 = 0.151 (Adjusted R2= 0.131)

**Table 2.** Descriptive statistics (mean and standard deviation) for children's age at pacifier withdrawal by regularity of dental checkups.

Child's regular checkups	N	Children's age of pacifier withdrawal	
		Mean	S.D.
No	46	2.39	1.22
Yes	167	1.60	0.95

high education levels. There was no significant difference, however, between medium and high maternal educational level in age of pacifier withdrawal.

The mean age at which children stopped using the pacifier differed according to the regularity of dental visits. Children who did not visit the dentist for regular checkups abandoned the use of the pacifier later than those who regularly visited the dentist (Table 2). An independent samples t-test confirmed that these differences were statistically significant ( $t = 4.69, df = 211, p < 0.01$ ). Non-parametric tests also yielded significant results (Mann-Whitney's  $U=2375.50$ , Wilcoxon's  $W=16403.50, p < 0.01$ ).

As shown in Table 3, a two-way ANOVA revealed a significant interaction between maternal education level and dental attendance on the age of pacifier withdrawal. This interaction effect is presented in Figure 1 and Table 4. Interestingly, the average age at pacifier withdrawal was three years old for children who did not regularly attend dental visits and who had a low-educated mother, while the mean age of pacifier withdrawal was at one year of age for children of low-educated mothers who regularly visited the dentist. A t-test analysis showed that these differences were statistically significant ( $t = 3.05, df = 17, p < 0.01$ ). Non-parametric test, such as Mann-Whitney's U and Wilcoxon's also confirmed this result ( $U=3.00, W=18.00, p < 0.01$ ). Furthermore, the children of medium-educated mothers who regularly visited the dentist abandoned the pacifier at a significantly earlier age, compared with those children of medium-educated mothers who did not regularly visit the dentist ( $t = 3.09, df = 100, p < 0.01$ ). Consistent with the parametric t-test, non-parametric tests also revealed significant differences between these groups ( $U=679.50, W=3454.50, p < 0.01$ ). However, in the case

**Table 4.** Descriptive statistics (mean and standard deviation) for children's age of pacifier withdrawal by regularity of dental checkups and maternal education.

Child's regular checkups	Maternal Educational level	Children's age at pacifier withdrawal		
		N	Mean	S.D.
No	Low	14	3.07	1.44
	Medium	28	2.18	0.98
	High	4	1.50	1.00
Yes	Low	5	1.00	0.71
	Medium	74	1.54	0.91
	High	88	1.68	0.98

of high maternal education, there was no significant difference in the age at pacifier withdrawal between children who regularly visited the dentist and those who did not ( $t = -0.36$ ,  $df = 90$ ,  $p > 0.05$ ). This result was also obtained when non-parametric statistic was used ( $U = 165.00$ ,  $W = 175.00$ ,  $p > 0.05$ ).

A simple effects analysis also revealed that children who regularly received dental checkups (Figure 1, grey bars) did not statistically differ in the age of pacifier withdrawal, regardless of maternal education level [ $F(2, 164) = 1.47$ ,  $p > 0.05$ ]. The Kruskal-Wallis non-parametric test ( $\chi^2 = 3.14$ ,  $df = 2$ ,  $p > 0.05$ ) pointed at the same direction.

## DISCUSSION

References of modern pacifiers, called “coral teething rings” or “sugar tits”, date back to the end of 15th century and the beginning of 16th century.<sup>2,7,11</sup> As some authors have pointed out, the process of industrialization and modernization of society, which requires the participation of females in the labour force, has entailed a reduction in breastfeeding and it has made children more likely to adopt the habit of sucking fingers and pacifiers.<sup>15</sup>

The current study highlights the importance of pediatric dental visits for the promotion of proper oral health care specifically among parents with low education. The results revealed joint effects of maternal education level and regular dental check-ups on the age of pacifier withdrawal. Low maternal education and infrequent dental visits prolonged pacifier use. Moreover, studies have shown that dental consultation plays a key moderating role in the effect of low maternal education on pacifier use.<sup>23</sup> Regular visits to the dentist can significantly decrease the age at which the pacifier is withdrawn among children of mothers with low and intermediate education levels. Conversely, children who do not regularly receive dental checkups tend to use the pacifier longer. Therefore, pacifier use relies on an important interaction between maternal education and regular dental visits rather than maternal educational level alone.<sup>19</sup> This interaction may explain contradictory findings from previous research on the role that maternal education plays on pacifier withdrawal.<sup>4,20,21</sup>

Oral health care information alone does not necessarily change unhealthy habits. A previous study found that mothers of at-risk pre-school children had only superficial knowledge, attitudes and behaviours about their child’s dental health, in spite of regular visits to the paediatric dentist.<sup>24</sup> Several factors could counteract the influence of oral health care professional advice. Despite advice against it, pacifier use is deeply rooted in some cultures.<sup>25</sup> Previous research has found an association between social factors and pacifier use. For example, North *et al*<sup>20</sup> reported that socially disadvantaged mothers were more likely to allow their children to use a pacifier. The use of pacifiers as a means to control negative behaviors (e.g. crying or fussing) in the short term<sup>26</sup> is a common practice.

There are certain limitations to the current study that must be considered. First, the sample population was a convenience sample and therefore, may not be representative of the broader population. It may thus, be difficult to generalize the results. Second, parents were asked to recall a past event (children’s age at pacifier withdrawal) and their response may have been affected by memory errors and biases. Third, as with all self-report measures, responses may be biased by socially desirable attitudes. Despite these limitations, the

current results draw a coherent relationship between study variables and are consistent with previously published results on pacifier use.

While the topic of pacifier use has received considerable attention and contradictory results have frequently lead to further discussions,<sup>27</sup> few studies have previously taken into account the relationship between maternal education and pacifier use. Prior studies have found that caregivers acknowledge the need for more information about good oral habits for preschool aged children.<sup>28</sup> In particular, dental advice should be offered to high-risk groups during dental consultations.<sup>29</sup> Pediatric dentists should be made aware of their influence on patient knowledge and behaviors.<sup>5,30</sup> They can provide parents and caregivers with reliable information on maintaining good oral health habits starting in early childhood. The advice given by dental professionals has been shown to be the most efficient method for decreasing pacifier use; however, it may also be the one least often practiced.<sup>31</sup>

## CONCLUSIONS

The main contribution of the current study was the finding that regular dental visits can moderate the negative contribution of low maternal education to pacifier usage, indicating the critical role of paediatric dentists, particularly among children of mothers with low and medium educational levels. Thus, this study emphasizes educational issues involved in pediatric dentistry, the vital role of dental care practitioners in the promotion of healthy oral habits and the need for identifying specific target groups (e.g. lower educated or socially disadvantaged mothers) to enhance child oral health care. A lack of regular dental check-ups negatively affects oral health, not only because dental problems may remain unidentified and untreated but also because the opportunity to receive professional advice on good dental care practices is reduced.

In this context, paediatric dentists play a leading role in decreasing the age of pacifier withdrawal and we therefore suggest that children visit the dentist starting at an early age.

## REFERENCES

1. Gili D. And another thing! A diatribe on dummies. *Arch Dis Child*, 86: 222, 2002.
2. Ravin JJ. The prevalence of dummy and finger sucking habits in Copenhagen children the age of 3 years. *Community Dent Oral*, 2: 316-322, 1974.
3. Adair SM. Pacifier use in children: a review of recent literature. *Pediatr Dent*, 25: 449-458, 2003.
4. Warren JJ, Levy SM, Nowak AJ, Tang S. Non nutritive sucking behaviors in preschool children: a longitudinal study. *Pediatr Dent*, 22: 187-191, 2000.
5. Ovsenik M, Farcnik FM, Korpar M, Verdenik I. Follow-up study of functional and morphological malocclusion trait changes from 3 to 12 years of age. *Eur J Orthodont*, 29: 523-9, 2007.
6. World Health Organization. Protecting, promoting and supporting breastfeeding: the special role of maternity services. *Int J Gynaecol Obstet*, 31: 171-183, 1990.
7. Adair S M, Milano M, Lorenzo I, Russel C. Effects of current and former pacifier use on the dentition of 24- to 59-month-old children. *Pediatr Dent*, 17: 437 – 444, 1995.
8. Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. *Pediatrics*, 116: 716-723, 2005.
9. Scavone H Jr, Ferreira RI, Mendes TE, Ferreira FV. Prevalence of posterior crossbite among pacifier users: a study in the deciduous dentition. *Braz Oral Res*, 21: 153-158, 2007.

10. Warren JJ, Bishara SE, Steinbock KL, Iones T, Nowack AJ. Effects of oral habits' duration on dental characteristics in the primary dentition. *J Am Dent Assoc*, 132: 1685-1693, 2001.
11. Zardetto CGC, Rodrigues CRMD, Stefani FM. Effects of different pacifiers on the primary dentition and oral myofunctional structures of preschool children. *Pediatr Dent*, 24: 552-560, 2002.
12. Bishara SE, Warren JJ, Broffitt B, Levy SM. Changes in the prevalence of nonnutritive sucking patterns in the first 8 years of life. *Am J Orthod Dentofac*, 130: 31-36, 2006.
13. Duncan K, McNamara C, Ireland AJ, Sandy JR. Sucking habits in childhood and the effects on the primary dentition: findings of the Avon Longitudinal Study of Pregnancy and Childhood. *Int J Paediatr Dent*, 18:178-188, 2008.
14. Heimer MV, Tornisiello Katz CR, Rosenblatt A. Non-nutritive sucking habits, dental malocclusions, and facial morphology in Brazilian children: a longitudinal study. *Eur J Orthodont*, 30: 580-585, 2008.
15. Macena MC, Katz CR, Rosenblatt A 2009 Prevalence of a posterior cross-bite and sucking habits in Brazilian children aged 18-59 months. *Eur J Orthodont*, 3: 357-361, 2009.
16. Päivi Ollila. *Assessment of caries risk in toddlers. A longitudinal cohort study*. Oulu: University of Oulu; 2010.
17. Peressini S. Pacifier use and early childhood caries: an evidence-based study of the literature. *J Can Dent Assoc*, 69: 16-19, 2003.
18. Zhang M, McGrath C, Hägg U. Who knows more about the impact of malocclusion on children's quality of life, mothers or fathers? *Eur J Orthodont*, 29:180-5, 2007.
19. Hebling SR, Cortellazzi KL, Tagliaferro EP, Hebling E, Ambrosano GM, Meneghim Mde C, et al. Relationship between malocclusion and behavioral, demographic and socioeconomic variables: a cross-sectional study of 5-year-olds. *J Clin Pediatr Dent*, 33: 75-79, 2008.
20. North K, Fleming P, Golding J. Pacifier use and morbidity in the first six months of life. *Pediatrics*, 103: 34, 1999.
21. Farsi NMA, Salama FS: Sucking habits in Saudi children: prevalence, contributing factors and effects on the primary dentition. *Pediatr Dent*, 19:28-33, 1997.
22. Ostberg AL, Ericsson JS, Wennström JL, Abrahamsson KH. Socio-economic and lifestyle factors in relation to priority of dental care in a Swedish adolescent population. *Swed Dent J*, 34: 87-94, 2010.
23. López R, Fernández O, Baelum V. Social gradients in periodontal diseases among adolescents. *Community Dent Oral*, 34: 184-196, 2006.
24. Blinkhorn AS, Wainwright-Stringer YM, Holloway PJ. Dental health knowledge and attitudes of regularly attending mothers of high-risk, pre-school children. *Int Dent J*, 51: 435-438, 2001.
25. Soares MEM, Giugliani ERJ, Braun ML, Salgado ACN, Oliveira AP, Aguiar PR. Pacifier use and its relationship with early weaning in infants born at a Child-Friendly Hospital. *J Pediatr*; 79: 309-316, 2003.
26. Kramer MS, Barr RG, Dagenais S, Yang H, Jones P, Ciofani L, et al. 2001 Pacifier use, early weaning, and cry/fuss behavior: a randomized controlled trial. *JAMA*, 286: 322-326, 2001.
27. Victora CG, Behague DP, Barros FC, Olinto MTA, Weiderpass E. Pacifier use and short breastfeeding duration: cause, consequence, or coincidence? *Pediatrics*, 99: 445-453, 1997.
28. Chan SC, Tsai JS, King NM. Feeding and oral hygiene habits of preschool children in Hong Kong and their caregivers' dental knowledge and attitudes. *Int J Paediatr Dent*, 12: 322-331, 2002.
29. Lewis CW, Grossman DC, Domoto PK, Deyo RA. The role of the pediatrician in the oral health of children: a national survey. *Pediatrics*, 106: 84, 2000.
30. Primožic J, Ovsenik M, Richmond S, Kau CH, Zhurov A. Early crossbite correction: a three-dimensional evaluation. *Eur J Orthodont*, 31:352-6, 2009.
31. Degan VV, Puppini-Rontani RM. Prevalence of pacifier-sucking habits and successful methods to eliminate them: a preliminary study. *J Dent Child*, 71: 148-151, 2004.

