Introduction

Many studies report great variability in the eruption time of deciduous teeth in different ethnic and racial groups. The eruption of the first teeth usually begins around the sixth month after birth, and is completed between 30 and 36 months of age. Tooth development is genetically determined and this seems to be the main influencing factor, while the environmental factors play a less important role [Baykan and Sahin, 2004]. Eruption is a term used to indicate the movement that brings the crown of a tooth from its location within the alveolar crypt into a functional position in the oral cavity; the main component of the movement has axial direction. Because teeth undergo continuous adaptive occlusal micro-movements due to dental wear, bone structures remodeling and dental migration, eruption can be considered as a life-lasting phenomenon.

The mechanism of dental eruption has always aroused interest so many are the theories proposed to explain its origin. Those about the axial migration of the tooth during eruption postulate that the erupting force is generated by deposition of alveolar bone, cell proliferation (especially in basal pulp region), root growth, tissue pressure induced by muscle action on the bone structure and the tension generated by the periodontal ligament. It is still unknown if this force is continuous or intermittent [Baccetti et al., 1993, Berkovitz and Moxham, 1999; Cattaneo and Baratta, 1940]. Probably the phenomenon requires the synergy of all elements: tooth, alveolar cavity and periodontium. Completion of deciduous dentition is not the primary goal of dental development, but it should be considered only a stage in the gradual progression of events that allows an individual in growing phase to meet the changing functional demands [Picton, 1985]. As soon as the primary dentition is completed, the child is able to use the masticator system for its function. For this reason the primary dentition starts developing long before birth. At birth and during the first year of life the brain development follows a foetal growth pattern. During this stage the brain doubles its dimension. This type of cranial growth follows the rules of Moss functional matrix, where bone structures adapt to the functional stimuli received by the soft tissues [Chiarugi, 1940, Creasoli, 2000, De Micheli, Modica, Re 1998, Fejerskov Ole & Josephsen Kaj, 1988].

In newborns there is a large disproportion between neurocranium and splanchnocranium, and between maxilla and mandible. The high discrepancy between maxilla and mandible at birth is due to the fact that the maxilla in the fetal period develops primarily as an epiphenomenon of brain growth. In fact, during the first 6 months of life, the child's brain continues to develop at a foetal pace, as if it was still in the womb [Rowe and Johns, 1985; Snawder, 1998]. The mandible in turn, which cannot develop as an
epiphenomenon of other organs growth, owes its formation to its function; in fact nature provided it of membranous ossification, therefore it is more sensitive to hormonal and functional stimuli than the other cranial bones. Therefore breast-feeding contributes to mandible development during the rapid growth phase taking place after birth; the process offsets the initial discrepancy allowing to both arches to be properly aligned when the deciduous teeth will start to erupt in the oral cavity. Subsequently the suction engram will be replaced by the act of chewing, and this not only allows the mandible to keep up with the maxilla, which meanwhile continues growing following the bones of the skull, but it also acts as a mortar pestle adapting the mandible to function, and promoting its further growth. It is obvious that artificial feeding, by preventing the antero-posterior movement of the tongue-mandible unit and removing the stimulus for the bone bases growth, mainly the mandible, determines the development of the articular eminences in a backward position. For this reason the mandible will be smaller and in a distal position, predisposing to skeletal occlusal disorders [Dettori and Confalonì, 2001].

Ages of eruption. Eruption of deciduous teeth has a high temporal variability between populations, due to genetic and environmental factors. For this reason assessment of eruption ages and their variability has been the focus of many studies over the years, which also investigated the corollary symptoms sometimes present, to verify whether they are indeed related to tooth eruption [Skibinski, 2000]. The order of eruption of deciduous teeth should correspond to the starting of their calcification [Ashley, 2001; Backstrom et al., 2000; Hubertus et al., 2001; Hulland et al., 2000; Kronfeld and Logan, 2000]. Eruption, therefore, begins with the lower central incisors around the sixth month of life, immediately followed by the upper central and lateral incisors between 12-14 months of age. Around the sixteenth months make their appearance the first molars, followed towards the twentieth months by the canines. It will take ten more months for completion of primary dentition, which ends with the eruption of the second deciduous molars, at about the 30th month [Melcher and Furseth, 1988]. From a clinical point of view there is still some discrepancy compared to the times listed in the texts. At least in the eruption of the first teeth, there is a gap of about a month and a half. The first teeth to erupt are in most cases the lower central incisors. It was found that actually in different populations eruption times change and the authors link these changes to the influence of environmental factors [O'Rahilly and Muller, 1992; Rojic, Rojic and Vukusic, 1999; Steward, 1972]. The purpose of our work is to verify whether there are variations in the time of eruption of deciduous teeth compared to those reported in literature.

Methods and material
The population covered by our study includes 204 children aged between six to twenty-four months. The work was performed in collaboration with seven paediatricians of the province of Sassari (Italy), and the children were followed-up for one year. Examinations were carried out at the pediatric offices to get immediate feedback of the clinical conditions of the children. The parents were asked to fill in a questionnaire.

This can be divided into three sections.
1) General information, namely: pediatrician name, date of visit, details about the child and a parent, APGAR index, length and weight at birth and the possible presence concomitant systemic diseases (which may cause a delay in eruption).
2) Collection of data of dental interest. Type of feeding and its duration, age of weaning, use of feeding bottles and use of dummy in hours per die. This section also include periods of tooth eruption and the possible presence of collateral manifestations.
3) Informed consent.

All children were examined by the same operator for the first and subsequent visits. The ages of eruption of reference were based on those reported by the standard reference manual of paediatric dentistry [van Waes and Stockli, 2001]. The ages are: six months for the upper central incisors and lower, ten months for lateral incisors, fourteen months for the first molars, eighteen months for canines and finally twenty four months for the second molars. Our intent was to detect any shift from these reference dates and confirm the hypothesis that there might be an initial delay in eruption.

Results
All children of our sample at birth weighted between 2.5 and 4.0 kg, of the sample only 2 children had not reached optimum weight, being born premature. The length at birth, fallen between 46 and 55 cm, was the norm for all children. As for breastfeeding, we classified it into three types: breast-feeding, artificial and mixed. It resulted that of the 204 children, 114
were breast-feed, 41 were artificially feeded, and 49 had a mixed type feeding.

The period in which paediatricians, with the help of parents, decided to introduce foods other than milk (maternal or artificial) in the diet was always between the fifth and eighth month of life. Over 149 children, 9 were weaned at the fifth month, 83 at the sixth, 38 at the seventh and finally 19 after the eighth month. Weaning starts when the child is given new foods other than milk, and the type of feeding is completely different. Ends that period where the child stimulates the oral and perioral structures by the act of suction. Of the young patients weaned at the fifth month, 3 over 9 had the eruption of teeth 71 and 81 before 6 months of age. For the dental elements 51-61 the average eruption time was 7.37 months; for the 72-82 and 52-62 an average of 12 months, for the first molars an average of 16.25 months, for the canines around 18.5 months, and the second molars erupted at 23 months. Among those weaned at six months, only 7 over 83 had an early eruption; for most of them the first eruption shifted from sixth months and up, even to the fifteenth month of age in a few cases, with an average of 8.66 months. For the 51-61 the eruption occurred at 10.8 months on average, for the teeth 72-82 at 12.5 months. Later incisors appeared at 13 months, first molar at 15.75 months, canines 21-23 months, and second molars at 23-24 months.

Among the 38 children weaned at seventh months, 4 had an early eruption of the first teeth, while for all others the same teeth erupted between the sixth and seventeenth month, with a greater frequency around the eighth month with 8.65 on average.

For 51-61, the average time of eruption was 9.51 months, 72-82 averaged 12 months, and the 52-62 averaged 12 months. First molars 18.25 months on average; canines 20.7 months; second molars 23 months (only 7 patients). Finally among all those children whose weaning took place after the eighth month, only one had the eruption of tooth 71 at the fifth month. For all other subject the first eruption was between the seventh and sixteenth month, with a marked preponderance between the tenth and twelfth months with an average of 9.25. For the 51-61 the average was 10 months; 72-82 averaged 12.35 months; 52-62 averaged 12.64 months and the first molars approximately 17.26 months, canine 20 months, second molars 23.4 months (only 5 of 19 children). The analysis of the habits, typical of the early childhood, that may affect dental eruption gave us the following results:

Use of bottle. Of 152 children, 121 used the bottle, only 31 didn’t use it. It must be remembered however that in most cases children used the bottle only for drinking milk.

Pacifier. 155 children used the dummy. It was necessary to divide the sample into three main groups: children who used it sporadically (61 subjects) – regarded as a non-use for analysis purposes; children who used it less than 10 hours throughout the day (75), and finally children who used it for more than 10 hours (12).

The prolonged use of dummy leads to a 50% delay in eruption for those who use it improperly, and teeth 71 and 81 erupt with a delay varying between 3 to 6 months. On the other hand, among the children who never used it, it can be seen a more or less significant delay in 31 cases, about half of them.

Discussion

As regards the ages of eruption of all elements there was a change more or less significant depending on the tooth taken into account.

The first teeth to erupt are always the lower central incisors, except in two cases where the first to erupt were the upper incisors. The teeth 71 and 81, which should erupt around the sixth month, according to our results shift the eruption times of approximately 2.7 months, and therefore erupted at 8.7 months in average. The eruption of the upper incisors occurs with a delay of almost four months, around the tenth month. Also the lateral incisors erupt with a delay of more than two months for the upper ones and more than three months for the lower.

When the frontal teeth eruption is almost completed, it takes 5 more months for first molars to appear in the oral cavity, even though in three cases they erupted before the lateral incisors.

The latter, as reported in literature [Lunt and Law, 1974; Nasser et al., 2003; Ramirez et al., 1994] should appear at the fourteenth month, while in our study they erupted with a delay of about four months, at the average age of about eighteenth months. They are immediately thereafter followed by the canines, which erupt at the average of twenty months, with a delay of approximately two months. The last elements that complete the primary dentition are the second molars. They are not present in 186 children at 24 months of age; only in 18 of 204 examined children they erupted around the 23rd month (Fig. 1, 2).

Our results reflect those changes that are taking place in the rest of the world, and the data are in agreement with the studies performed by other authors.
[Baykan and Sahin, 2004; Nasser, Al-Jasser, Lanre Bello, 2003; Ralph, 2000; Charchut et al., 2003]. Many believe that the cause of this delay is to be found in the changes of environmental factors occurred during the past decades. It’s sure that pregnant women eat a more balanced diet than sixty years ago. Even the foods used for weaning (and homogenised food) are more easily “chewable” and digestible, and don’t stimulate the primary dentition effectively. New habits such as the use of dummy further affect the stomatognatic child’s system, changing the homeostasis determined by the position of tongue and its relationship with the palate and soft tissues. In our sample, we observed that most of the breast-feeding children, and that have a limited use of the dummy, have a peak of eruption of the teeth 71-81 at the eighth month. Times are longer for the group with mixed feeding and even more so for those who had been artificially fed. All those who use the dummy throughout the whole day have much longer times of eruption. Therefore the use of dummy seems to encourage the teeth eruption, if used for a limited number of hours. By contrast, misuse leads to considerable delays of eruption (Fig. 2, 3).

Early weaning, typical of our times, has no further effect on the eruption times, even if it modifies the muscular physiological activity turning movements with an antero-posterior direction in vertical movements, with subsequent decreased stimulation of the retrodiscal area, so influencing the mandible development [Kazajian, 1940; Petrovic, 1982; Petrovic and Stuzmann, 1972; Kino Ohmura and Amagasa, 1993].

**Conclusion**

The results of our study allow to state that the times of eruption, related to our sample, are moved forward from those reported in old reports; breastfeeding remains the best type of feeding, from a dental point of view, because it favours the development of upper and lower maxilla. The judicious use of dummy is even advisable.

**Aknowledgement**

We thank for their cooperation Mrs. Giovanna Senes, professional nurse, and Mrs. Antonina Mura, dental hygienist.

**References**


Baccetti T, Defraia E, Franchi L. Recenti acquisizioni sulla fisiologia dell’eruzione dentale: teorie a confronto. Nota 1.

**Fig. 1 - Times of eruption and our results.**

**Fig. 2 - Comparison between breast-feeding-teats and times of eruption incisors.**

Ordinate axis =hours during the day
Abscissa axis =age expressed in months.

**Fig. 3 - Comparison between breast-feeding, use of dummy and deciduous incisors eruption (51-61).**

Ordinate axis = hours during the day
Abscissa axis = age in months.
Chiarugi G. Trattato di Embriologia. Torino: Vallardi; 1940.