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Dental Age Estimation in Down Syndrome Children, Using Schour-Massler and the Blenkin-Taylor Method in Jember Region

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ABSTRACT

Background: Dental age estimation plays a vital role in today's medical world. There are various methods for determining the approximate age of a person. Dental age estimation seen from the growth of the teeth can be measured by looking at the clinical condition of the individual's oral cavity or through panoramic photos. There are many studies related to the estimation of individual age through the teeth but not yet in children with Down Syndrome.

Purpose: The purpose of this study was to analyze the differences in the dental estimated ages of Down syndrome children using the Schour-Massler and the Blenkin-Taylor method in Jember Region.

Material and Methods: The research was cross-sectional. The research subjects were people with Down Syndrome 10-17 years old and taking panoramic photos. Calculating dental age using the method of Schour- Massler and Blenkin-Taylor by 3 observers. Data analysis using Kolmogorov Smirnov and Paired T-Test.

Results: The mean difference between the age of the sample and the age of the teeth in the Schour - Massler method is 2.0-3.1 years and the difference between the age of the sample and the age of the teeth in the Blenkin-Taylor method is 1.6-3.2 years.

Conclusion: There was a delay in the teeth age, especially in Down Syndrome children using both the Schour-Massler measurement method and the Blenkin-Taylor method.

ARTICLE DETAILS

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INTRODUCTION

According to the Indonesian health magazine in 2011, the prevalence of diseases with genetic disorders is 5-15% of cases, and for Down syndrome, there is 1 in 700 births in Indonesia[1]. Genetic disorders often cause miscarriages, babies who die shortly after birth, or babies born with disabilities[2]. Genetic Abnormalities are closely related to Chromosomal Abnormalities. Certain chromosomal abnormalities can result in metabolic abnormalities which in turn negatively affect brain development and lead to mental disabilities, for example, Down's Syndrome. Children with Down Syndrome tend to experience obstacles in growth and development[3].

Down syndrome is one of the disorders caused by an anomaly in the number of chromosomes on chromosome 21[4]. In children with Down syndrome, there is a mutation of one of the receptors for BMP (Bone Morphogenesis Protein) which can cause delays in the growth and development of the teeth[5]. The average baby with Down syndrome experiences a delay in the eruption of the teeth for 2-3 years[6].

The estimation of a person's age plays a vital role in today's medical world. There are various methods for estimating a person's age[7]. The estimated age seen from the growth of the teeth can be measured by looking at the clinical condition of the individual's oral cavity or through radiographic photographs, for example, panoramic radiography[8].

Several methods have been used to determine dentition calcification. Among these methods include Schour and Massler and the Blenkin and Taylor methods[9]. Many studies have determined the estimated age of individuals using

methods of estimating the condition of the teeth, but none have determined the delay in the eruption of the teeth of children with Down syndrome using the method of estimating the age of the teeth, giving rise to differences in the age of the teeth and the age of the sample. in children with Down syndrome in the Jember region using the Schour-Massler and Blenkin-Taylor methods. The purpose of this study was to analyze the differences in the dental estimated ages of Down syndrome children using the Schour-Massler and the Blenkin-Taylor method in Jember Region.

MATERIAL AND METHODS

This type of research is cross-sectional. The research was conducted at Patrang State SLB, TPA SLB, Bintoro Asuhan Foundation, and Parahita Jember Laboratory. This study is based on the results of panoramic radiography in patients with Down syndrome. This research has received approval from the Health Ethics Commission of the Faculty of Medicine, University of Jember. The research subjects were sufferers of Down Syndrome aged 10-17 years. Issues that met the sample criteria and were willing to sign informed consent were then taken panoramic photos. After that, tracing was carried out from the results of panoramic photos. Then, calculations were carried out to estimate the age using the Schour and Massler and Blenkin and Taylor methods by 3 observers. The sample panoramic photos are coded 1, 2, 3, and so on, then each observer compares the dramatic photo conditions with the Schour and Massler and Blenkin and Taylor tables to get the age of the sample teeth. The results of measurements and calculations are recorded in a data form and then averaged. After the data is averaged, the standard deviation is calculated and the data is analyzed using the Kolmogorov Smirnov and Paired T-Test.

RESULT

Table 1. The average age difference using the Schour-Massler and Blenkin-Taylor methods

Number of samples	Average age difference (Schour-Massler)	Average age difference (Blenkin-Taylor)
7	2.0 - 3.1 year	1.6 - 3.2 year

Based on table 1. the average age difference between the sample and the age of the teeth in the Schour-Massler method is 2.0-3.1 years and the difference in the age of the sample and the age of the teeth in the Blenkin-Taylor method is 1.6-3.2 years out of a total of 7 samples of children Down Syndrome. Samples calculated using the Schour-Massler and Blenkin-Taylor methods were analyzed for normality using the Kolmogorov-Smirnov test and obtained Sig.> 0.05, which means that all samples are normally distributed. Samples were also analyzed using the Paired T-Test and obtained a value of $\alpha < 0.05$ in all samples so that it can be stated that there was a significant difference between the age of the sample and the age of the sample teeth.

DISCUSSION

This research was conducted to determine the age estimation of children with Down syndrome using the Schour and Massler and Blenkin and Taylor methods. The Schour and Massler method is the oldest age estimation method among all methods[10]. The Blenkin and Taylor method is a modification of the Schour and Massler method, modifications are made to a larger sex and age range[11].

There are several drawbacks to the Schour and Massler method, namely on this graph there is no survey differentiating between men and women, and the average age range from 2-5 years is concluded to be 6 months and this is too narrow[12]. Improved by Ubelaker (1999) and later by Blenkin and Taylor with a calculation method that has a larger range so that it allows for a higher level of accuracy and distinguishes between male and female gender[12,13].

A.E.W. Miles (1959) researched to ensure that Schour and Massler's chart could be used for children in England and to test the accuracy of what age can be assessed using the Schour and Massler method[10]. Strengthened by Quendangen (2016) who examined the accuracy of the Schour and Massler method for children in Denpasar, Indonesia aged 5-16 years where in his research concluded that this method was accurate enough to determine the estimated age of children from Indonesia so that this method could be a benchmark for forecasting delayed growth and development of teeth in children with Down syndrome, especially in Jember district[14].

From the results of the research on age estimation using the Schour and Massler method, it can be seen that nothing matches the age of the sample, even the overall age of the teeth using the Schour and Massler method is below the age of the sample. 3 samples with a difference of up to 3-4 years, 2 samples with a difference of up to 2-3 years, and 2 samples with a difference of 0-1.5 years, this shows that there is a delay in the growth and development of the teeth of children with Down syndrome compared to normal children with a delay of about 2 years. This reinforces Webster's (2007) statement which states that children with Down Syndrome experience delays in body growth and development which are directly related to delays in the growth and development of their teeth for around 2 to 3 years. Children with Down Syndrome tend to experience obstacles in the growth and development of their bodies, as well as the development of their teeth. Delays in body development are closely related to chromosomal abnormalities experienced by sufferers, causing metabolic abnormalities and negatively affecting brain growth or what is generally called 'developmental delay'[3].

The growth and development of the teeth in children with Down Syndrome also experience delays, marked by the

delayed eruption of the teeth. The eruption of these teeth requires resorption of the alveolar bone overlying the crown of the erupting tooth and the process of growth of the alveolar bone beneath the erupting tooth thus pushing the tooth to erupt in its path[15]. For the alveolar bone or primary teeth to be adsorbed on the tooth buds, the activity of osteoclasts or odontoblasts is needed, to produce osteoclasts or odontoclast cells, stellate reticulum cells from the teeth that will erupt, secreting parathyroid hormone (PTH)-related protein (PTHrP)) and interleukin 1a (IL-1a). As a result, the dental follicular cells are stimulated to release factors that can recruit monocytes which are then carried toward the coronal of the tooth. These monocytes will fuse and differentiate into osteoclasts or odontoblast cells which, when in contact with cells expressing RANKL (Receptor Activator of Nuclear Factor Kappa B Ligand) will absorb hard tissue[16].

Other factors that also play a role in the occlusal movement of the tooth at this stage are elongation of the rapidly growing pulp apically and alveolar bone growth at the base of the tooth germ which can generate forces to push the crown occlusal. Previous studies have shown that the motive force of the intra-bone phase of tooth eruption is bone formation at the alveolar base. the formation appears to be regulated by the dental follicle, particularly the apical one-half of the follicle. Based on previous studies, it was shown that the BMP-2 gene was chronologically expressed in follicles and that expression was greater in the basal one-half of follicles. BMP-2 is a candidate molecule to regulate bone growth at the base of the alveolar socket[17].

In children with Down Syndrome, trisomy 21 chromosome abnormalities mostly cause mutations in the Anaplastic Lymphoma Kinase 2 receptor, hereinafter abbreviated as ALK-2[18]. ALK-2 is a receptor of the Bone Morphogenesis Proteins (BMPs) gene. BMPs are one of the genes included in the TGF-Bheta Super Family[19] which plays a role in the process of growth and development of teeth[20]. Mutations in BMPs receptors lead to reduced induction capacity between receptors and BMPs genes and cause effects in the form of mild but dominant signal transfer disturbances[18]. Tooth eruption occurs if it occurs when it receives a signal from the BMPs gene, if this signal is blocked it will cause a decrease in the process of osteogenesis and a delay in tooth eruption[5]. In the process of tooth eruption, 2 cells are needed at the same time which have opposite roles, but if at least one of them is disturbed, the individual will experience a delay in the growth and development of the teeth[16].

The results obtained from calculations using the Schour and Massler method and the Blenkin and Taylor method show that the range of results from calculations using the Blenkin and Taylor methods is larger, 1.5-3 years. The difference in this range is thought to be because the Australian race has a higher similarity than the European race. Strengthened by the geographical position of the Australian continent which is in line with Indonesia allows for higher interbreeding and migration so that there is a significant range of modification in the Blenkin and Taylor method[21].

An example of an estimated age, for example, age of sample 3 is 16.8 years and according to the estimated age using the Blenkin and Taylor method is 12.4-15.5 years, this method is more efficient to use for estimating the age of children with Down syndrome when needed for forensic odontology.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that there is a delay in the growth and development of the teeth, especially eruption in children with Down syndrome using either the Schour and Massler or Blenkin and Taylor measurement methods. Age estimation using the Schour and Massler method produces an average delay of 2-3 years, while age estimation using the Blenkin and Taylor method produces an average delay of 1.5-3 years.

CONFLICT OF INTEREST

All authors have read and approved the manuscript and take full responsibility for its content. All authors do not have a conflict of interest in regard to this research or its funding.

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