

The Application of Al-Qahtani Method for Dental Age Estimation of Down Syndrome Children

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ABSTRACT

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Dental age estimation is one of the methods in the forensic dental examination. Dental age estimates are often carried out to complete the victim's identity using methods from experts such as Al-Qahtani. There have been many studies related to estimating tooth age using the Al-Qahtani method in normal humans but not in human subjects with special needs, such as children with down syndrome. This study aims to determine the estimated dental age using the Al-Qahtani method in children with down syndrome and to differentiate between chronological age and dental age in children with down syndrome. This research is a cross-sectional study. The research subjects were 13 children with down syndrome who attended special schools in the Jember Regency and met the sample criteria. Tooth age estimation is done by matching the results of panoramic radiographs with the Al-Qahtani Atlas. Data were analyzed using Shapiro-Wilk, Levene's Test, and paired sample T-Test. Estimating dental age using the Al-Qahtani method shows varying dental age values, and there is a delay in the dental age of boys compared to girls with down syndrome. The dental age of all research subjects was delayed from their chronological age. The dental age of children with Down syndrome estimated using the Al-Qahtani method shows an average value of 1 year 2.5 months, and there is a difference between dental age and chronological age with a difference of 1 year seven months. Therefore, adjustments need to be made if the Al-Qahtani method is applied to children with down syndrome.

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INTRODUCTION

Dental age prediction is an effort that plays an essential role in the field of dentistry. This critical role includes helping to provide data in forensic dentistry to identify victims in the event of a mass disaster (Apriyono DK, 2022). This method is carried out by utilizing theories from experts, such as the Al-Qahtani method. The Al-Qahtani method utilizes panoramic radiographs matched to the Al-Qahtani Atlas (Al-Qahtani et al., 2010). Estimating dental age using this method has been carried out a lot, but it is limited to normal humans. It cannot be denied that there is a human population who are born with unique features, such as children with down syndrome, who have a high birth rate with a ratio of 1:800-1000 births each year (Soewondo, 2021).

Down syndrome is a genetic disorder that can occur in humans with an increase in the number of chromosome 21. The presence of an excess number of chromosomes causes children with Down syndrome to experience physical and

mental developmental delays (Wang RN et al., 2014). Mental retardation is the cause of children's with down syndrome and requires attention and special treatment from other people as well as providing health services, both general health and dental and oral health. Physical delays, such as delays in the development of bone and teeth, affect the prediction of bone age and tooth age (Moraes MB et al., 2012; Saez et al., 2021). Like humans in general, children with down syndrome also have the same right in efforts to complete identity through dental age estimation because it does not rule out the possibility of mass disasters occurring and claiming victims such as children with down syndrome. Dental predictions were carried out using the Al-Qahtani method, which was matched with panoramic radiographs of children with down syndrome.

The Al-Qahtani method was chosen because it is a renewal method from the Schour Massler, Demirjian, and other dental prediction methods. In addition, this method provides clear

information regarding the age of the resulting teeth and covers the age of the teeth that vary according to the conditions of human dental development. There has been no research using the Al-Qahtani method to predict tooth age in children with Down syndrome, which is the reason the authors conducted research in this field.

This study aims to determine the estimated dental age using the Al-Qahtani method and distinguish between the dental age estimated using the Al-Qahtani method and the chronological age of children with down syndrome in Jember Regency.

METHOD

This research used an analytical observational method with a cross-sectional design at the Dental and Oral Hospital, Faculty of Dentistry, Jember University. The research population was children with Down syndrome, namely Special School (SLB) students in Jember Regency aged 7-21 years. This research uses the results of panoramic radiography of children with Down syndrome and the Al Qahtani Atlas. This research was carried out based on permission from the Health Ethics Code Commission, Faculty of Dentistry, Jember University, number 1777/UN25.8/KEPK/DL/2022. This research was carried out from January 2023 to February 2023.

The research subject is children with Down syndrome boys and girls aged 7-21 years who attend Special Schools in Jember Regency.

Subject criteria needed in this study were children with sufferers down syndrome whose parents or guardians are willing to sign an informed consent and agree to take panoramic photos. Of the total population that met the criteria, 13 research subjects were obtained, consisting of 6 boys and seven girls. After taking x-rays, determine the chronological age and age of the teeth.

Chronological age was calculated from the date of birth of the research subject until the panoramic photo was taken. Dental age determination was carried out by two observers every two weeks within one month. Determination of the age of the teeth was carried out by observing the right region of the upper and lower jaw on soft file panoramic radiographs and then matching them with Al Qahtani's atlas. Observation begins by looking at the crowns and roots of the central incisors. Suppose the central incisors have formed their crowns and roots and have experienced complete eruption. In that case, you can continue to observe the other teeth using the same method in the first molars, lateral incisors, second premolars, first premolars, canines, second molars, and third molars. If there is agreement between the panoramic radiograph and the Al Qahtani atlas observed, the dental age of the research subjects will be obtained. The dental age data obtained was then tested for reliability with the ICC test and then tested for consistency with the test Cohen's kappa. Research data that has been consistent is then tested for normality, homogeneity test, and test paired sample T-Test.

RESULTS

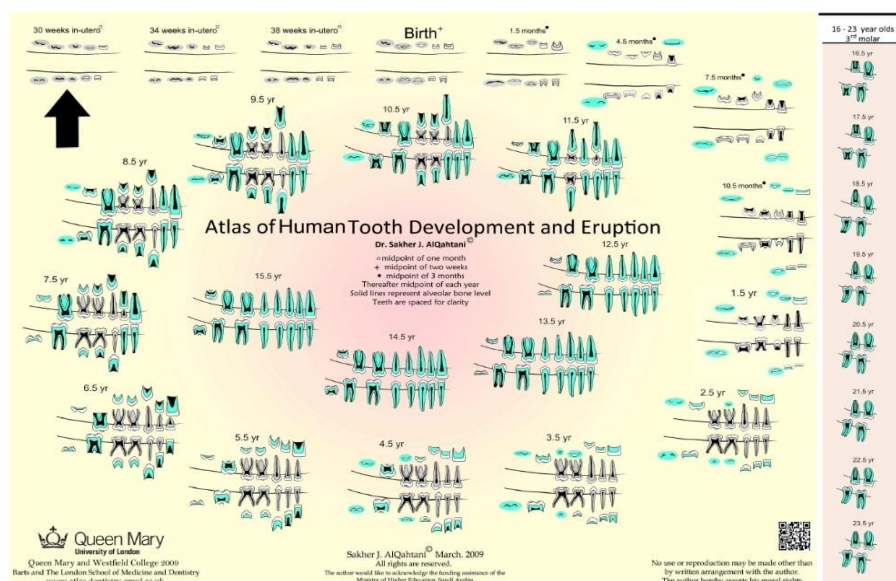


Figure 1. Atlas of Al-Qahtani



Figure 2. Panoramic radiograph of children with down syndrome

One of the x-rays of the children with Down syndrome, which is compared with Atlas Al-Qahtani, produces a dental age value of 15.5 - 16.5 years. Dental ages were generated in 12 other subjects using the same prediction method and yielded various values.

Table 1. Average dental age and chronological age of boys with down syndrome

Subject	Gender	Chronological Age	Dental Age	Age Difference
1	M	10.22	9.50	0.72
2	M	10.71	9.50	1.21
3	M	12.95	11.50	1.45
4	M	16.29	16.00	0.29
5	M	16.85	12.75	4.10
6	M	17.08	13.00	4.08
Average		14.01	12.04	1,9

Table 2. Average dental age and chronological age of girls with down syndrome

Subject	Gender	Chronological Age	Dental Age	Age Difference
7	F	10.95	10.00	0.95
8	F	11.71	11.25	0.46
9	F	13.07	11.25	1.82
10	F	13.74	12.25	1.49
11	F	14.11	12.50	1.61
12	F	15.45	13.50	1.95
13	F	16.85	15.75	1.10
Average		13.6	12.3	1.36

Table 1 and Table 2 show that the chronological age of 13 children with down syndrome is divided into six boys and seven girls who experienced delays compared to their chronological age of 1 year seven months. Based on the ICC test and Cohen's kappa. The results of the two researchers were solid and consistent. Then, the normality test results, Shapiro-Wilk and homogeneity test Levene, produce a significance value of more than 0.05, which indicates that the data is normal and homogeneous so that parametric tests can be carried out paired sample T-Test. The results of the different tests showed a significance value of less than 0.05 ($p\text{-value} < 0.05$), so it can be said that there is a significant difference between dental age and the chronological age of children with down syndrome.

DISCUSSION

Research with child subjects with Down syndrome aged 7-21 years who attended Special Schools in Jember Regency showed the results of

the dental age values of sufferers with Down syndrome divided into male and female subjects. There is a difference between the dental ages of boys and girls. The results also showed a difference between the dental age estimated by the Al-Qahtani method and the chronological age of the children with down syndrome. This difference was obtained from the results of the different tests, which showed a significance value below 0.05, and there was a difference between chronological age and dental age. The difference between chronological age and dental age results in an average difference of 1 year and 7 months. The existence of this difference can be interpreted as a delay in dental age compared to the chronological age of the patient's children with down syndrome.

Based on gender, the average age of teeth in boys with down syndrome shows a delay compared to the average dental age of girls with down syndrome. Delay in boys' dental age for down syndrome than girls' down syndrome indicated by the dental age of the boy Down syndrome the mean difference is 1 year 11 months and the dental age of girls Down

syndrome on average 1 year and 3 months later than their chronological age. This aligns with Soesilawati's research (2021), which explains that ordinary girls show a faster dental age than ordinary boys. This is because the eruption of teeth in girls is faster than in boys (Soesilawati et al., 2021; Sasmitha et al., 2020). The slower eruption of teeth in boys compared to girls is that growth hormone, which plays a role in the body's metabolism, tends to develop faster in girls than in boys (Sinaga, 2018). From this description, it can be interpreted that in boys, both normal and down syndrome experience delayed dental age compared to normal girls and those with down syndrome.

The estimated dental age delay with the AI Qahtani method was compared with the child's chronological age of down syndrome, possibly due to delayed tooth eruption. Factors that may cause delays in the eruption of children's teeth down syndrome include genetic factors, hormonal deficiencies, nutritional deficiencies, and socio-economic factors. Genetic factors influence the sequence of tooth eruption. This aligns with research by Sinaga (2018), which explains that genetic factors affect tooth eruption with a percentage of 78%.⁹

Genetic factors in children with down syndrome cause delays in tooth eruption due to gene mutations in Bone Morphogenesis Proteins (BMPs) (Wang et al., 2015). BMPs gene mutations lead to reduced induction capacity between receptors and BMPs genes and cause signal transfer barriers. As a result, the inhibition of signal transfer between receptors and BMPs genes causes a decrease in the process of osteogenesis and ultimately delays in tooth eruption (Kurniasih et al., 2023).

Growth hormone deficiency is another influential factor in the growth and development of children's teeth with down syndrome. Children with down syndrome also have hypothalamic dysfunction, causing hormone deficiency growth. This growth hormone deficiency causes delayed tooth eruption in children with down syndrome. In addition, based on research by Bull et al. (2022), It is estimated that 2-7% of children with Down syndrome have congenital (have it at birth) or acquired (developed later in life) thyroid disease. This thyroid hormone deficiency causes PTHrP hormone secretion, which plays a role in root morphogenesis as well as remodeling bone experience inhibition of the process replacement of bones and teeth is delayed. The inhibited formation of bones and teeth will eventually influence the process of tooth eruption in children with down syndrome, who also

experience delays (Tuchendler & Bolanowski, 2014).

Nutritional factors are one of the factors that influence tooth eruption. The adequacy of nutrients in the body is influenced by how to consume, type, and feeding time. Nutritional deficiencies can hinder the course of growth and development (Rusydia et al., 2016). This is also in line with Baladina's research (2022), which states that nutritional deficiencies are related to tooth eruption, so they can affect tooth development because the role of nutrition for oral tissues is no different from other body organ tissues. Lack of intake of carbohydrates, protein, fat, iodine, calcium, magnesium, phosphorus, vitamin C, and vitamin D during the growth and development of teeth can cause delayed tooth eruption (Irwanto et al., 2019). Sick children with down syndrome generally have difficulty eating. Children with down syndrome have difficulty putting food into their mouths, so when eating, they require assistance from others. In addition, not all types of food can be consumed because some children only eat the food they like. This causes nutritional deficiencies in down syndrome children, influencing tooth eruption.

The last factor that can affect the growth and development of teeth is the socio-economic factor. The low socio-economic level also affects the delay in tooth eruption. This is in line with Verma's et al. (2017) research which states that when socio-economic status increases, the number of teeth that erupts is more significant according to the age of the teeth. Children from families with low socio-economic levels experience delayed tooth eruption due to a lack of nutritious food intake for their bodies. Research by Jasmine (2021) states that there is a possibility of delayed tooth eruption in children due to the low level of education and socio-economic status and parents' work. The lack of adequate information regarding how to care for children influences activities to maintain children's dental health and consumption patterns that are good for children (Baladina et al., 2022).

The child's economic status is down syndrome, and he belongs to an affluent family. Parents of children with down syndrome have income that can meet the needs of their children, especially the need for nutrition, which affects the growth and development of the body, especially the development of teeth. In addition, the social status of the child with down syndrome and his own family is also quite good. Adequate communication skills between children with down syndrome and the surrounding environment and the ability to get good

information from the family in parenting down syndrome minimize the problems that occur in childcare with down syndrome. However, please do not rule out the emergence of obstacles in educating children with down syndrome, for example, such as difficulty taking down syndrome children to eat nutritious food and difficulties in getting them to maintain healthy teeth and mouth. Although the influence of economic and social factors does not have a direct impact, these factors contribute to the causes of delayed tooth eruption in down syndrome children.

CONCLUSION

The research results concluded that the dental age of Down syndrome children estimated using the Al-Qahtani method showed an average value of dental age of 12 years and 2.5 months, and there is a difference between dental age and chronological age which is accompanied by a delay in tooth age of 1 year 7 months from chronological age. Therefore, adjustments need to be made if the Al-Qahtani method is applied to children with Down syndrome.

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