Angle's Malocclusion Classification and Soft Tissue Facial Profile in People with Down Syndrome in Jakarta - Angle's Malocclusion Classification and Soft Tissue Facial Profile in Down Syndrome

Aditya Eka Nurcahya[1], Margaretha Suharsini[2]*, Sarworini Budiardjo[2], Heriandi Sutadi[2], Ike Siti Indiarti[2], Mochammad Fahlevi Rizal[2], Eva Fauziah[2]

1. Undergraduate Program, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.
2. Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.

Abstract

Down Syndrome is caused by a genetic abnormality in chromosome 21. Phenotypically, the abnormality is characterized by defective orocraniofacial growth. In this descriptive and cross-sectional study, participants were 40 people with Down Syndrome, aged 14–41 years, and enrolled in specialized schools in Jakarta.

Angle's malocclusion classification was determined by clinical examination and soft tissue profile by measuring the angle of soft tissue nasion (N'), subnasal (Sn) and pogonion (Pog') on a digital profile picture. Angle's malocclusion classification class I was found in 14 people (35%), Class II was found in 3 people (7.5%), and Class III was found in 23 people (57.5%). We found a flat soft tissue facial profile in 13 people (32.5%), a convex soft tissue facial profile in 3 people (7.5%), and a concave soft tissue facial profile in 24 people (60%). Class III Angle's malocclusion and a concave soft tissue facial profile is predominate orocraniofacial characteristic of individuals with Down Syndrome.

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Introduction

Down Syndrome is a genetic disorder caused by trisomy of chromosome 21.[1,2] Down Syndrome was first defined in 1866 by John Langdon Down, and is a major genetic cause of intellectual disabilities.[3] Common characteristics of individuals with Down Syndrome include mental retardation, a flat facial profile, small ears and nose, a *simian crease,* tongue fissure, and macroglossia along with a high and narrow palate.[1,3,4]

In 1890, Angle proposed that permanent maxilla and mandibular first molars characterized varieties of occlusion. Angle stated that the mesiobuccal cusp of the maxillary first molar should contact the buccal groove of the mandibular first molar to form a normal occlusion. Angle then classified occlusions based on the mesiobuccal cusp position relative to the buccal groove: class I, Class II and Class III. Class I is considered normal occlusion while Class II and Class III are forms of malocclusion.[5–7] In study of individuals with Down Syndrome in Saudi Arabia (mean age of 10.61 years), 50/93 individuals (53.8%) had Angle's malocclusion Class III.[8] A similar study conducted in the United States found that 17/30 people (56.7%) had Angle's malocclusion Class III.[9] Similarly, in Brazil 31/60 individuals with Down Syndrome (51.7%) exhibited Angle's malocclusion Class III.[10] From this research, it can be concluded that most people with Down Syndrome tend to have Angle's malocclusion Class III.[8–10]

Facial profiles are a focus of aesthetic analyses in orthodontic treatment such as the Subtelny analysis. According to Subtelny, there are 3 facial profile angle analyses. These include the skeletal profile (N-A-Pog), facial soft tissue profile (N'-Sn-Pog') and total facial soft tissue profile (N'-Pr-Pog'). These three points connect and form an angle at the central anatomical point. The skeletal profile angle decreases with age, while the total soft tissue profile angle

Corresponding author:
Margaretha Suharsini
Department of Pediatric Dentistry,
Faculty of Dentistry, Universitas Indonesia,
Jakarta, Indonesia.
E-mail: margarethasuharsini@gmail.com

increases until age 18 because of the growth of the nose.[11] The soft tissue profile of the face tends to be stable and unaffected by age.[11] Research on facial soft tissue profiles, performed on 28 people with Down Syndrome aged 12–45 years, showed that the N'-Sn-Pog' angle value was greater in people with Down Syndrome than that of people without Down Syndrome.[12]

Individuals with Down Syndrome often demonstrate a growth deficiency in the maxilla. This condition causes the dental arch in the upper jaw to lie more posteriorly relative to the lower jaw, creating a Class III skeletal profile and class III Angle's malocclusion. In normal individuals, a class III Angle's malocclusion is usually accompanied by a concave facial profile. However, conventional wisdom holds that people with Down Syndrome have flat facial profiles. This finding is quite contradictory given that the flat facial profile is generally associated with a class I Angle's malocclusion in individuals without Down Syndrome.[6,13] Several studies on Angle's malocclusion and facial profiles of people with Down Syndrome have been conducted, but in Indonesia the information is scarce. Therefore, we sought to examine the distribution of Angle's malocclusion and soft tissue facial profiles on people with Down Syndrome in Jakarta as a complement pre-existing research.

Materials and methods

The study was approved by the Ethical Committee of the Faculty of Dentistry at the University of Indonesia. This study is a descriptive study using cross-sectional method and was conducted at Type C special schools in Jakarta. The inclusion criteria were males and females with Down Syndrome, aged 14 and above, with all permanent teeth (except permanent third molars) erupted and meeting their antagonists. Participants all had complete sets of permanent teeth, ranging from the central incisive to the permanent second molar throughout the region, could stand upright for facial profile examination and could follow examination procedures. Exclusion criteria included having a history of orthodontic treatment, loss of a permanent tooth either due to extraction, trauma, or congenital factors, presence of a cleft lip or palate, surgical wounds or facial trauma so that the soft tissue facial profile could not be determined, and inability to close the mouth or follow examination procedures.

Angle's malocclusion and the soft tissue facial profile were the dependent variables of interest. Angle's malocclusion is determined by clinical examination of the mesiobuccal cusp of the permanent maxillary first molar and buccal groove of the permanent mandibular first molar. The soft tissue facial profile is determined by N'-Sn-Pog' angle measurement from a digital photo. Nasion (N') is the most concave point in the middle of the forehead and nose. Subnasal (Sn) is the point between the nasal septum and upper lip, and Pogonion (Pog') is the most anterior point of the soft tissue of the chin.

The examination was conducted by Pediatric Dentistry Specialist students and Faculty of Dentistry at the University of Indonesia. Information about the study and informed consent forms were provided to the parents/school representatives. Classification of Angle's malocclusion was determined and divided into three classes. Class I was where the mesiobuccal cusp of the permanent maxillary first molar was in line with buccal groove of the permanent mandibular first molar. Class II and Class III were where the mesiobuccal cusp of the permanent maxillary first molar were located anterior (Class II) or posterior (Class III) of the buccal groove of the permanent mandibular first molar.[6]

Participants were instructed to stand upright with a Frankfort Horizontal Plane positioned parallel to the floor. Participants who wore glasses were instructed to remove their glasses first. The camera and tripod were positioned at 150 cm to each participant's right side and the camera height was adjusted to each participant's height. The camera was adjusted to aperture priority mode with a f/11 aperture value, automatic shutter speed, and automatic ISO. The digital profile photo was taken from the right side of the participant using the camera and the image was then transferred to a computer. The N'-Sn-Pog' angle measurement was performed on the inner side of the face using ImageJ V 1.51r software. The resulting angles were grouped into three soft tissue facial profile classifications: flat (161^{o} -165^{o}), convex ($<161^{o}$) and concave ($>165^{o}$).[14] The research data are presented in tabulation showing the distribution of Angle's malocclusions and soft tissue facial profiles in individuals with Down Syndrome.

Results

Table 1 shows that 23 people (57.5%) with Down Syndrome exhibited a class III Angle's malocclusion, including 15 males (37.5%) and 8 females (20%). Class II was found in only 1 male (2.5%) and 2 females (5%). Angle's malocclusions and soft tissue facial profiles of people with Down Syndrome also vary with age. In this study, participants ranged in age from 14 to 41 years, with the largest population in the 14-29 year age group (n = 29). Distributions of Angle's malocclusion in people with Down Syndrome by age group are presented in Table 2.

Angle's Malocclusion	Male		Female		n	%
	n	%	n	%		
Class I	13	32.5	1	2.5	**14**	**35**
Class II	1	2.5	2	5	**3**	**7.5**
Class III	15	37.5	8	20	**23**	**57.5**
Total	**29**	**72.5**	**11**	**27.5**	**40**	**100**

Table 1. Distribution Frequency of Angle's Malocclusion in Persons with Down Syndrome by Sex.

Class III malocclusion was most prevalent among 14–20-year-olds (n = 16; 55.17%) and 21–30-year-olds (n = 6; 66.67%) (Table 2). Class I malocclusions were most commonly found among 14–20-year-olds (n = 11; 37.93%), while Class II malocclusions were most common among 14–20-year-olds (n = 2; 6.9%).

Angle's Classification	Age Group (years old)					
	14-20		21-30		30-41	
	n	%	n	%	n	%
Class I	11	37.93	2	22.22	1	50
Class II	2	6.9	1	11.11	0	0
Class III	16	55.17	6	66.67	1	50
Total	**29**	**100**	**9**	**100**	**2**	**100**

Table 2. Distribution Frequency of Angle's Malocclusion in Persons with Down Syndrome by Age Group.

Female participants had average angle values that were greater than males. The minimum and maximum angle values were 155.36^{o} and 183.71^{o}. The mean soft tissue facial profile angle across all participants was 167.75^{o} with a standard deviation of ±5.72^{o}. The angles were grouped into 3 categories of soft tissue facial profiles: flat (161^{o} -165^{o}), convex (<161^{o}) and concave (>165^{o}).

The concave soft tissue facial profile was found in 24 individuals (60%), including 17 males (42.5%) and 7 females (17.5%). The flat facial profile was the second most frequently observed, with more males than females demonstrating this characteristic. The convex soft tissue facial profile was the least frequent, being observed in only 3 males (7.5%) and no females (Table 3).

Soft Tissue Facial Profile	Sex				n	%
	Male		Female			
	n	%	n	%		
Flat	9	22.5	4	10	**13**	**32.5**
Convex	3	7.5	0	0	**3**	**7.5**
Concave	17	42.5	7	17.5	**24**	**60**
Total	**29**	**72.5**	**11**	**27.5**	**40**	**100**

Table 3. Distribution Frequency of Soft Tissue Facial Profile in People with Down Syndrome by Sex.

The concave soft tissue facial profile was the most common finding in all three age groups (Table 4). No convex soft tissue facial profiles were observed in individuals older than 21 years. Flat soft tissue facial profiles were not observed in individuals aged 30 years and older.

Soft Tissue Facial Profile	Age Group (years old)					
	14-20		21-30		30-41	
	n	%	n	%	n	%
Flat	10	34.49	3	33.33	0	0
Convex	3	10.34	0	0	0	0
Concave	16	55.17	6	66.67	2	100
Total	**29**	**100**	**9**	**100**	**2**	**100**

Table 4. Distribution Frequency of Soft Tissue Facial Profile in People with Down Syndrome by Age Group.

Table 5 shows that the most common finding among individuals with Down Syndrome was the Class III malocclusion and concave soft tissue facial profile (n = 16; 40%). A class I malocclusion and concave profile were found in 7 people (17.5%), as was the class I malocclusion and flat profile. No individuals exhibited class I and Class II malocclusion with a convex profile.

Angle's Malocclusion	Soft Tissue Facial Profile						n	%
	Flat		Convex		Concave			
	n	%	n	%	n	%		
Class I	7	17.5	0	0	7	17.5	**14**	**35**
Class II	2	5	0	0	1	2.5	**3**	**7.5**
Class III	4	10	3	7.5	16	40	**23**	**57.5**
Total	**13**	**32.5**	**3**	**7.5**	**24**	**60**	**40**	**100**

Table 5. Distribution Frequency of Angle's Malocclusion in People with Down Syndrome based on Soft Tissue Facial Profile.

Discussion

The purpose of this study was to obtain an overview of the distribution frequency of Angle's malocclusion and soft tissue facial profiles in people with Down Syndrome in Jakarta. The study was conducted in 43 Type C special schools scattered throughout Central Jakarta, North Jakarta, West Jakarta, East Jakarta, and South Jakarta. The study participants were people with Down Syndrome aged 14 and above because, in people with Down Syndrome, permanent dental eruption can be delayed for up to 2 years and the permanent dentition period usually begins around age 14.[1]

Clinical examination was used to determine the classification of Angle's malocclusion. We found that more than half of the study participants (n=23; 57.5%) demonstrated Class III malocclusion, including 15 males (37.5%) and 8 females (20%). These results are similar to those of other studies conducted in Saudi Arabia (53.8% with Class III malocclusion), United States (56.7%), and Brazil (51.67%).[3,8,10] Class III malocclusion occurs due to an underdeveloped maxilla, especially in the anteroposterior dimension, so the teeth in the upper jaw tend to erupt posteriorly relative to the lower jaw.[3] Our results also resemble other studies in that Angle's malocclusion was found in approximately twice as many males than females.[15] Soft tissue facial profile examination and angle measurement were performed using photos taken from each participant's right side with a digital camera. We selected the Subtelny analysis because this method features the smallest standard error and reveals the most obvious difference for each skeletal profile.[16]

As shown in Tables 2 and 4, Class III malocclusion and the concave soft tissue facial profile were the most common findings in the age groups of 14–20 years and 21–30 years. Other studies have shown that, in people with Down Syndrome, skeletal maturation is generally completed by 15 years of age, in contrast to those without Down Syndrome were maturation is typically completed by 18 years; however, people with Down Syndrome often exhibit deficiencies in the anteroposterior, vertical, and lateral skeletal planes. Deficiencies in the anteroposterior plane may affect the position of existing teeth and the soft tissue facial profile.[17]

In our study, the average angle soft tissue facial profile angles in males and females were 166.87^{o} and 170.1^{o}, respectively. This angle was larger than those found in other studies (163.74^{o} and 164.98^{o}). In addition, angular measurements were obtained using three-dimensional face analysis so that the resulting accuracy was higher than the two-dimensional analysis used in this study.[12]

In our study, 60% of individuals with Down Syndrome exhibited a concave facial profile. This result stands in contrast to conventional theory that people with Down Syndrome have flat facial profiles.[1,3] These differences might be due to different methods and criteria used. Subjective assessment of facial profiles may result in different conclusions compared to quantitative measurements. The concave profile in people with Down Syndrome reflects a skeletal Class III profile. The middle third of the face, which is the maxilla, undergoes hypoplasia, reducing the anteroposterior dimension and leading to the formation of a concave facial profile. The condition is often accompanied by a prominent forehead and mandible shape.[18] That flat form of nasal trunk in people with Down Syndrome also contributed to the impression of a concave facial profile as it affected the anatomical point of nasion used in this study.[9]

We found that 32.5% of people with Down Syndrome had a flat soft tissue facial profile (Table 3), caused by soft tissue thickening in the lip area. This condition may compensate for the Class III skeletal profile. Retrusion of soft tissue pogonion also affects the soft tissue facial profile.[18,19] This condition was also a likely contributor to the findings in Table 5 that 40% of the population had a Class III malocclusion with a concave profile. A similar study in 240 people without Down Syndrome revealed that a concave profile and Class III skeletal profile was found in 59.3% of the population.[20] This difference was due to an increase in soft tissue thickness of the upper lip and lower lip region accompanied by retrusion of soft tissue pogonion so that the existing soft tissue profile was flattened.[19]

Other studies have suggested that individuals with Down Syndrome have smaller mandibles and maxillae. However, the maxillary and mandibular relationship of people with Down Syndrome on the sagittal side is not as expressive as individuals with a Class III skeletal profile because of the overall reduction in

craniofacial dimensions.[21] This also explains the flat and convex soft tissue facial profiles frequently seen in people with Down Syndrome.

Conclusions

Class III Angle's malocclusion and a concave profile were found to be common craniofacial characteristics of individuals with Down Syndrome.

Declaration of Interest

The authors declare no conflict of interest.

References

1. McDonald RE. Dentistry for the Child and Adolescent. 10th ed. Missouri: Mosby Elsevier; 2011. 510-49.
2. WHO | Genes and human disease [Internet]. WHO. World Health Organization; 2010 [cited 2017 Apr 1]. Available from: http://www.who.int/genomics/public/geneticdiseases/en/index1.html
3. Bauer DNL. Occlusal Disharmonies in Down Syndrome: A Quantitative Analysis. Thesis. 2010. 3-59.
4. Badan Penelitian dan Pengembangan Kesehatan. Riset Kesehatan Dasar (RISKESDAS). Laporan Nasional. 2013. 188-9.
5. Nelson SJ, Ash MM. Wheeler's Dental Anatomy, Physiology, and Occlusion. 9th ed. St. Louis, Missouri: Saunders Elsevier; 2010. 275-9.
6. Proffit WR, Fields HW, Sarver DM. Contemporary Orthodontics. 5th ed. St. Louis, Missouri: Elsevier; 2011. 20-50.
7. Cobourne MD, DiBiase AT. Handbook of Orthodontics. 1st ed. London: Mosby Elsevier; 2010. 1-5.
8. AlSarheed M. A Comparative Study of Oral Health amongst Trisomy 21 Children Living in Riyadh, Saudi Arabia: Part 1 Caries, Malocclusion, Trauma. Saudi Dent J. 2015;27(4):220-3.
9. Bauer D, Evans CA, Begole EA, Salzmann L. Severity of Occlusal Disharmonies in Down syndrome. Int J Dent. 2012;1-6.
10. Marques LS, Alcantara CEP, Pereira LJ, Ramos-Jorge ML. Down Syndrome: A Risk Factor for Malocclusion Severity? Braz Oral Res [Internet]. 2015;29(1):1-7.
11. Susilowati. Correlation Between Soft Tissue and Skeletal Profile of Deutro-Malay Indonesians. Pakistan Orthod J. 2009;1(2):40-3.
12. Ferrario VF, Dellavia C, Serrao G, Sforza C. Soft Tissue Facial Angles in Down's Syndrome Subjects: A Three-Dimensional Non-Invasive Study. Eur J Orthod. 2005;27(4):355-62.
13. Mitchell L. An Introduction to Orthodontics. 4th ed. Oxford University Press Inc. Oxford: Oxford University Press; 2013. 73-84.
14. Subtelny JD. A Longitudinal Study of Soft Tissue Facial Structures and Their Profile Characteristics, Defined in Relation to Underlying Skeletal Structures. Am J Orthod. 1959;45.
15. Mestrovic S, Miksic M, Stefanac-Papic J, Stipeti J. Prevalence of Malocclusion in Patients with Down's Syndrome. Acta Stomatol Croat. 2002;36(2):239-41.
16. Godt A, Muller A, Kalwitzki M, Goz G. Angles of Facial Convexity in Different Skeletal Classes. Eur J Orthod. 2007;29(6):648-53.
17. de Moraes MEL, Tanaka JLO, de Moraes LC, Filho EM, de Melo Castilho JC. Skeletal Age of Individuals with Down Syndrome. Spec Care Dentist [Internet]. 2008;28(3):101-6.
18. Sforza C, Dellavia C, Allievi C, Tommasi DG, Ferrario VF. Anthropometric Indices of Facial Features in Down's Syndrome Subjects. In: Handbook of Anthropometry: Physical Measures of Human Form in Health and Disease [Internet]. 2012. 1603-18.
19. Damasceno LN, Basting RT. Facial Analysis in Down's Syndrome Patients. 2014;62(1):7-12.
20. Blazeyi Z, Tanic T, Radojicic J. Profile Types in Relation to Facial Angle in Different Skeletal Jaw Relationships. Stomatol [Internet]. 2009;88(6):66-72.
21. Jesuino FAS, Valladares-Neto J. Craniofacial Morphological Differences between Down Syndrome and Maxillary Deficiency Children. Eur J Orthod. 2013;35(1):124-30.