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Research Report

Posterior transverse interarch discrepancy on HbE β thalassemia patients

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ABSTRACT

Background: *One of the symptoms that often arises on thalassemia patients is disharmony dentofacial, class II skeletal malocclusion, as a result of the malrelation of maxilla and mandible. This malrelation can be affected by either maxillary bone position, dentoalveolar maxillary position, mandibular bone position, dentoalveolar mandibular position, or combinations of those components.* ***Purpose:*** *The study was aimed to examine whether there is posterior transverse interarch discrepancy on the HbE β thalassemia patients or not.* ***Methods:*** *This study is an observational research with cross-sectional design. The sample consisted of 33 HbE β thalassemia patients and 33 non-thalassemia patients as a control group aged 12–14 years. Lateral cephalogram was carried out and dental casts of maxillary and mandibular dental arches were also taken in all of those patients.* ***Results:*** *There was no difference between the maxillary intermolar width of the HbE β thalassemia patients and that of the normal ones, but the mandibular intermolar width of the HbE β thalassemia patients was significantly smaller than that of the normal ones. Beside that, posterior transverse interarch discrepancy of of the HbE β thalassemia patients was significantly greater than that of the normal ones, which showed great difference between maxillary and mandibular intermolar widths.* ***Conclusion:*** *Posterior transverse interarch discrepancy of the HbE β thalassemia patients was different from that of the normal ones. The dentofacial abnormalities on the HbE β thalassemia patients aged 12–14 years primarily was due to disporposional dentofacial growth in the vertical, sagittal, and transversal directions, especially in the posterior region.*

Key words: *HbE β thalassemia, dentofacial disharmony, interarch discrepancy*

ABSTRAK

Latar belakang: *Salah satu akibat yang sering timbul pada penderita talasemia adalah disharmoni dentofasial berupa maloklusi skeletal kelas II yang merupakan kelainan hubungan maksila dan mandibula. Malrelasi ini dapat dipengaruhi oleh posisi maksila, posisi dentoalveolar maksila, posisi mandibula, dan posisi dentoalveolar mandibula atau kombinasi komponen ini dalam banyak variasi.* ***Tujuan:*** *Penelitian ini adalah untuk melihat apakah ada diskrepansi antar rahang arah tranversal di regio posterior pada penderita talasemia beta HbE.* ***Metode:*** *Penelitian ini adalah penelitian observasional dengan disain potong lintang. Sampel terdiri atas 33 penderita talasemia beta HbE dan 33 subjek normal (non talasemia) usia 12–14 tahun. Dilakukan pengambilan foto sefalogram lateral dan pembuatan model studi gigi RA dan RB pada semua subjek penelitian.* ***Hasil:*** *Jarak intermolar maksila tidak berbeda dengan subjek normal, namun jarak intermolar mandibula lebih kecil secara bermakna dibandingkan dengan subjek normal. Selain itu, diskrepansi antar rahang dalam arah transversal di regio posterior lebih besar secara bermakna dibanding subjek normal, yang menunjukkan besarnya selisih jarak antara jarak intermolar maksila dan jarak intermolar mandibula.* ***Kesimpulan:*** *Diskrepansi antar rahang arah transversal di regio posterior antara penderita talasemia beta HbE dengan subjek normal usia 12–14 tahun. Kelainan*

dentofasial pada penderita talasemia beta HbE usia 12–14 tahun disebabkan oleh pertumbuhan disporposional dentofasial berbeda arah vertikal, sagital dan transversal terutama di regio posterior.

Kata kunci: *Talasemia beta HbE, disharmoni dentofasial, diskrepansi antar rahang*

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INTRODUCTION

Disharmony of dentofacial component growth may cause chewing function problem and disharmony. One of the diseases which can cause the dentofacial disharmony is thalassemia.[1] Based on data derived from a variety of major hospitals and educational centers, Indonesia is a country with quite high frequency of thalassemia cases, namely between 3–8%, which means that 3 to 8 people out of 100 Indonesia has thalassemia genes.[2] Patients with thalassemia often get spacing/diastema and protrusion of maxillary anterior teeth, as a result, it may be an indication of orthodontic treatment.[3] In a study of HbE β thalassemia patients in Jakarta, it was known that the rate of dentofacial disharmony or class II skeletal malocclusion was quite high, which is about 90.6%.[2,4]

HbE β thalassemia is a disease of genetically inherited blood disorder caused by disturbances of hemoglobin formation. On HbE β thalassemia patients, it was found that there was growth problems, one of which was skeletal growth retardation. In severe cases, the growth problems that occur particularly on dentofacial bone even lead to distinctive facial abnormalities, called as *Facies Cooley*. In severe circumstances, besides causing distinctive facial abnormalities, it will also cause the disruption of chewing and talking functions. Later, it can lead to feeling of inferiority, which eventually becomes a psychological burden on a thalassemia patients.[4]

The result of cephalometric research, shows that dentoskeletal deformity in patients with thalassemia is generally caused by the retardation and disproportion of dentoskeletal components.[5] It then leads to class II skeletal malocclusion caused by the retardation of mandibular growth and the retrognati of mandibular position.[2,4] Class II skeletal malocclusion is actually a malocclusion with maxillary and mandibular malrelations. More than 60% of this malocclusion case are caused by mandibular discrepancy in the sagittal direction, which was inclined more to the distal mandibular position against maxilla.[6] This malrelation can also be caused by either the maxillary bone position, maxillary dentoalveolar position, mandibular bone position, mandibular dentoalveolar position, or combinations of these components in many varieties.[7]

Class II malocclusion is usually characterized by a convex facial profile and a large overjet, even not rarely accompanied also with deepbite. In such condition, the pressure of the facial muscles and tongue become abnormal, as a result, there is often deep mentolabial groove, often called as lip trap. This such description of class II malocclusion, thus, usually encourage patients or their parents to obtain orthodontic treatment.[8] In orthodontic treatment, a complete examination and accurate data are required to diagnose, including clinical examination, modeling study analysis, and cephalometric analysis.[10] An examination of jaw in transversal direction must be conducted in class II malocclusion since disporposional jaw growth in the sagittal direction will affect the growth of jaw in the transversal direction.[11] The size of tranversal interarch discrepancy in the posterior region then will assist both in establishing the diagnosis and in determining the class II malocclusion treatment.[12] Untreated class II malocclusion without posterior transverse interarch discrepancy in mixed dentition will become class II malocclusion with posterior transverse interarch discrepancy in its development.[11,12]

Therefore, this study is aimed to examine if there is posterior transverse interarch discrepancy on the HbE β thalassemia patients aged 12–14 years old compared to that on non thalassemia patients. The result of this study is then expected to be able to provide information about posterior transverse interarch discrepancy, as a result, a diagnosis of class II malocclusion in HbE β thalassemia patients will be more easily conducted. Thus, the determination of treatment plan and treatment time do not only become more accurate, but the determination of class II malocclusion prognosis on HbE β thalassemia patients will also become easier.

MATERIALS AND METHODS

This study is an observational research with cross-sectional design. The samples of this study were HbE β thalassemia patients aged 12–14 years old who were routinely treated in the Thalassemia Clinical Center of Child Health, Medical Faculty of UI/RSCM Jakarta. However, those children must also meet several inclusion criteria and must be willing to join the study by signing an informed consent. The inclusion criteria are that both 12–14 year old men and women suffer with HbE β thalassemia (defined by a pediatrician) and have no interdental caries. On the other side, the selection of the control group (non-thalassemia) in this study is adjusted to its equivalent aged 12–14 years. Similarly, non-thalassemia patients classified into a control group must also meet some criteria,which are; with first molar teeth that are still intact, no interdental caries, with

class I molar relationship with distobuccal cusp of the first mandibular molar located on the central fossa of the first maxillary molar.[11]

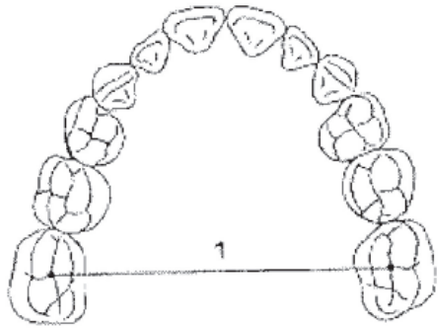

Figure 1. Maxillary intermolar distance.[11]

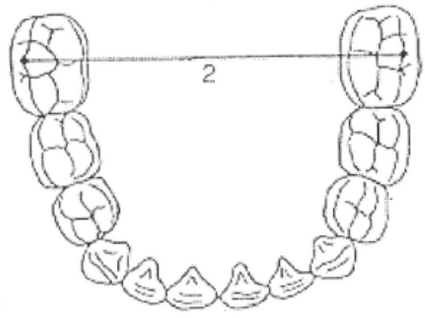

Figure 2. Mandibular intermolar distance.[11]

In this study, parameters were measured by using study model and cephalogram. In the study model, maxillary intermolar distance (Figure 1) and mandibular intermolar distance (Figure 2) were measured. The difference between maxillary intermolar distance and mandibular intermolar distance was then defined as posterior transverse interarch discrepancy (PTID).[11]

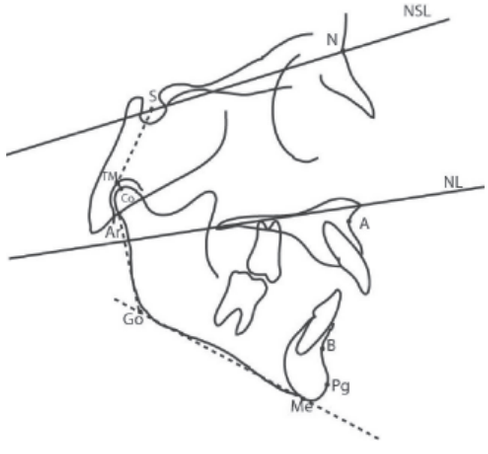

Figure 3. Cephalometric analysis.[11]

Cephalometric analysis (Figure 3) was conducted, in which anterior-posterior relations were measured, such as maxilla in the sagittal direction (SNA angle), mandible in the sagittal direction (SNB angle), maxillary-mandibular discrepancy in the sagittal direction (ANB angle), glenoid fossa position in the sagittal direction (NS-TM angle), the vertical relations of the maxillary inclination relative to the cranial base (NL/NSL angle), mandibular inclination relative to the cranial base (ML/NSL angle), vertical maxillary-mandibular relations (NL/ML angle) and gonial angle (Ar-Go-Me angle). Mandibular dimension involves mandibular length (Go-Pg), mandibular ramus length (Co-Go), and total mandibular length (Co-Pg).

RESULTS

There are thirty-three samples of HbE β thalassemia aged 12–14 years and 33 samples of non-thalassemia individuals aged 12–14 years who met the inclusion criteria distributed (Table 1).

Table 1. Number of sample based on sex

Sex	Thalassemia	Normal
Men	16	16
Women	17	17

Besides lateral cephalogram was carried out for each subject of this study, both dental casts of maxillary and mandibular dental arches as well as study model were also taken in all of those patients. Statistical test was also conducted in order to know the difference between variables of the thalassemia group and those of the non thalassemia group (Table 2). The results of the test then showed that there was significant difference on SNA angle, angle NS-TM, mandibular ramus length, and maxilla intermolar distance ($p < 0.05$).

DISCUSSION

The results of observing dentofasial components with cephalometric analysis showed that there was disproportional growth in the vertical direction on the HbE β thalassemia patients indicated by the width of NL/NSL angle, ML/NSL angle, NL/ML angle, and Ar-Go-Me angle. The width of NL/NSL angle indicated that the relative maxillary inclination on the HbE β thalassemia patients towards the cranial base was significantly smaller than that on the normal ones, while the width of ML/NSL angle showed that the relative mandibular inclination towards the cranial base was significantly larger than that on the normal ones. Similarly, the width of NL/ML angle also showed that vertical relation between maxilla-mandibula is significantly greater than that on the normal ones. Besides that, the width of Ar-Go-Me angle showed that the gonial angle was significantly greater than that on the normal ones.

Table 2. Mean, standard deviation, and t-test result between variables of the thalassemia group and those of the normal group with a sample (n) of each group=33

Variable	Thalassemia		Normal		t- test result	
	Mean	SD	Mean	SD	t	p
SNA angle	82.77	2.88	83.23	2.19	0.69	0.490
SNB angle	76.65	3.42	79.10	2.55	3.20	0.002
ANB angle	6.13	1.67	4.10	1.60	- 4.90	0.000
N-S-TM angle	132.55	8.54	128.84	6.57	- 1.92	0.060
NL/NSL angle	6.55	3.55	10.26	5.39	3.20	0.002
ML/NSL angle	38.29	6.27	32.90	7.57	- 3.05	0.003
NL/ML angle	32.87	7.89	25.52	5.67	- 4.22	0.000
Ar-Go-Me angle	127.45	7.94	121.74	4.65	- 3.45	0.001
Mandibular length	65.48	5.34	71.42	3.20	5.31	0.000
Mandibular ramus length	52.87	4.92	54.58	5.14	1.34	0.186
Mandibular length total	105.84	5.83	111.03	4.93	3.79	0.000
Maxillary intermolar distance	45.40	2.56	46.39	2.31	1.60	0.114
Mandibular intermolar distance	40.07	2.54	44.97	1.26	- 0.17	0.005
PTID	5.33	1.75	1.24	1.03	1.92	0.001

These results also completed the results of Sjahruddin's observation that there was facial abnormality in the vertical direction on the HbE β thalassemia patients. These results were also in accordance with Rothstein's and the Pan's[13] ideas that in class II malocclusion, small and retrognative mandible as well as mandibular plane angle (MPA) were obtained.

The same observation results obtained from dentofacial components on the HbE β thalassemia patients also showed that there was no disproportional growth in the sagittal (anteroposterior) direction. This condition could be seen from the fact that ANB angle was significantly greater than that on the normal group, so class II skeletal malocclusion occured on the HbE β thalassemia patients. The fact that SNB angle was significantly smaller than that on the normal group indicated that the position of the mandible towards the cranial base on the HbE β thalassemia patients was inclined more to the posterior region or retrognati than that on the normal subjects. Nevertheless, the width of SNA angle on the HbE β thalassemia patients must not be different from that on the normal ones. It means that the position of maxilla towards cranial base on the HbE β thalassemia patients is the same as that in the normal ones.

In addition, mandibular dimension consited of mandibular length which total was smaller than that on the normal ones although the length of the mandibular ramus was not different from that of the normal ones. On the other side, NS-TM angle showed that the anteroposterior position of the glenoid fossa on the HbE β thalassemia patients was not different from that on the normal ones. This finding is the same as that of Sjahruddi's[4] and Retno Hayati's[5] researches in which it was known that class II skeletal malocclusion on the HbE β thalassemia patients occured due to the retardation of mandibular growth and retrognative mandibular position.

These results of observing dentofacial components then showed that the transversal direction on the HbE β thalassemia patients measured from the maxillary intermolar distance was not different from that on the normal ones, but the mandibular intermolar distance was significantly smaller than that of the normal ones. Similarly, it was also known that the posterior transverse interarch discrepancy on the HbE β thalassemia patients significantly greater than that on the normal ones which indicated the difference distance between the maxillary intermolar distance and the mandibular intermolar distance. This finding was different from that in Wahadni's and Omarii's[14] research among youth and adult of Jordanian which stated that the maxillary intermolar distance on the HbE β thalassemia patients was smaller than that on the normal ones. In contrast to this study, the maxillary intermolar distance on the HbE β thalassemia patients was the same as that on the normal ones.

The posterior transverse interarch discrepancy of the HbE β thalassemia patients also indicated that class II malocclusion was caused by the narrowing of the mandibular arch since the posterior teeth were inclined more to the lingual, and the basal spinal was also narrowing.[15] Several other researchers even said that the position of the first mandibular molars were normal, but the position was inclined more to the mesial of the maxillary teeth.[13,15-17] This condition was contrast to the finding of this study showing that the position of the first mandibular molars on the HbE β thalassemia patients was more distally than that on the first maxillary molars or the first angle class II molar relation.

Mandibular retrusion or maxillary protrusion is considered as a cause of skeletal abnormalities in class II malocclusion which is more dominant disorder and still a problem for researchers. 56.3% of class II malocclusion case were caused by the maxillary protrusion, meanwhile the mandibula was normal either in size, shape and position.[16] Class II malocclusion due to mandibular retrusion can only be obtained about 27%,[16] but on the HbE β thalassemia patients class II malocclusion can mostly be obtained due to mandibular retrusion.

Dr. E.H. Angle distinguished class II malocclusion into two types, namely class II division 1 malocclusion with the typical signs of maxillary arch constriction and class II division 2 with normal maxillary arch,[17] so that the maxillary intermolar distance was usually smaller in class II division 1 malocclusion than that in class II division 2. This condition was caused by class II division 1 skeletal malocclusion often accompanied by anomalous teeth compared with class II division 2.[18]

That maxillary intermolar distance on the HbE β thalassemia patients, furthermore, is not different from that on the normal ones which indicated that there is no narrowing of the maxillary arch. This condition can be caused due to the compensation of the teeth towards the skeletal discrepancy.[19] These results, however, are different from those of Tollaro *et al.*,[12] research stating that all the class II malocclusion samples with or without the posterior tranverse discrepancy had a narrower maxillary arch.

Various opinions about the cause of the absence of maxillary arch constriction indicated by the maxillary intermolar distance, for example, is that in class II division 2 malocclusion, there will not be any the disharmony of maxillary bone, and the characteristics of typical stereotypes. The malocclusion is not only caused by the disharmony of tooth eruption, the pressure of the muscles, and/or some variation of its compesantion.[20] Another researcher even says that in class II division 2 malocclusion, the reduction of mesiodistal and labiolingual of maxillary and mandibular incisors occurs. The reduction of incisor width then will reduce the need of space in the dental arch, as a result, it has positive effects since dentoalveolar arch does not only become sufficient enough to accommodate all of the teeth, but will also have spacing in anterior teeth.[15, 21] According to Litt and Nielsen, in class II division 2 malocclusion, there is normal jaw transverse dimension.[21]

In this study, mandibular intermolar distance on the HbE β thalassemia patients was significantly smaller compared to that of the normal ones. Actually, the reduction of mandibular arch width measured from the mandibular intermolar distance actually will show the characteristics of class II division 2 malocclusion, particularly looked in the region of the mandibular interkanina.[15] This condition can also be caused by excessive overbite so that the maxillary incisor teeth cover the crown of mandibular incisor teeth (deep bite). Mandibular incisor teeth that are blocked then will inhibit the development of the mandibular dentoalveolar to the anterior. The teeth, as a result, will be depressed by the lack of space caused by the rotation of mandibula.[15,21] It means that the deficiency of transversal direction on the maxilla has been an abnormal characteristics of occlusal pattern in class II malocclusion since the early development. After the first permanent molar eruption, transversal discrepancy is still ongoing, and becomes a typical condition of class II malocclusion in mixed tooth period.[22]

In this study, moreover, the mandibular intermolar distance of the HbE β thalassemia patients was very different from that of the normal ones. The small mandibular intermolar distance and the normal intermolar distance caused posterior transverse interarch discrepancy. This result is the same as what Sjahruddin explained[4] that the HbE β thalassemia patients with retardation of mandibular growth and anterior cranial base growth have the position of the mandible against the anterior cranial base that was inclined more to retrognati compared to the normal ones. Posture, activity, and behavior of orofacial muscles and mastication may also cause the narrowing of the dental arch and basal arch. This condition can also be triggered by several factors, such as habit factor or the abnormal pulling of muscles that causes the inclination plain distal locked. Other factors are the lack of muscle pressure against the labial surface of maxillary incisors, the error coordination function of the muscles, and the abnormal pulling of the mandibular corpus by muscles attached to the buccal side of the mandible. There is also mechanical force factor that causes mandibular incisor teeth pushed into the posterior and inhibits the growth of the mandible to the anterior direction and toward the transversal direction.[19]

Finally, it can be concluded that the posterior transverse interarch discrepancy of the HbE β thalassemia patients aged 12–14 years was different from that of the normal ones in the same ages. The dentofacial abnormalities in HbE β thalassemia patients primarily was due to disporposional dentofacial growth in the vertical, sagittal, and transversal directions, especially in the posterior region.

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