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Research Article

Description of Dento-Maxillary Malocclusions in Sickle Cell Patients in Two Hospitals in The City of Yaounde (Cameroon)

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ABSTRACT

Malocclusion is defined as a change in the position of the teeth and in the growth of the skeleton that can cause aesthetic and functional problems. Bone development and heredity influence the appearance and/or aggravation of this anomaly. Thus, sickle cell disease, which is manifested by sickle cell disease, leads to tissue hypoxia. The consequence is a reduction in oxygenation of the bone tissue, which may become hyperplastic or hypertrophic and lead to bone deformities. This study aimed to determine the prevalence of malocclusions in sickle cell patients. We conducted a cross-sectional analytical study at the Yaounde Central Hospital (HCY) and the Mother and Child Centre/ Chantal Biya Foundation in Yaounde during the period from February to July 2020 (6 months). Homozygous sickle cell patients aged between 12 and 18 years were included. Socio-demographic, clinical and biological data were collected through an interview and medical records. A clinical examination was performed to investigate: maxillary overhang or overjet, Angle class, inter-incisal mismatch, labial incompetence and the Dental Aesthetic Index (DAI). The prevalence of malocclusions was 68.2%. Increased overhang was found in 26.0% of patients. There were 41.6% with class I, 41.6% with class II and 18.7% with class III Angle. Inter-incisal agreement was found in 45.5% of patients. Labial incompetence was found in 42.2% of patients. Regarding the DAI, 12.1% of the patients had severe malocclusions and 13.01% were in the very severe malocclusion class. Thus, 3 factors were significantly associated with dento-maxillary malocclusions in sickle cell patients. These were: the clinical manifestation of vaso-occlusive crises with an odds ratio of OR=5.94(1.37-19.81) and P=0.00000; the positive Rosenthal test which confirms mouth breathing OR= 4.65(1.51-14.27) P=0.00713; mouth breathing itself OR= 3.15(1.03-12.94) P=0.00428. The most common malocclusions found in sickle cell patients were maxillary overhang, maxillary misalignment, and class II malocclusions. The associated factor was the frequency of vaso-occlusive crises.

Keywords: Malocclusion; Sickle Cell Disease; Dento-Maxillary; Yaounde

Introduction

Since its first description in 1904 by Dr. James Herrick in Chicago [1], interest in sickle cell disease has grown steadily. It is indeed the most common hemoglobinopathy in the world in terms of the number of affected population. According to the World Health Organization 28.5 million people are affected, 300,000 children are born each year with this pathology [2]. In Cameroon, 4,000 new births are registered on average in hospitals in our region. These alarming figures make sickle cell disease a public health problem.
The pathophysiology of this disease can be summed up in a continual hypoxia of the vessels which leads to undernourishment or undernutrition of the tissues of the human body, creating complications in the osteo-articular system that can be dangerous. Indeed, the literature teaches us that the bone pathology in sickle cell disease is characterized by numerous manifestations, either noisy or silent. The former are mainly represented by acute and chronic osteomyelitis, mono or polyarticular arthritis, osteoarthritis and osteonecrosis. The second, on the other hand, is expressed by the appearance of dystrophies which may result in the appearance of the skull in bump [3]. The presence of malocclusions, which represent misalignment and / or interlocking of the teeth of the antagonistic arches, could only be a consequence of all these manifestations.

Thus, according to a cross-sectional study by Alves e et al [4], carried out in Brazil in 2013 on sickle cell patients, it was found that the prevalence of malocclusion in preschool children was 62.9 %. It should be noted that 80.6% of the adolescents presented very serious or severe malocclusions.

In Nigeria, the results showed that, of the 92 patients seen, 88.5% had Class 1 malocclusion according to Angle. Increased overhang was observed in 48.2% of the sample population, while an overbite depth of 2 was most commonly observed in these patients. Spacing in the anterior segment of the superior and inferior arches was a fairly common phenomenon, occurring in 49.0% and 30.8% respectively within the consulted patients [5].

In Cameroon, malocclusions in sickle cell patients have been poorly described. What motivated us to carry out this study.

Materials and Methods

This is an analytical cross-sectional study carried out in the hematology service of the Yaoundé central hospital and in the sickle cell treatment service of the Mother and Child Center of the Chantal Biya Foundation from October 2019 to August 2020.
Using a technical sheet, and appropriate material, social demographic, clinical and dental data and complications were identified in homozygous sickle cell patients aged 12 to 18 years who had not undergone any previous orthodontic treatment and who did not not wearing a dental prosthesis.

Data were entered using Cspro 7.3 software. Analysis was performed using SPSS25 software. For the construction of the charts, we used Microsoft Excel 2016 software and for the drafting of the report, we used Microsoft Word 2016.

Quantitative data was represented by their means, standard deviations, minimum, maximum, median while quantitative data was represented by their numbers and frequencies.

The chi-square and Fischer tests were used on the one hand to study the links between the different variables and the presence of malocclusions and on the other hand to prepare the multivariate analysis by logistic regression which was used to bring out the factors associated with the presence of malocclusions.

Results

We identified a total of 123 including 50 at the central hospital and 73 at the Chantal Biya foundation
Our sample was predominantly female, made up of 56.1% women and 40% men, for an M / F sex ratio of 0.7. The following figure

shows the distribution of the population according to age groups (Table I).

Age Groups	Effective (N)	Fréquencies (%)
]12-14]	43	34,96
[14-18[	**80**	**65,4**

Table 1: Distribution of the population according to age groups.

The most represented age group is that ranging from 14 to 18 years old. This corresponded to 80 out of 123 patients collected. There is no statistically significant difference between the presence of malocclusions and age

(P = 0.36015). For sex, on the other hand, there is a statistically significant difference (P = 0.00197).

Variables	**Effective (N)**	**Percentages (%)**
Dento-maxillary malocclusions		
Those with malocclusions	84	68,29
Those without malocclusions	39	31,71

Table 2: Distribution of Dento-Maxillary Malocclusion

We found 68.2% of patients who presented with dental occlusion problems compared to 31.7 who did not.

Angle Classification	Effective(N)	Percentages (%)
Class 1	51	41,64
Side (N = 51)		
Left	1	1,96
Right	1	1,96
Left and right	49	96,08
Class 2 (N = 51)	51	41,64
Side		
Left	1	1,96
Right	2	3,92
Left and right	48	94,12
Class 3	23	18,70
Side (N = 23)		
Left	1	4,35
Right	1	4,35
Left and right	21	91,30

We identified 41.6% of classes 1, 41.6% of classes 2 and finally 18.7% of classes 3 of angles. The class II orthodontic anomaly was therefore the most common anomaly.

Overjet	Effective(N)	Frequency (%)
Normal	63	52,03
Exaggerated	43	34,96
Butt contact	16	13,01

Table 4: Distribution of the population according to the overjet.

In this table, the overjet is exaggerated in 34.9% of cases.

Variables	Effective(N)	Percentages (%)
ROSENTHAL test		
Positive	98	79,67
Négative	25	20,32
GUDDIN Test		
Positive	65	52,84
Négative	58	47,15

Table 5: Distribution of the population according to the results of the functional examination (ROSENTHAL and GUDDIN tests).

Examination of respiratory function revealed that 98 out of 123 patients were positive for the ROSENTHAL test, or 79.6%, and 65 of 123 patients were positive for the GUDDIN test, or 52.8%.

DAI Score	Effective (N)	Percentages (%)
≤25	39	31,71
[26 ; 30]	53	**43,09**
[31 et 35]	15	**12,19**
≥36	16	**13,01**

Table 6: Distribution of the population according to the Dental Aesthetic index (DAI).

We found that 31.7% of patients had an IAD <25 (minor malocclusion), 43.0% had an IAD between 26 and 30 (defined malocclusions with optional treatment), 12.1% was between 31 and 35 (severe malocclusions) finally 13.0% were found with an IAD greater than 36 (very severe malocclusions)

Variables	ORa (IC $_{95\%}$)	P-value
Sex (Female)	*0,32 (0,12– 0,80)*	*0,01568*
Clinical manifestation of CVO (Yes)	*5,94 (1,37 – 19,81)*	*0,00000*
Worsening of chronic anemia (No)	*6,18 (0,28 – 11,90)*	*0,07790*
Rosenthal's test (positive)	*4,65 (1,51 – 14,27)*	*0,00713*
Chewing direction (Unilateral L / R)	*0,25 (0,09– 0,74)*	*0,01165*
Congestion level (Moderate)	*1,38 (0,96– 1,97)*	*0,07791*
Mouth breathing (yes)	*3,15 (1,03 – 12,94)*	*0,00428*

Table 7: Results of the multivariate logistic regression of the factors associated with dento-maxillary malocclusions in sickle cell patients

After eliminating the confounding factors after multivariate logistic regression, it emerges that three (3) factors are really associated with malocclusions. These are: the clinical manifestation of vaso-occlusive crises with an odds ratio OR = 5.94 (1.37-19.81) and P = 0.00000; positive Rosenthal test which confirms mouth breathing OR = 4.65 (1.51-14.27) P = 0.00713; mouth breathing itself OR = 3.15 (1.03-12.94) P = 0.00428.

Discussion

The study population consisted of 123 adolescents aged 12 to 18 including 69 girls and 54 boys whom we recruited from the Yaoundé central hospital and the Chantal Biya foundation, the prevalence of malocclusions was 68.2%. We found as factors associated with dento-maxillary malocclusions in sickle cell patients in our study: female sex, worsening of chronic anemia, mouth breathing, vaso-occlusive crisis and unilateral chewing direction.

The female sex was the most represented in our study population with a sex ratio of 0.78. The first clinical manifestations occurred between 0 and 6 years in 87.8% of patients, which would mean that the treatment was early, however, 93.5% of patients had vaso-occlusive crises 90.4% could manifest it 1 at 5 times per year while 65.2% presented maxillo-dental pain during CVOs. the recurrence of maxillo-dental pain would be a factor favoring malocclusions. The prevalence of malocclusion in the 112 patients was 68.29%, it is almost equivalent to the prevalence found in Brazil in 2013 by Ana C et al who found a prevalence of 62.9% in elderly preschool children. from 12 to 18 years [6]. This prevalence is slightly higher than those (49.7%) reported by Soares et al. In a study developed with 704 children, aged 6 months to 8 years, with SCD in the state of Bahia, Brazil. This is different from the prevalence obtained in a study conducted by Ahmed B et al. in Saudi Arabia in 112 Saudis suffering from sickle cell anemia aged 12 to 18 years who estimated this prevalence at 87.5% [4]. These differences must be linked to the methodology applied in these different studies. 34.1% of patients presented with an exaggerated overhang. This result differs from that found by Dacosta O et al in Nigeria in 2005 which found a prevalence of 48.2% of increased overhang as well as from the result (28.6%) found in Ana C et al. these differences could be explained by the difference in the age of the study population, which is between 10 and 45 years in the study of Dacosta O [6].
We found 41.6% for canine class II malocclusions and 18.7% for class III malocclusions. It is almost identical to what was found by Ana C et al [7]. In a study carried out in preschool children suffering from ACS whose findings were 37.1% of class II canines

In 54.4% of patients there was a disparity with regard to the concordance of the interincisal media, which is in agreement with Basyouni A et al in 2018 in Nigeria who found a maxillary misalignment evaluated at 56% [8].

We found 52.0% of patients with Normal overjet, 34.9% of patients had exaggerated overjet. The result is different from the study by Ana C et al, which found jaw protrusion in 21% of patients with SCD [4]. This could be explained by the difference in the method used.

For IAD, 31.71% had an IAD <25 (minor malocclusion), 43.09% had an IAD between 26 and 30 (defined malocclusions with optional treatment), 12.19% was between 31 and 35 (malocclusions severe) finally 13.01% were found with an IAD greater than 36 (very severe malocclusions), these values do not coincide with Ana C et al who found in adolescents of 12 years 11.6% and 7.1% respectively for severe and very severe malocclusions, as well as 6.6% and 10.3% respectively for severe and very severe malocclusions amongst teenagers aged between 15 and 19, these differences could be explained by the breakdown of the age groups at the 'adolescence in the study of Ana C et al then in ours the sample is comprised in a block between 12 and 18 years [4].

Craniofacial bone abnormalities are considered to be factors that may contribute to the development of dental malocclusion in any individual. In sickle cell disease, it is considered that these factors are decisive, deviations of the teeth and face can produce functional disorders of chewing, swallowing, phonation and breathing and even psychosocial disorders with potential effects on the self-esteem and interpersonal relationships of people with severe illness [9]. In the present study three (3) factors were associated with the end of the multivariate analysis.

First, the female sex, which could be explained by the fact that girls consult more because they pay more attention to their health than boys. Then, the unilateral sense of chewing; indeed 44.7% of patients suffering from ACS have unilateral chewing. The causes of this behavior can be multiple; it could be pulpopathies on the unwanted side or missing or impacted molars or even just that have not erupted, it can also be chewing habits. Finally the vaso-occlusive crisis, here everything resides in the physiopathological mechanism because the increase in the viscosity of the blood created by the reduction in the plasticity of the erythrocytes which reduces their capacity to cross the vessels and to transport oxygen causing ischemia and a local infarction. The recurrence of this phenomenon in the bone of thousands of infarcts per year causes a structural modification at this level, particularly in the bone bases maxillae; According to Ana C et al., occlusal abnormalities can occur as a result of hyperplasia and expansion of the bone marrow to compensate for the short lifespan of red blood cells.

Oral breathing, which sets in to compensate for the already reduced lack of oxygen provided by normal inspiration, either worsens or creates the initial state of malocclusion. In the present study, 42.2% of patients presented with lips incompetence. This result was confirmed following the Rosenthal test carried out. It revealed to us that 79.6% of the patients presented an insufficiency in the respiratory function and that they compensated somehow by mouth breathing. Dacosta O et al found a prevalence of 39.4% for lip incompetence, a result substantially equal to what we found [6].

The research hypothesis which stipulated that sickle cell disease would have an influence on the appearance and / or worsening of malocclusion in sickle cell patients is therefore indirectly verified by the pathophysiological mechanism of sickle cell disease which causes mouth breathing, a sign of compensation. respiratory tract indicating continued tissue damage. The consequence being an orofacial structural modification as sufficiently proven by the study carried out by Ribault J et al in 1990 on 53 children with breathing difficulties [10]. It proves that nasal incompetence coupled with permanent mouth breathing leads to disorderly growth and a change in the morphogenesis of the naso-ethmoido-maxillary unit. Thus, the adaptation of swallowing and phonation to these new conditions produces changes in the tension of the velopharyngo-facial and pharyngo-hyoglossal musculo-aponeurotic bands with a tendency to produce more vertical mandibular growth in children.

Conclusion

There is a significant influence of sickle cell disease on the development of malocclusions. This influence acts over time.