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Assessment of Malocclusion and Orthodontic Treatment Need in Patients with Sickle Cell Disease at a Tertiary Hospital in Lagos. -A Pilot Study.

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Abstract

Background: Sickle cell disease (SCD) is a hereditary autosomal recessive disorder of haemoglobin and mainly affects the black population. Previous studies that documented the orthodontic profile of patients with SCD however, did not have uniform exclusion criteria. The aim of this study was to evaluate the prevalence and severity of malocclusion in a sample of SCD patients receiving care the Haematology clinic of LASUTH using the Dental Aesthetic Index.

Method: This descriptive study had a sample of SCD patients that were registered for care for over 4 years at the Haematology clinic of LASUTH. A structured interviewer administered questionnaire was used to obtain the socio-demographic, dental and orthodontic information of the respondents.

Results: An increased overjet >3mm was noted in 34.88% of the subjects while about 18.60% of them deviated from a normal molar relationship. About 30% percent presented with identifiable malocclusion and of these, 26.74% had definite malocclusion while none had very severe or handicapping malocclusion. The study subjects that had definite or severe malocclusion had significantly poorer oral hygiene (p=0.000); gingival inflammation (p=0.000); and higher DMFT scores. (p=0.000).

Conclusion: The Orthodontic treatment need in this sample of SCD patients was similar to that obtained in the general population in Nigeria but lower than that obtained in previous studies in patients with SCD. Access to appropriate haematology care may limit the compensatory marrow hyperplasia associated with expansion of the jaws. A longitudinal study design may however be required to validate these findings.

Key Words: Sickle Cell Disease; Dental Aesthetic Index; Malocclusion.

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Introduction

Sickle cell disease (SCD) is a hereditary autosomal recessive disorder of haemoglobin resulting in chronic anaemia and vaso-occlusion which mainly affects the black population. Global estimates suggest that more than 312,000 infants are born with HbSS each year.[1] The vast majority of sickle cell births occur in the developing world, with an estimated 230,000 annual HbSS births in sub-Saharan Africa.[2]A single point mutation in the sixth codon (GAG instead of GTG;

compensatory marrow hyperplasia resulting in trabecular bone changes associated with expansion

of the jaws.[10] This can increase the distance between upper and lower incisors teeth, resulting in altered inter-labial distance with an untoward physical appearance and occlusion problems.[11]

The maxillae can also be adversely affected in sickle cell disease. In a study of Nigerian children, prominent maxillae were more common in those children with sickle cell disease than in a control group.[12] Subjects with SCD may present with a small mandible, short cranial base, and hyperdivergent facial planes. The cumulative effect of this altered growth produces hyperdivergent, dolichofacial, retrognathic facies. Deviations of the teeth and face may produce functional, chewing, swallowing, phonation and breathing disorders. These changes may produce psychosocial disorders with potential effects on the self-esteem and interpersonal relationships of severely affected individuals.[13]

Previous studies that documented the orthodontic profile of patients with SCD however, did not have uniform exclusion criteria. Similarly, they did not consider other familial and environmental aetiological factors before ascribing their findings solely to SCD. Furthermore, Quinn et al., [14] documented an improvement in the medical profile of patients with SCD over the past decades due to effective vaccinations and appropriate medication. Access to appropriate haematological interventions may hence modify the effect of SCD on craniofacial growth and development thus alter the orthodontic observations in this cohort of patients. The Dental Aesthetic Index (DAI) is a simple, universally accepted index which can be used in epidemiological surveys to assess unmet treatment need and as a screening tool for determining priority for orthodontic care in publicly financed programmes.[15] The aim of this study was thus to evaluate the prevalence and severity of malocclusion and orthodontic treatment needs in a sample of Sickle cell Disease patients receiving regular care the Haematology clinic of LASUTH using the Dental Aesthetic Index (DAI).

Materials and Methods

This cross-sectional study was conducted at the Haematology clinic of the Lagos State University Teaching Hospital, Ikeja, Lagos. (LASUTH).

Sample Selection

The study population consisted of SCD patients that were registered for care at the Haematology clinic of LASUTH. A simple random sampling technique using the balloting method was used to determine the study subjects using the attendance

18, Chicago, IL) statistical software package. Frequency distribution tables were generated for all

variables and measures of central tendency and dispersion were computed for numerical variables. Since the data were normally distributed, descriptive statistics including means, standard deviations, and percentages were used to summarize the demographic variables and health-related behavior of the study sample.A standard Dental Aesthetic Index (DAI) score was calculated for each subject using the DAI formula. The subjects were classified into four groups according to the severity of malocclusion and treatment need as measured by the standard DAI score. The Chi square test was used to determine the level of association between variables. For the comparison of means between groups, the ANOVA (analysis of variance) was used. Differences and associations were considered statistically significant where the associated p-values were equal to or less than 0.05.

Results

Table 1 shows the results of analyses of variance of mean DAI scores of the study subjects according to their socio-demographic variables. Significant differences were found in mean DAI scores among age groups with those in the 10-19 years age range having the highest mean DAI scores ($p< 0.05$). Significant differences in mean DAI scores were not found in the other demographic variables explored.

Table 2 displays the distribution of the DAI scores of the study participants. One or more missing teeth was present in 6.97% of the study subjects while incisal crowding was observed in 18.60%. An increased overjet >3mm was noted in 34.88% of the subjects while about 18.60% of them deviated from a normal molar relationship

.The prevalence and severity of malocclusion and the recommended orthodontic treatment need for each of the categories of the DAI is summarised in Table 3. The results show that 70.93 per cent of the subjects in the sample presented with good occlusion or minor malocclusion. Just about 30% per cent presented with identifiable malocclusion or a DAI score higher than 26. Of these 26.74 per cent had definite malocclusion, 2.33 per cent had severe malocclusion while none had very severe or handicapping malocclusion.

Table 4 shows the relationship between some orthodontic parameters of the study subjects and their mean DAI scores. Skeletal pattern 1 and was prevalent (93%) in the study population while Class I molar relationship was observed in 81.39 % of the sample. An increased overjet of greater than 3mm was seen in 34.80% while anterior open bite occurred in 6.97% of the study population. A midline diastema occurred in 23.25% of the study subjects. Most of the orthodontic parameters were significantly associated with high DAI scores in the study population.

Table 5 shows the relationship between the dental and gingival status of the study subjects and their orthodontic treatment needs. The study subjects that had definite or severe malocclusion had significantly poorer oral hygiene ($p=0.000$); gingival inflammation ($p=0.000$); and higher DMFT scores.($p=0.000$)

Discussion

Table 1: Mean DAI Scores of the Study Subjects according to their Socio - Demographic Variables.

		Number (n)	Percentage (%)	DAI score (Mean ± SD)	P value
Age (years)	10-19	42	48.84	21.95±5.79	0.022
	20-29	34	39.54	18.71±2.53	
	30-39	6	6.97	20.33±1.37	
	40-49	4	4.65	19.00±4.61	
Gender	Female	46	53.48	21.13±5.47	0.068
	Male	40	46.52	19.30±3.27	
Ethnicity	Hausa	2	2.33	18.00±2.12	0.221
	Ibo	6	6.97	19.33±4.03	
	Yoruba	68	79.07	20.79±4.93	
	Others	10	11.63	17.80±1.81	
Occupation	Trader	8	9.30	19.67±0.51	0.584
	Civil servant	6	6.97	23.00±1.15	
	Engineer	4	4.65	21.00±0.56	
	Hairdresser	2	2.33	19.00±1.45	
	Student	66	76.75	20.58±5.12	
Education	Primary	14	16.27	21.43±3.41	0.401
	Secondary	38	44.19	20.53±5.46	
	Tertiary	34	39.54	19.53±4.64	

Table 2: The Distribution of DAI Components in the Study Population.

DAI component	Number (n)	Percentage (%)
Missing teeth = 1	6	6.97
Crowding 1–2	16	18.60
Spacing 1–2	24	27.91
Diastema (mm)= 1	20	23.26
Anterior mandibular irregularity (mm) = 1	22	25.58
Anterior maxillary irregularity (mm) = 1	18	20.93
Overjet (mm) > 3	30	34.88
Reversed overjet (mm) > 0	0	0.00
Open bite (mm) > 0	5	5.81
Molar relationship 1–2	16	18.60

Table 3: Orthodontic Treatment Need of the Study Subjects according to the Dental Aesthetic Index.

Dental Aesthetic Index	Severity levels	Number (n)	Percentage (%)
≤ 25	Normal or minor malocclusion No treatment need or slight need	61	70.93
26 – 30	Definite malocclusion Treatment elective	23	26.74
31 – 35	Severe malocclusion Treatment highly desirable	2	2.33
= 36	Very severe handicapping malocclusion Treatment mandatory	0	0

Table 4: The Relationship between some Orthodontic Parameters of the Study Subjects and their Mean DAI Scores.

		Number (n)	Percentage (%)	DAI scores (Mean ± SD)	P value
Skeletal Pattern	1	80	93.02	19.48±3.52	0.000
	2	6	6.98	30.00±4.73	
Angles Classification	1	70	81.39	18.77±2.87	0.000
	2 div1	10	11.63	27.41±5.37	
	2 div2	4	4.65	26.29±4.28	
	3	2	2.33	23.00±0.41	
Anterior Open bite (mm)	None	80	93.02	19.65±3.84	0.000
	2	4	4.65	24.00±2.21	
	3	2	2.33	31.00±6.93	
Lips	Competent	56	65.12	19.04±2.88	0.001
	Potentially competent	18	20.93	21.88±4.37	
	Incompetent	12	13.95	23.67±8.41	
Overjet (mm)	Edge to Edge	2	2.33	23.00±1.28	0.000
	1-3	54	62.78	19.17±3.87	
	4-6	28	32.56	22.25±4.23	
	>6	2	2.33	35.00±1.78	
Spacing	Absent	62	72.09	18.65±3.83	0.000
	Incisal segment	24	27.91	19.50±2.42	
Crowding	Absent	70	81.40	18.54±3.01	0.000
	Incisal segment	16	18.60	25.86±6.18	
Diastema	Absent	66	76.75	18.87±3.52	0.000
	Present	20	23.25	23.92±5.27	

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Table 5: Relationship between the Dental And Gingival Status of the Subjects and their Orthodontic Treatment Needs

Dental Aesthetic Index	Severity levels	OHI			GINGIVAL INDEX			DMFT		
		Good	Fair	Poor	Mild	Moderate	Severe	0	1-3	4-8
≦ 25	Normal or minor malocclusion	11	50	0	39	22	0	60	1	0
26 – 30	Definite malocclusion	6	15	2	8	13	2	18	3	0
31 – 35	Severe malocclusion	0	0	2	0	0	2	0	1	1
= 36	Very severe handicapping malocclusion	0	0	0	0	0	0	0	0	0
		P= 0.000			P= 0.000			P= 0.000		

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In this present study, respondents less than 20 years of age made up over 28% of the study population. The subjects in this age category also had significantly higher DAI scores than those in the other age categories. Silva Costa et al17 had observed that patients in this age range may be in the bone growth phase when malocclusion may still be unstable. There was however no significant association between the other socio-demographic variables explored even though females and subjects with only a primary level of education had higher mean DAI scores.

An overjet > 3mm was the most prevalent component of DAI in the study sample and it was present in 34.88% of them. Diastema, spacing and anterior mandibular/ maxillary irregularities were moderately prevalent in over 20% of the subjects. This was in agreement with the findings of previous researchers that observed that the most common craniofacial bone abnormalities in SCA individuals were maxillary protrusion, [18,19] increased overjet, overbite, [18,19] and spacing of the anterior segment in both arches. None of the subjects had reversed overjet while open bite was present in only 5.81% of them.

The results of this study indicated that slightly over 70% of the study subjects had normal occlusion or minor malocclusion required no treatment need or a slight need. This result shows that even though some orthodontic discrepancies were moderately present in the study sample, their overall orthodontic treatment need was not significantly higher than that observed in the general population in Nigeria.[20] Only about 26% of them had definite malocclusion requiring elective treatment and about 2.33% had severe malocclusion with desirable treatment. These findings were similar to that obtained by Otuyemi et al20 in the general population but in contrast to a study by Onyeaso et al16 who observed that about 50% of SCD subjects in their study required orthodontic treatment. The inclusion of only subjects that have had access to regular care in the haematology clinic may have modified the results obtained in this study when compared to those previously obtained in SCD patients.

The class 1 skeletal pattern was prevalent in the study population even though subjects that had Class 2 skeletal pattern had significantly higher DAI scores. Molar relationships that deviated from angles class 1 were also significantly associated with higher orthodontic treatment need scores. Over 20% of the subjects had potentially competent lips while over 13% had incompetent lips. This common finding in SCD patients was similar to that obtained by Oredugba et al.[12]

Study subjects that had higher DAI scores were noted to have OHI-S scores indicating a poorer oral hygiene and higher gingival index scores. Similarly, subjects that had higher DAI scores were observed to have a higher DMFT. Helm and Petersen[21] demonstrated a positive association between malocclusion and periodontal health. They found higher scores for gingivitis and periodontal pocketing in subjects with various malocclusions. Malocclusion can cause psychosocial problems related to impaired dento-facial aesthetics, disturbances of oral function, such as mastication, swallowing, speech[22] and greater susceptibility to trauma and periodontal disease..[23] Prompt identification and interception of developing malocclusion is desirable to prevent the attendant dental and psychosocial sequelae associated with it.

A significant attitude persists in the medical and non-medical community that patients with sickle cell disease must have a characteristic facial appearance that typifies them. Gnathopathy, skull bossing, a lack of lip seal, which exposes the anterior teeth, and a prognathic maxilla have been typically associated with SCD. Increased maxillary overjet and an accompanying lack of lip seal were however the most significant findings observed in this present study. A recent review by Silva Costa et al[7] of epidemiological studies on SCD observed that despite the high frequency of craniofacial bone abnormalities and malocclusion among patients with sickle cell anaemia, there is insufficient scientific proof that this disease causes malocclusion. They made this observation based of the fact that many of the publications reviewed had selection bias for their subjects with respect to age, medical history, sampling technique and study design. The results from this study are in agreement with most of these findings indicating that the orthodontic treatment need of patients with SCD receiving regular care is not significantly different from that obtained in the general population. A cohort study design may however be required to validate these observations.

Study Limitation

A major limitation of this study is the cross sectional nature of the study design which will not permit conclusive inferences to be made from its observations. Similarly, the duration of care could not be adequately correlated with the findings due to the descriptive nature of the study design. Familial and other environmental predisposition to malocclusion apart from SCD could also not be adequately determined. A longitudinal or cohort study design is desirable to adequately elicit the effect of appropriate medical care on the orofacial manifestations of sickle cell disease.

Contributors

Ogunbanjo BO was responsible for the conceptualization of the study, study design, interpretation of results, critical review and editing. Oyapero A was responsible for the conceptualization of the study, study design, statistical analysis, interpretation of results, critical review and editing. Akinbami AA and Yemitan TA were responsible for the study design and critical review. Ajisafe OA was responsible for data collection, critical review and editing of the article.

Funding

Self

Conflict of Interests

Nil

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