IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 1 Ser. 16 (January. 2019), PP 19-23
www.iosrjournals.org

Oral Health Status of Sickle Cell Anaemia Patients – A Case Control Study

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Objective*: To evaluate the oral hygiene status of Sickle cell anaemia (SCA) patients and control group using Oral Hygiene Index Simplified (OHI-S), Decayed Missing Filled Tooth (DMFT) index and Decayed Missing Filling Surface (DMFS) index. To compare oral hygiene status of SCA patients with control group. To counsel and educate SCA patients, control group children and their parents/guardians.*
Material and Method*: Descriptive survey was conducted A total of 86 patients were included in SCA group and 88 in control group. DMFT and OHIS was recorded.*
Result: *A significant difference in DMFT and DMFS indices was found between SCA and control group ($p<0.01$ and $p<0.001$) respectively. The OHI-S of SCA and control group was similar. No Significant difference was there in mean DMFT, DMFS & OHI-S scores with respect to sex and age in AS pattern of SCA. Significant difference was only found in mean DMFT score in age group of SS pattern. 5-10 (3.5000) age group is having significantly more caries rate when compared with 11-15(1.3333) and 16-20(1.8000) age group ($p=0.02$).*
Conclusion: *SCA patients are more prone to caries than control group. Severity of the disease does not affect the prevalence of dental caries.*
Keywords: *DMFT, OHIS, Sickle cell anemia*

Date of Submission: 12-01-2019 Date of acceptance: 29-01-2019

I. Introduction

Sickle cell disease (SCD) is one of the most common monogenic disorders globally with an autosomal recessive inheritance [1]. Sickle cell anaemia (SCA) is caused by point mutation in the β-globin gene resulting in substitution of glutamic acid by valine at position 6 of the β-globin chain (Glu6Val). The resulting abnormal haemoglobin S (HbS) polymerizes when deoxygenated, causing a mechanical distortion of the red blood cells (RBC). The deformed short living sickle-shaped RBCs can interact with endothelial cells, leukocytes, platelets and other plasma components to initiate the typical vaso-occlusive manifestations of the disease [2,3].

Two types of sickle cell disease have been recognized; homozygous (Hb-SS) and heterozygous (Hb-SS)[4-8]. Each year approximately 3,00,000 children are born with sickle cell anaemia or one of its variants and nearly 80 per cent of these births occur in poor socio-economic countries [9,10].

James Herrick (1910), a physician first described the characteristic sickle shaped red cells in a medical student from Grenada [11].

In Maharashtra, the sickle gene is widespread in the eastern districts, also known as the Vidarbha region. The prevalence of sickle cell carriers in different tribes in that region varies from 0 to 35 per cent [12].

Algic crisis is the most common and important clinical symptom of SCA9 among several other complications. The pathological effects of sickle cell disease also occur in dental tissues and the oral cavity. SCD has been linked to delayed tooth eruption, hypoplasia and hypomineralization, hypercementosis, pulp stones, and asymptomatic pulp necrosis due to thrombosis in the blood vessels [13].

There is no consensus regarding the caries experience in SCD patients compared to healthy controls. Few studies have been conducted to examine this relationship but the results are contradictory [14-20]. The purpose of this study is to investigate prevalence of dental caries and oral health status in SCA patients and

compare it with control group. To educate SCA patients, control group children and their parents/guardians about diet and oral hygiene habits.

II. Methodology

Descriptive survey was conducted at Government Medical College, Nagpur and Indira Gandhi Government Medical College, Nagpur in their respective SCA Outdoor Patient Department (OPD) days during the period of March 2016 - June 2016. A total of 86 patients were included in SCA group and 88 in control group. The subject in both the groups ranged from 5 to 20 years in age. The sample size was calculated using the software G Power 3.1.9.2.

Patients diagnosed with sickle cell disease ranging 5 to 20 years and agreed to sign the consent form were included, while those suffering from any other disease along with SCA or refused to sign consent form were excluded. Children exceeding the age criteria were diagnosed but not considered for statistical analysis.
For control group, children studying in Siddeshwar School, Manewada Nagpur, who were present on the day of the survey and not suffering from SCA were included. Children suffering from any disease known to influence dental caries or severity of periodontal disease were excluded.

All the clinical assessments were done according to the WHO guidelines. Prior to the dental examination, information like age and gender for each subject was recorded. Caries prevalence was recorded according to DMFT index under proper illumination. Oral hygiene was assessed according to the rules of OHI-S [21].

Strict sterilization protocols were followed. Clinical assessment was done with sterilized mouth mirror and no. 23 explorer. Usage of head Cap, gloves and mask by the examiner was ensured. Clinical assessment of oral hygiene status was done in presence of caregivers, instructors or parents to achieve maximum cooperation. Model showing various caries extension, dentulous model for brushing habits, charts and posters showing ill-effect of tobacco chewing were used to educate the children and guardian.

III. Observation and Results

Statistical analysis software SPSS V 16.0 was used. Descriptive & inferential statistical analysis was performed on categorical and continuous data. Chi-square, independent sample T tests and ANOVA test were used to compare the distribution of caries and OHI-S between different groups. P value less than 0.05 ($p<0.05$) was considered to be significant.

The mean age of SCA patients was 9.20 ± 2.69 and that of the control group was 11.06 ± 2.69 (Table 1).

Table 1: Age Distribution

Age in years	Sickle Cell Anaemia (Group 1)	Control (Group 2)
5-10	58	44
11-15	17	44
16-20	11	-
Mean Age	9.20 ± 2.69	11.06± 2.69

SCA group consisted of 44 males and 42 females whereas control group included 38 males and 50 females (Table 2).

Table 2: Sex Distribution

Sex	Sickle Cell Anaemia (Group 1)	Control (Group 2)
Male	44	38
Female	42	50
Total	86	88

A significant difference in DMFT and DMFS indices was found between SCA and control group ($p<0.01$ and $p<0.001$) respectively. The OHI-S of SCA and control group was similar (Table 3).

Table 3: Comparison of oral health status between Sickle cell Anaemia & control group

	Sickle Cell Anaemia (Group 1) **Freq (%) or Mean (SD)**	Control (Group 2) **Freq(%) or Mean (SD)**	**P Value**
DMFT	2.47(2.01)	1.21(0.75)	**<0.01***
DMFS	3.97(2.07)	1.63(0.41)	**<0.001***
OHI-S	0.77(0.31)	1.03(0.51)	0.08*

No Significant difference was there in mean DMFT, DMFS & OHI-S scores with respect to sex (Table4) and age (Table 5) in AS pattern of SCA .

Table 4 : Distribution of mean DMFT, DMFS & OHI-S scores with respect to sex in AS group

	Sex	N	Mean	Std. Deviation	P Value
DMFT	Male	4	2.5000	1.73205	
	Female	6	1.6667	1.21106	0.39
DMFS	Male	4	4.7500	4.34933	
	Female	6	2.1667	1.47196	0.20
OHIS	Male	10	.5800	1.26649	
	Female	15	.6400	1.01756	0.89

Table 5: Distribution of mean DMFT, DMFS & OHI-S scores with respect to age in AS group

		N	Mean	Std. Deviation	P Value
DMFT	5-10	8	1.8750	1.35620	
	11-15	1	4.0000	.	0.31
	16-20	1	1.0000	.	
	Total	10	2.0000	1.41421	
DMFS	5-10	8	2.8750	2.79987	0.22
	11-15	1	8.0000	.	
	16-20	1	1.0000	.	
	Total	10	3.2000	3.04777	
OHIS	5-10	18	.4889	.84637	0.47
	11-15	5	.7200	1.60997	
	16-20	2	1.5000	2.12132	
	Total	25	.6160	1.09836	

Significant difference was only found in mean DMFT score in age group of SS pattern. 5-10 (3.5000) age group is having significantly more caries rate when compared with 11-15(1.3333) and 16-20(1.8000) age group (p=0.02) (Table 6).

Table 6: Distribution of mean DMFT, DMFS & OHI-S scores with respect to age in SS group

		N	Mean	Std. Deviation	P Value
DMFT	5-10	18	3.5000	2.52633	0.02
	11-15	9	1.3333	.50000	
	16-20	5	1.8000	.83666	
	Total	32	2.6250	2.16646	
DMFS	5-10	18	5.2222	5.15131	0.33
	11-15	9	3.2222	3.38296	
	16-20	5	2.4000	1.67332	
	Total	32	4.2188	4.39012	
OHIS	5-10	40	.8150	.79568	0.92
	11-15	12	.8333	.97639	
	16-20	9	.9444	1.03575	
	Total	61	.8377	.85521	

IV. Discussion

This study was performed to investigate the prevalence of dental caries and evaluate oral health status in SCA patients.

A significant difference ($p<0.01$) in DMFT index was found between SCA (2.47 with mean standard deviation of 2.01) and control group (1.21 with mean deviation of 0.75) suggesting that sickle cell anaemic patients are more prone to caries. The results were similar to the study by Jaideep Singh (2013) [14] and Halely M (2015) [16]. This difference could be because of hypomineralization of the enamel matrix and metabolic and hormonal disturbances in SCA patients. Other possible explanations could be low priority in seeking dental care, especially among individuals with low income, and the reluctance of dentists to treat these individuals due to fear of trans and postoperative complications [20]. Risk of developing caries is also related to frequent hospitalizations due to health complications associated with greater consumption of medication, like antibiotics containing sucrose [22,23].

The present study shows some variations as compared to the study by Laurence (2007) [15] and AL-Alwai H (2014) [18]. Both these studies stated no significant difference in SCA patient and control group's DMFS and DMFT respectively. They also found higher caries prevalence and lower filled teeth in SCA patients.

The result is partly similar to the present study showing higher caries prevalence in SCA patients as compared to control group. But because of no restoration found in either group in this study, their DMFT and DMFS also showed significant difference. A possible explanation for this difference could be differences in the age group.

The results of this study contradict that of E. Ralstrom (2010) which reported no significant difference in DMFT between the control group and the HbSS group (p=0.97) [19]. The results were also dissimilar to the study conducted by Passos CP (2008) which stated that the risk factors known to cause caries and periodontal disease have more influence on oral health than the direct impact of SCD [20]. The results were also dissimilar to the study by M. Fernandes (2015) which stated that 8-10 years of children with SCD had lower caries experience compared to healthy peers (p = .03) and 11-14-year olds had similar dental caries experience to healthy peers (p > 0.05) [17].

S. Rathod's (2013) study in Government Medical College, Nagpur reported DMFT of 5.62 for SCA patients in the age group 18-29 years and DMFT of 4.36 for patients aged between 30-40 [24]. They had examined SCA patients visiting only Government Medical College (GMC), Nagpur whereas present study has also included SCA patients reporting at Indira Gandhi Government Medical College (IGGMC), Nagpur as more number of sickle cell patients are reported to IGGMC when compared to GMC.

In this study no significant difference was found in DMFT, DMFS and OHI-S indices of SCA - SS and AS patterns with similar socio-economic characteristics indicating that severity of the disease does not affect the prevalence of dental caries.

There is no significant difference in mean DMFT, DMFS and OHI-S among different age group in SS and AS pattern. Significant difference was only found in mean DMFT score in age group of SS pattern. The mean DMFT (Table 7) score in 5-10 (3.50) age group is having significantly more caries rate when compared with 11-15(1.33) and 16-20(1.80) age group (p=0.02). Male (1.35) is having significantly more OHIS score when compared to female (0.79) in control group (p=0.01). There is significant difference (p=0.02) in DMFS score in different age group in control group. Mean DMFS score of 5-10(2.2955) age group is significantly greater than that of 11-15(0.9773).

The oral hygiene status calculated using OHI-S of both SCA and control group was found to be poor with no significant variation. This is differing from the S. Rathod (2013) study that stated majority of the SCA patients had fair oral hygiene status i.e. 53%, 21.5% had poor oral hygiene while 2.5% had good oral hygiene status [24]. This may be due to differences in the subject age group.

4.1Special findings

In the present study few special findings were recorded. It was found that 8.1% of SCA patients suffered from enamel hypoplasia which was also reported by Kelleher R et al (1996) [13] as a dental finding in SCA patients. 6.9% of the SCA patients suffered from crowding, 4.6% over retained teeth, 3.4% fluorosis, 2.3% from congenitally missing teeth, 1.1% from cleft palate surgery and 1.1% from delayed eruption of teeth.

Tooth discoloration was a common finding in SCA patients; this was also reported by Walsh (2004) [25]. In SCD, smoking, medications, and particular foods could induce micro-infarcts, which can be entrapped within the dentinal tubules and cause pre-eruptive red staining [15,16]. Another explanation for SCD-related tooth discoloration is the release of haemoglobin and its by-products due to erythrocytosis into the peripheral circulation where they incorporate into the dentin and enamel and cause intrinsic discoloration [14].

Even though many efforts have been made in the western world for improving the oral health status of SCA individuals, not much attention is given to this serious issue in India. It appeared that a relatively high proportion of the children in our study did not currently receive or had not yet received any form of professional oral care. This suggests that there is a need for renewed collaborative efforts by the various health disciplines and social service agencies to increase access to dental services for these patients.

Limitation of the study is small sample size and short duration. Majority of subjects belonged to lower socio-economic class. SCA patients visiting only government hospitals were included.

V. Summary and conclusion:

Based on the results and within limitations of the present study, it can be concluded that SCA is a potential risk factor in development of dental caries and poor oral hygiene. The results reinforce the importance of care related to oral health among children and emphasize the need to implement appropriate preventive measures for these patients. Counselling and education are fundamentals to avoid complications in the oral health of children with SCD. Therefore, dentists have an important role in preventing health complications in patients with SCD and providing a better quality of life for them. Early diagnosis of periodontal disease and dental caries will show productive and preventive benefits regarding sickle cell crisis. Further research focusing on continual monitoring of the oral health status of SCA patients' needs to be conducted. There is a need to adjust the resources available to best meet the needs of these patients.

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Dr. Padma Badhe. "Oral Health Status of Sickle Cell Anaemia Patients – A Case Control Study." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 1, 2019, pp 19-23.