

# Evaluation of Oral Health Status in Patients of Congenital Cardiac Defects

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## ABSTRACT

**Introduction:** Congenital Cardiac Defect are most common anatomical and developmental anomalies of the cardiovascular system. Poor oral health status in such patients predispose them to the risk of developing Bacterial Infective Endocarditis. The aim of this study was to evaluate the Oral Health Status of Congenital Cardiac Defect patients.

**Material and Methods:** This cross-sectional study was conducted on (n=50) patients with clinically diagnosed Congenital Cardiac Defect by the Cardio-Thoracic Surgery Department of our Institute during the year 2019-2020. The evaluation of Oral Health Status was done by assessing two dental indices viz Simplified Oral Hygiene Index and Modified Gingival Index. Post data analysis appropriate statistical test were applied.

**Results:** A comparative evaluation of Oral Hygiene Status (Simplified- Oral Hygiene Index scores) was done between male and female study subjects which demonstrated that 54% (14 Males and 13 females=27), had good oral hygiene status. Similarly, evaluation of Gingival Health Status by (Modified Gingival Index scores) showed 74% (19 Males and 18 Females=37) having mild gingival inflammation.

**Conclusion:** Our study demonstrated a high percentage of Congenital Cardiac Defect patients having Good Oral Hygiene and Gingival Health. Although, it is recommended that a regular oral health assessment of such patients is done from time to time to promote continuous oral health awareness and education amongst them to lower their risk of developing IE. Dentist are also advised to use simple, quick and non-invasive dental indices and diagnostic tools to assess the Oral Health Status of Congenital Cardiac Defect Patients.

**Key words:** Congenital cardiac defect (CCD), Infective endocarditis (IE), Oral health status (OHS)

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## INTRODUCTION

Congenital Cardiac Defect (CCD) are most common anatomical and developmental anomalies of the cardiovascular system, with occurrence in approximately 8 in 1000 live births. However, with the improvement and advancement in medical sciences, survival rates have increased [1].

Ventricular Septal Defect (VSD) is the most common type of Congenital Cardiac Defect (CCD), occurring in 50% of all patient of CCD. In 20% patients it occurs as an isolated lesion. The VSD incidence ranges between 1.56 to 53.2 per 1000 live birth. Aortic Valve Stenosis (AVS) is found in 7% of all CCD patients. M:F ratio of Coarctation of Aorta is 1.5:1 which is more common in Males [2]. Streptococcus Viridians is the most common etiologic agent for development of Bacterial Infective Endocarditis (IE) in 60% of CCD patients [3].

In 1971 many authors like Cameron and others performed various studies that showed occurrence of Streptococcus

Viridians endocarditis in edentulous patients. They even proposed that Bacterial IE may occur due to oral ulcerations caused by ill-fitting dentures [4]. In 1997, American Heart Association recommendations stated that as a prophylactic measure against IE CCD patients should maintain best possible oral health status (OHS) to reduce bacteremia [5].

Penicillin is the first line drug for antibiotic prophylaxis against bacterial IE except in patients allergic to the drug [6]. Jolly, et al. in their study enumerated that any intervention that is likely to expose blood vasculature should be performed under antibiotic prophylaxis [7]. Investigations led by OKell, et al. and others predicted 25% to 88% bacteraemia depending on the type of procedure undertaken ranging from Extraction of teeth, Periodontal procedures, and Multiple Extraction of teeth [8].

Thus, the aim and objective of this study was to evaluate the Oral Health Status of CCD patients visiting our tertiary care center. This was accomplished by using simple, non-invasive clinical examination diagnostic tools and indices for calculating their Oral Health Status. Oral Health Status evaluation was performed with an objective to devise a

strategy for oral health awareness and education of this vulnerable population who is at constant risk of developing bacterial IE.

## MATERIAL AND METHODS

### Study design

This is a cross sectional study involving participation of a group of individuals with clinically diagnosed Congenital Cardiac Defects (CCD).

### Study population and sample selection

The study sample population comprised of a total number of 50 patients (n=50); ( 25 males and 25

females) with clinically diagnosed Congenital Cardiac Defects by the Cardio-Thoracic Surgery Department of our Institute who were referred for either routine clinical oral examination or for dental fitness prior to undergoing cardiac surgery to our Dental Outpatient Clinic of our Institute, during the year 2019-2020. Table 1 depicts distribution of Patients of Congenital Cardiac Defects attending dental OPD during the study period. The inclusion criteria of this descriptive study included patients between age group of 14 years to 50 years with clinically diagnosed Congenital Cardiac Defects. Edentulous patients, patients with other co-existing systemic /debilitating diseases were excluded in this study.

**Table 1: Distribution pattern of CCD Patients received in Dental OPD during study period.**

Sn	Congenital Cardiac Defect	Frequency
1	Atrial Septal Defect	10
2	Ventricular Septal Defect	21
3	Atrioventricular Septal Defect	3
4	Pulmonary Stenosis	2
5	Aortic Stenosis	3
6	Single Ventricle	1
7	Other lesion	10
8	Total	50

### Assessment of clinical parameters

Entire Clinical examination was performed by one doctor on a dental chair under standard lighting conditions with mouth mirror and diagnostic probe. Periodontal probing was not performed in any subject of the study group as it may cause bacteremia and may pose risk of IE in CCD Patients [9].

OHS of Congenital Cardiac Defect patients was evaluated by assessing and subsequently calculating two dental indices viz Simplified Oral Hygiene Index (OHI-S) [10] and Modified Gingival Index (MGI) as described in available clinical literature [11]. Oral Hygiene Status was evaluated by using Simplified Oral Hygiene Index [12]. Modified Gingival Index was used to access the severity of gingivitis and evaluate the Gingival Health Status of CCD Patients since it is non-invasive and avoids periodontal probing [13]. The gingival changes were recorded by mere visual examination in MGI. OHIS-S and MGI were taken as Oral Health Indicators for assessing the Oral Health Status of CCD Patients in this study.

### Statistical analysis

This was done using Statistical Package of Social Science (SPSS Version 20; Chicago Inc., USA). Statistical procedures were carried out in 2 steps:

Data compilation and presentation.

Statistical analysis.

Unpaired Student 't' test was performed at 95% Confidence interval to reveal demographic distribution of study subjects within the sample population according to age and gender. Further, the Unpaired Student 't' test was also used for 1) Comparison of Mean Simplified Oral Hygiene (OHI-S) Index between male and female study subjects, and 2) Comparison of Mean Modified gingival index (MGI) between male and female study subjects. Chi square test was performed to compare Oral Hygiene Status (OHI-S Index) and Gingival Health (Modified Gingival Index) between male and female study subjects and to calculate overall Oral Hygiene Status and Gingival Health. The Significance value of P was set at 0.01.

## RESULTS

Table 2 depicts demographic distribution of study subjects according to age & gender Mean age of male and female subjects was  $35.48 \pm 11.85$  year and  $35.52 \pm 11.50$  year, respectively. There was statistically no significant difference in age of male and female subjects.

Table 3 reveals mean of Simplified Oral Hygiene Index (OHI-S Index) and Modified Gingival Index between male and female study subjects. Mean Oral hygiene index value was  $1.466 \pm 0.947$  and  $1.616 \pm 1.238$  among male and female patients, respectively. Similarly Mean Modified Gingival Index (MGI) value was  $0.617 \pm 0.489$  and  $0.778 \pm 0.667$  among male and female patients, respectively. No statistically significant difference was found in Mean of OHI-S and MGI based on gender on application of

unpaired student t test. (P=0.633 for OHI-S), (P=0.366 for MGI).

Table 4 reveals overall comparison of oral hygiene status (OHI-S) between male and female study subjects Out of 50 patients, 27(54%) {14 Males (56%) & 13 females (52%)} had good oral hygiene status. 19(38%) {9 males (36%) & 10 Females (40%)} had fair and 4(8%) {2 males (8%) and 2 Females (8%)} had poor oral hygiene status. There was statistically no significant difference found in oral hygiene status between male and female patients on application of Chi Square Test. (P=0.956).

Table 5 reveals overall comparison of MGI between male and female study subjects showing majority of 37 patients (74%; 19 Males and 18 Females) having mild gingival inflammation, 11patients (22%; 4 Males and 11 Females) having moderate gingival inflammation, 2 patients (4%; 0 Males and 2 Females) having severe gingival inflammation. Application of Chi Square Test statistically showed no significant difference in MGI (Gingival Health) between male and female patients. (P=0.281).

**Table 2: Demographic Distribution of study subjects (Patients of CCD) according to Age and Gender.**

Gender	Number	AGE (Years)			Unpaired Student 't' Test Value	P- Value
		Mean	SD	Range		
Male	25	35.48	11.85	17-52	0.012	0.990 (NS)
Female	25	35.52	11.5	16-58		
Total	50	35.5	11.56	16-58		

**Table 3: Comparative evaluation of Mean of (OHI-S Index and MGI Index) between Male and Female study subjects of CCD.**

Groups	N	Oral Hygiene Index (OHI-S)			Modified Gingival Index (MGI)		
		Mean	SD	Range	Mean	SD	Range
Male	25	1.466	0.489	0.04-1.70	0.617	0.947	0.10-4.00
Female	25	1.616	0.667	0.10-2.24	0.778	1.238	0.13-5.40
Total	50	1.541	0.585	0.04-2.24	0.698	1.09	0.10-5.40
Unpaired Student 't' test		0.481			0.971		
Significance 'p' Value		0.633(NS)			0.336(NS)		

**Table 4: Comparison of Oral Hygiene Status (OHIS-S) between Male and Female study subjects of CCD.**

Groups	N	Oral hygiene status (OHI-S)		
		Good N (%)	Fair N (%)	Poor N (%)
Male	25	14(56.0%)	9(36.0%)	2(8.0%)
Female	25	13(52.0%)	10(40.0%)	2(8.0%)
Total	50	27(54.0%)	19(38.0%)	4(8.0%)
Chi Square Test Value		0.09		
Significance 'p' Value		0.956(NS)		

**Table 5: Comparison of Modified Gingival Index between male and female study subjects of CCD.**

Group	N	Gingival Health (MGI Classification)		
		Mild N (%)	Moderate N (%)	Severe N (%)
Male	25	19 (38.0%)	4 (8.0%)	0 (0.0%)
Female	25	18 (36.0%)	7 (14.0%)	2 (4.0%)
Total	50	37 (74.0%)	11 (22.0%)	2 (4.0%)
Chi square test value		2.541		
Significance 'p' value		0.281 (NS)		

## DISCUSSION

Most guidelines found in scientific literature pertaining to increased risk of developing IE in Congenital Heart Disease Patients have now recently drifted from the earlier concept of antibiotic prophylaxis to the importance of maintaining good oral health and hygiene as a preventive measure. This concept was validated in 2015 by the most recent European guidelines for management of IE. In other words, the susceptibility of an individual with a pre-existing cardiac defect towards developing IE is influenced by existence and intensity of an oral disease [14].

A case control study was conducted by Folwaczny, et al. to compare the oral health status in 112 adults with Congenital Heart Disease and 168 heart healthy control subjects. Oral Health status was evaluated using DMFT index, Sulcular Bleeding index according to Muhlemann et.al and presence of plaque at un-restored facial and lingual tooth surfaces using modified Quigley Hein Index along with radiological assessment for each study group. The study reported considerably lower caries experience and periodontitis amongst adults with Congenital Heart Disease and thus, concluded that adults with Congenital Heart Disease have better Oral health than the controlled heart healthy group [15]. The present study conducted by us was a cross sectional study with no comparative groups and evaluation of oral health status of Congenital Heart Disease patients was done within the sample population by using Simplified Oral Hygiene Index and Modified Gingival Index which was found to be good and healthy for majority (More than 50%) of the study subjects. The results of our study appear to be in conformity with the aforesaid discussed study. We did not perform any radiological assessment for the simple reason that we did not intend to expose the study population to radiation hazards just for performing a study survey.

There are reports in literature of edentulous patients suffering from IE which require special mention. Presence of candidiasis and denture granuloma in the study conducted by Thom, et al. [16] and occurrence of IE associated with denture ulcer in a case report by Davies also needs to be discussed since edentulism may also be a critical factor while assessing/ evaluating the oral health of a patient [17]. However, in our study no edentulous patient was included. Evaluation of oral health status in our study was based on OHIS-S and MGI which cannot be applied to edentulous patients.

As discussed earlier regarding the most recent European guidelines from 2015 which validated the maintenance of good Oral health and Hygiene as a preventive measure against IE, our study reported 54% (27 CCD Patients) having Good Oral Hygiene Status, 38 % (19 Patients) of having Fair Oral Hygiene Status and 8%(4 Patients) of having poor Oral Hygiene Status. Further, a majority of 37 patients (74%; 19 Males and 18 Females) reported only mild gingival inflammation depicting their good gingival health. Remaining 26% corresponded to moderate and severe gingival inflammation. Thus, in view of the

published guidelines it becomes imperative especially to adequately instruct patients having fair & poor category oral hygiene index score and moderate to severe gingival inflammatory status to improve their oral health status and prevent such patients from risk of developing IE due to any operative procedure that involves exposing the blood vasculature. Our study also arms a dentist to formulate a quick and easy protocol regarding assessment of the oral health of a Congenital Heart Defect patient by using simple, quick, non-invasive dental indices which will further validate the need to administer antibiotic prophylaxis regime in such patients.

There have been many studies in literature which have reported gender differences in risk of developing IE in Congenital Heart Defect (CHD) patients. Moreillon, et al. reported a male to female ration of 2:1 after performing a review analysis of 26 publications [18]. In another data analysis of the CONCOR Registry (CONGenital CORvitia Dutch National Registry database) comprising of greater than 10,000 patients with CHD, the risk for women to develop IE was lower compared to men [19]. Another study from Olmstead County reported lower age-adjusted incidence rate of IE over a prolonged period in women versus men (2-4/100000 patients/years in women and 8-12/100000 patients –years in men) [20]. Although none of the studies have been able to explain the reason for this gender difference. In present study when Oral Hygiene status and MGI score of Male and Female study individuals were analysed no statistical significance was found. However, in light of the literature pertaining to gender difference in developing risk for IE in the present study 36% of male population (9 Male CCD patients) with fair and 8% (2 Male CCD patients) with poor Oral Hygiene Status along with 8% (4 Males CCD Patients) having moderate gingival inflammation were specifically counseled for risk awareness, to improve their oral health care status before any dental intervention inducing bacteremia in order to prevent the risk of developing IE. Moreover, such patients shall require antibiotic prophylaxis prior to the dental procedure.

The importance of highlighting and developing excellent oral health has been the main objective of all IE guidelines. A cross sectional study by Stefan Hollatz et.al on 112 study participants emphasized the significance of making awareness amongst CCD Patients for achieving good oral health [21]. In the present study evaluation of oral health status was done by calculating and assessing simple, non-invasive dental indices which was useful in making risk awareness amongst CCD patients towards developing IE and educating the high risk sample population having fair/poor and/or moderate/severe oral hygiene and modified gingival index scores.

### **There are few limitations which need to be acknowledged**

The present cross-sectional survey has been done on a small sample population without any comparative group. The study has been done at a single tertiary care centre and the results obtained may not be representative for

other centres. Long term studies with larger study population need to be carried to find relation between gender based oral health status and gender related risk of developing bacterial IE. Prospective studies determining Prevalence of gingivitis and periodontitis may be undertaken for such group of patients for estimating risk of developing Bacterial IE in future.

### CONCLUSION

Maintaining optimum and good oral health status is a crucial factor in preventing the risk of developing bacterial endocarditis in CCD patients. Our study demonstrated a high percentage of Congenital Cardiac Defect patients having Good Oral Hygiene and Gingival Health which were used as indicators of assessing Oral Health Status in such patients. Although, it is recommended that a regular oral health assessment of such patients is done from time to time to promote continuous oral health awareness and education amongst them to lower their risk of developing IE. Dentist are also advised to use simple, quick, and non-invasive dental indices and diagnostic tools to assess the Oral Health Status of Congenital Cardiac Defect Patients.

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