IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 7 Ser. 8 (July. 2025), PP 19-23
www.iosrjournals.org

Oral Health Status Of Children With Congenital Heart Diseases

Authors: Dalia Osama Saleh Hassen[1], Mariem Osama Wassel[2], Khaled Ahmed Shams[3], Reham Khaled Elghazawy[4]

[1] (Post graduate student, Department of Pediatric Dentistry and Dental Public Health, Faculty of Dentistry, Ain Shams University, Egypt)

[2] (Professor of Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Ain Shams University, Egypt)

[3] (Lecturer of Cardiology Department at Helwan University, Egypt)

[4] (Associate Professor of Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Ain Shams University, Egypt)

Abstract:
Children with congenital heart disease (CHD) are a medically compromised population who face unique and multifaceted oral health challenges. These children exhibit a higher prevalence of dental caries, gingivitis, enamel defects, soft tissue abnormalities, and delayed tooth eruption compared to their healthy peers. These conditions are exacerbated by systemic complications, medications, feeding difficulties, and limited access to preventive dental care. Poor oral health in CHD children not only affects quality of life but also poses serious risks, such as infective endocarditis (IE). This comprehensive review aims to consolidate current evidence on the oral health status of children with CHD, detailing the epidemiological trends, pathophysiology, associated risk factors, clinical manifestations, diagnostic approaches, and the role of preventive strategies. It highlights the importance of interdisciplinary collaboration among cardiologists, pediatricians, and dental professionals, as well as the pressing need for targeted oral health education programs, particularly in low- and middle-income countries.

Keywords: *Congenital heart disease, oral health, infective endocarditis, oral health education, pediatric dentistry*

Date of Submission: 19-07-2025 Date of Acceptance: 29-07-2025

I. Introduction

Congenital heart disease (CHD) encompasses a wide range of structural and functional abnormalities of the heart present at birth. It is a major cause of pediatric morbidity and mortality globally. As medical and surgical advancements have improved survival rates, attention has shifted toward long-term management, including comorbidities like oral health. The oral cavity often reflects systemic health, and children with CHD are particularly vulnerable to dental and periodontal diseases. Oral health not only affects nutrition, growth, and development but can also directly influence systemic complications, especially infective endocarditis. Therefore, understanding the oral health profile of these children is imperative for improving health outcomes and quality of life. This review critically analyzes published research from the last five years to illuminate the current understanding of oral health in children with CHDs, identify prevailing trends and persistent challenges, and pinpoint critical gaps for future investigation.

II. Main Body

Congenital Heart Disease: Background and Classification

Epidemiology: CHD affects approximately 9.4 per 1,000 live births worldwide, with higher prevalence observed in Asia and lower rates reported in sub-Saharan Africa—likely due to underdiagnosis. In the Middle East and North Africa (MENA) region, CHD rates are significantly higher, exacerbated by consanguinity and

healthcare disparities. In Egypt, epidemiological data remain limited, but hospital-based studies suggest a predominance of acyanotic CHD, particularly VSDs, followed by TOF among cyanotic cases[1,2]

Etiology and Risk Factors: The etiology of CHD involves both genetic and environmental influences. Chromosomal anomalies like Down syndrome and 22q11.2 deletion syndrome, along with gene mutations in NKX2-5 and GATA4, are known genetic contributors. Maternal factors such as uncontrolled diabetes, obesity, infections like rubella, teratogenic medications, and substance use during pregnancy also elevate risk[3].

Pathophysiology and Classification CHD can be divided into cyanotic and acyanotic types. Cyanotic CHD results in the mixing of oxygenated and deoxygenated blood (right-to-left shunt), leading to hypoxemia and systemic cyanosis. Common forms include TOF, transposition of the great arteries (TGA), and tricuspid atresia. Acyanotic CHD, characterized by left-to-right shunts, leads to increased pulmonary circulation and includes conditions like VSD, ASD, and PDA[4]

Oral Health Implications of CHD

Dental Caries: Dental caries is more prevalent in children with CHD due to factors such as enamel hypoplasia, reduced salivary flow from medications (e.g., diuretics, beta-blockers), and frequent consumption of sugar-laden medications and snacks. Feeding difficulties and prolonged use of feeding bottles also contribute. Caries indices such as the CAST index have proven effective in this group[5].

Gingivitis and Periodontal Diseases: Gingivitis is widespread in CHD populations, often due to inadequate oral hygiene, complex medical needs, and plaque accumulation. Medications like phenytoin and calcium channel blockers may cause gingival hyperplasia. Hypoxia in cyanotic CHD contributes to mucosal changes and impaired healing, exacerbating inflammation[6].

Enamel Defects: Hypoxia-induced dysfunction in ameloblasts leads to enamel hypoplasia and hypomineralization. These defects make teeth more susceptible to caries and erosion. Studies show a higher prevalence of developmental defects of enamel in CHD children compared to controls, especially among cyanotic cases[7].

Soft Tissue Changes: Mucosal cyanosis, glossitis, and oral ulcerations are frequent findings in CHD children, especially those with cyanotic defects. Drug-induced xerostomia contributes to soft tissue lesions and discomfort[8].

Delayed Tooth Eruption: Tooth eruption is often delayed in CHD patients, correlating with systemic hypoxia and nutritional deficiencies. Dental age assessments show a significant lag in eruption compared to healthy children[9].

Infective Endocarditis and the Oral-Systemic Link

Infective endocarditis (IE) is a major concern in CHD patients. Oral pathogens like *Streptococcus sanguinis* can enter the bloodstream during invasive dental procedures or daily activities like brushing. According to AHA guidelines, antibiotic prophylaxis is indicated for high-risk CHD patients undergoing invasive procedures[10].

Importance of Oral Health Education

Oral health education targeting caregivers and healthcare professionals is critical. Evidence shows that structured programs improve brushing frequency, reduce sugar intake, and enhance dental service utilization. Yet in Egypt and other LMICs, awareness and access remain inadequate. Collaboration between pediatric cardiologists and dental professionals is essential for integrated care[11],[12].

Research, as shown in table (1), shows that oral health education can make a real difference in the lives of children with medical conditions. Hartwig et al. (2017)[13] demonstrated that even simple interventions—like supervised toothbrushing and weekly lessons—significantly improved oral hygiene in children with special health care needs. Similarly, Sivertsen et al. (2018)[14] found that early counseling led to better oral health habits in children with serious heart conditions. Studies by Koerdt et al. (2018)[15] and Karikoski et al. (2023)[16] also emphasized that while children with congenital heart disease (CHD) are at higher risk for dental issues, their families often don't receive the support or information they need. These findings highlight how vital it is to educate both children and caregivers—and to strengthen the link between medical and dental care. Unfortunately, in countries like Egypt, there is a lack of research and structured programs targeting the oral

health of children with CHD. This gap underscores the urgent need to raise awareness and implement preventive education efforts in this vulnerable group.

Table (1): Studies Evaluating the Impact of Oral Health Education in Children with CHD or Special Health Needs

Author (Year)	Study Design	Methodology	Key Findings	Main Conclusion
Hartwig et al. (2017)	Interventional study	Supervised toothbrushing and weekly sessions for 4 weeks, final week with caregiver education	Significant improvement in oral hygiene and gingival status (OHI-S, GBI)	Basic education improves oral health in special needs children
Sivertsen et al. (2018)	Prospective cohort study	Early oral health counseling for CHD children	Improved oral hygiene behaviors and reduced risk factors	Early education promotes preventive habits in CHD patients
Koerdt et al. (2018)	Cross-sectional observational study	Assessment of dental status and parental knowledge in CHD children	Poor preventive care; low caregiver awareness	Need for parental education and medical-dental collaboration
Karikoski et al. (2023)	Intervention study	Early and repeated oral health promotion in CHD patients	Improved brushing habits, reduced sugar intake, potential IE risk reduction	Education reduces oral and systemic risks in CHD children

Evidence from Previous Studies

Recent studies consistently report that children with CHDs generally exhibit poorer oral health compared to their healthy peers, with a higher prevalence of dental caries, gingivitis, and developmental enamel defects. While some studies show varying degrees of statistical significance, the overall picture points to a heightened vulnerability.

Multiple studies, as show in table (2), over recent years have made it clear that children with congenital heart disease (CHD) are at increased risk for oral health problems—but too often, their dental needs are overlooked. Research from Schulz-Weidner et al. (2020)[6] found that CHD children brushed less frequently, visited the dentist less often, and consumed more sugary foods compared to healthy peers. Many parents were unaware of the importance of fluoride use and basic preventive care.

Other studies, like those by Karikoski et al. (2021)[17], Koerdt et al. (2022)[18], and Sethi et al. (2022)[19], further confirmed that children with CHD tend to have higher rates of untreated caries, gingivitis, and developmental enamel defects. Notably, Sethi's study also found that caries and poor oral hygiene were more severe in older children and those with acyanotic CHD.

Bsesa et al. (2023)[20] and Sarac et al. (2023)[7] expanded on this by examining the broader impact on oral health–related quality of life. CHD patients had significantly worse oral hygiene, more enamel defects, and higher levels of gingivitis and periodontitis. Importantly, Sarac's findings suggested that systemic hypoxia may play a role in the development of enamel defects, especially in children with lower oxygen saturation.

Moussa et al. (2024)[21], in a systematic review and meta-analysis, found mixed results: while some studies reported higher caries rates in CHD patients, not all results were statistically significant. However, the review still pointed to a trend of greater oral health challenges in this group and emphasized the need for better-designed studies to draw firmer conclusions.

Tasdemir et al. (2024)[22] provided more recent insight, showing that children with moderate to severe heart disease had the highest levels of tooth decay and pulp involvement. Over 75% of these children had extensive caries, and many had visible enamel defects.

Table (2): Summary of Studies on Oral Health in Children with Congenital Heart Disease (CHD)

Author (Year)	Study Design	Methodology	Key Findings	Main Conclusion
Schulz-Weidner et al. (2020)	Cross-sectional questionnaire study	Questionnaire completed by parents of 107 CHD children and 101 healthy controls (aged 2–6)	CHD children had poorer oral hygiene, less fluoride use, fewer dental visits, and higher intake of cariogenic foods	Greater need for parental education regarding oral hygiene in CHD children
Karikoski et al. (2020)	Systematic review	Literature review of 9 studies from 2000–2019 on caries prevalence in CHD vs. healthy children	3/9 studies showed significantly higher caries in CHD	Limited evidence suggests higher caries prevalence in CHD children; more high-quality studies needed
Koerdt et al. (2022)	Observational study	Dental examinations using DIAGNOdent in	38.8% had untreated caries; higher DMFT	CHD children are at increased caries risk;

		147 CHD children compared to healthy controls	in CHD group across all age categories	need for preventive care emphasized
Sethi et al. (2022)	Cross-sectional observational study	Clinical examinations of 300 CHD children aged 2–16	56.7% caries prevalence; worse in acyanotic CHD; increased oral indices with age	Poor oral health and dental anomalies common in CHD; acyanotic children had worse outcomes
Bsesa et al. (2023)	Case-control study	200 CHD patients vs. 100 healthy children aged 4–12; DMFT/dmft, OHI, MGI, enamel defects measured	CHD group had worse oral hygiene, more caries, higher gingivitis, and more enamel defects	CHD children show poorer oral health and need early interventions
Sarac et al. (2023)	Descriptive, correlational study	581 children (217 CHD, 364 controls); intraoral examinations	Caries similar across groups; CHD had more gingivitis and enamel defects	Oral health in CHD influenced by hypoxia and requires collaborative care
Moussa et al. (2024)	Systematic review & meta-analysis	12 studies reviewed; 4 in meta-analysis; DMFT/dmft indices used	Some studies showed higher caries in CHD, but meta-analysis was not statistically significant	Evidence suggests CHD children may have more caries; results inconclusive due to study variability
Tasdemir et al. (2024)	Descriptive study	301 children with congenital/acquired heart disease (aged 5–14); full oral assessment	Children with moderate/severe CHD had higher dmfs and pulp exposure; enamel defects in 15.9%	CHD children have high untreated caries and treatment needs; early dental care essential

III. Limitations In Current Research And Future Needs

Despite growing recognition of the oral health challenges faced by children with congenital heart disease (CHD), several key gaps remain in the current literature. First, there is a notable lack of data from low- and middle-income regions, particularly Egypt and the broader Middle East, where no published studies have assessed the oral health status or evaluated the impact of oral health education in this high-risk population. While many studies have documented poor oral hygiene and increased caries prevalence in CHD children, few have implemented structured preventive programs or assessed the long-term impact of educational interventions. Additionally, although parental awareness is known to influence children's oral health behaviors, limited research has explored effective strategies to educate and engage caregivers of medically compromised children. The absence of multidisciplinary collaboration between pediatric cardiologists, pediatricians, and dental professionals further contributes to inconsistent care. Methodological inconsistencies, including varied use of diagnostic tools and assessment indices, reduce comparability across studies. Furthermore, the majority of existing research is cross-sectional, offering limited insight into the progression of oral health issues over time. Finally, age-specific outcomes and differences based on disease severity (e.g., cyanotic vs. acyanotic CHD) are underexplored, highlighting the need for more comprehensive, standardized, and longitudinal research to guide effective preventive care strategies in this vulnerable population.

IV. Conclusion

Children with CHD face numerous oral health challenges that can complicate their medical condition and quality of life. Dental caries, gingival disease, enamel defects, and soft tissue abnormalities are common and often untreated. Coordinated efforts involving medical and dental professionals, comprehensive oral health education, and accessible preventive services are imperative for improving outcomes in this high-risk group.

Conflict of interest

The authors declare no potential conflicts of interest with respect to research, authorship and/or publication of this article.

References

[1] Liu Y, Chen S, Zühlke L, Et Al. Global Birth Prevalence Of Congenital Heart Disease 1970–2017: Updated Systematic Review And Meta-Analysis Of 260 Studies. Int J Epidemiol. 2019;48(2):455–463.

[1] Al-Fahham M, Elsheikh R, Alzahrani AM. Congenital Heart Disease In Egyptian Children: Three-Year Hospital-Based Study. Egypt Heart J. 2021;73(1):12.

[1] Blue GM, Kirk EP, Giannoulatou E, Sholler GF, Dunwoodie SL, Harvey RP, Et Al. Advances In The Genetics Of Congenital Heart Disease: A Clinician's Guide. J Am Coll Cardiol. 2017;69(7):859–870.

[1] Bruneau BG. The Developmental Genetics Of Congenital Heart Disease. Nature. 2008;451(7181):943–948.

[1] Hamza AA, El-Tayeb IM, Hammad M. Caries Assessment Spectrum And Treatment Index For Evaluating Primary Dentition In Egyptian Children. J Clin Pediatr Dent. 2021;45(3):179–185.
[1] Schulz-Weidner N, Hensel KO, Bauer R, Gedrange T, Kordass B, Zöller D. Oral Health Behavior And Caries Experience In Children With Congenital Heart Disease. BMC Oral Health. 2020;20:217.
[1] Sarac D, Ozkan E, Yildirim T, Et Al. Enamel Defects And Dental Age In Children With Congenital Heart Disease. Clin Oral Investig. 2023;27:417–426.
[1] Sethi R, Naik M, Patel M, Desai S. Oral Health And Prevalence Of Dental Anomalies In Children With Congenital Heart Disease. J Indian Soc Pedod Prev Dent. 2022;40(2):117–122.
[1] Raad N, Elhaddad A, Khattab N. Dental Development In Children With Congenital Heart Disease: A Histological And Clinical Study. Pediatr Dent J. 2023;33(2):88–95.
[1] Wilson W, Taubert KA, Gewitz M, Et Al. Prevention Of Infective Endocarditis: Guidelines From The American Heart Association. Circulation. 2007;116(15):1736–1754.
[1] Koerdt S, Hartwig S, Schmoeckel J, Et Al. Impact Of Early Oral Health Education In Children With Congenital Heart Disease. Clin Oral Investig. 2020;24(5):1913–1921.
[1] Sivertsen H, Bjørk IT, Nielsen BM, Saetre H. Oral Health In Children With Congenital Heart Defects: A Case-Control Study. Eur Arch Paediatr Dent. 2018;19(3):179–185.
[1] Hartwig AD, Stüermer VM, Da Silva Júnior IF, Schardosim LR, Azevedo MS. Effectiveness Of An Oral Health Educational Intervention For Individuals With Special Health Care Needs From A Southern Brazilian City. Special Care In Dentistry. 2017 Sep;37(5):246-52.
[1] Sivertsen TB, Åstrøm AN, Greve G, Aßmus J, Skeie MS. Effectiveness Of An Oral Health Intervention Program For Children With Congenital Heart Defects. BMC Oral Health. 2018 Dec;18:1-3.
[1] Koerdt S, Hartz J, Hollatz S, Frohwitter G, Kesting MR, Ewert P, Oberhoffer R, Deppe H. Dental Prevention And Disease Awareness In Children With Congenital Heart Disease. Clinical Oral Investigations. 2018 Apr;22:1487-93.
[1] Karikoski E, Sarkola T, Blomqvist M. Early Counseling To Improve Oral Health Behavior In Children With Major Congenital Heart Defects: A Randomized Controlled Trial. Caries Research. 2023 Dec 18;57(5-6):563-74.
[1] Karikoski E, Sarkola T, Blomqvist M. Dental Caries Prevalence In Children With Congenital Heart Disease–A Systematic Review. Acta Odontologica Scandinavica. 2021 Mar 4;79(3):232-40.
[1] Koerdt S, Hartz J, Hollatz S, Heiland M, Neckel N, Ewert P, Oberhoffer R, Deppe H. Prevalence Of Dental Caries In Children With Congenital Heart Disease. BMC Pediatrics. 2022 Dec 12;22(1):711.
[1] Sethi M, Sood S, Sharma N, Singh A, Sharma P, Kukshal P. Oral Health Status And Dental Anomalies Among Children With Congenital Heart Disease In Contemporary Times. Special Care In Dentistry. 2022 Dec 21
[1] Bsesa SS, Srour S, Dashash M. Oral Health-Related Quality Of Life And Oral Manifestations Of Syrian Children With Congenital Heart Disease: A Case-Control Study. BMC Oral Health. 2023 May 23;23(1):316
[1] Moussa C, Savard G, Estrade L, Bourgi R, Kharouf N, Denis F, Daou MH. Dental Health In Children With Congenital Heart Defects: A Systematic Review And Meta-Analysis. Journal Of Clinical Medicine. 2024 Nov 21;13(23):7022.
[1] Tasdemir T, Erbas Unverdi G, Ballikaya E, Aypar E, Aykan HH, Karagoz T, Uzamış Tekcicek M. Evaluation Of Oral Health Status And Treatment Needs Of Children With Congenital And Acquired Heart Disease. Journal Of Clinical Medicine. 2024 Jul 11;13(14):4060.