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Medical Health Problems Influencing Oral Health in Children and Adolescents – A Scoping Review on Existing Evidence and its Clinical Significance

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KEYWORDS

Health care, child health, adolescents, children, clinical significance, prevention, systemic disease, medical problems

ABSTRACT:

Background: Oral health is intricately linked with a wide range of systemic health conditions including cardiovascular diseases, dermatological issues, diabetes, asthma, respiratory disorders, and bone-related diseases. The objective of this study is to investigate the association between oral health and systemic health in children and adolescents, with the focus on clinical relevance and identifying directions for future research.

Methodology: This study was registered with PROSPERO prior to its commencement. A comprehensive review was conducted including both observational and experimental studies. Electronic databases including PubMed, Scopus, Web of Science, and grey literature were searched using predefined search terms. Two independent reviewers extracted data and documented study selection with reasons for inclusion and exclusion. Data were systematically compiled and assessed for relevance and methodological quality.

Results: From an initial pool of 367 studies, 31 full-text articles met the inclusion criteria. 4 studies assessed the Helicobacter pylori and oral health, 5 on bone disease and oral health, 3 on juvenile idiopathic arthritis and oral health, 10 on asthma and oral health, 6 studies on cardiovascular disease and oral health, and 3 studies on diabetes mellitus and oral health. Collectively, the results favour the implementation of interdisciplinary care models to ensure timely diagnosis, prevention, and management of oral and systemic complications.

Conclusion: This study highlights that many systemic diseases share common lifestyle related risk factors with oral diseases and reinforces the need for integrated health strategies. Regular awareness campaigns and lifestyle modifications are essential for the prevention of both oral and systemic health issues.

1. Introduction

Oral health poses a significant global public health challenge exerting a substantial impact on individuals' overall well-being and quality of life.[1,2] According to WHO estimates, 50% of people worldwide suffer from some type of oral illness and surveys reported that the untreated caries in the primary teeth accounts to around 6.21 crore.[3] Studies have reported that the prevalence of oral diseases was 52% among 3 to 18 year olds and dental caries was approximately two billion per year in permanent dentition.[3,4] The Dental Council of India's 2002–2003 National Oral Health Survey revealed a 49.8% incidence of dental decay for aged 12 to 15 years old[4]. With regard to the dentition types, the mixed dentition category had the highest overall prevalence of dental caries (58%) compared to the primary dentition

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type (54%).[4] Owing to the fact that dental caries takes time to develop into clinically noticeable lesions and also dietary changes can have an impact, these data suggest that the prevalence of caries increases slowly over the transitional period between primary and mixed dentition.[5]

Various factors contribute to the development of oral diseases (Table 1). The occurrence of oral disorders and their impacts on individuals' overall health is seen across all age groups, including psychological well-being, sleep patterns, social interactions, mental health, medical illness and functional limits.[1] Further, oral health is also associated with various general health problems such as cardiovascular disease, skin lesions, cancer, diabetes, asthma, respiratory issues, bone disorders and so on.[3,6,7] It was reported in the literatures that biological, behavioral, bacterial, salivary flow, socio-economic and preventative factors influences dental caries.[8-10] High population density, cost for the dental treatment and improper use of monitoring techniques also pose the potential cause for the high incidence of oral health diseases.[1] In India, lack of funding for studies on oral health, and lack of dental insurance scheme could be another additional factor for the disdain in the reduction of the oral disease.[2]

Furthermore, it was clear from the earlier studies that measures for identifying children and adolescents who are at high risk of developing dental caries is still a demandable part and requires active research.[8,10] This underscores the importance of using reliable caries risk assessment tools for detecting high-risk individuals for dental caries development.[10] Given the widespread prevalence of oral health diseases and the multitude of factors influencing oral health in children and adolescents (as outlined in Table 1), this study aims to evaluate the association between systemic health and oral health in children and adolescents. The objective is to emphasize clinically relevant outcomes, explore underlying mechanisms, and identify gaps to guide future interdisciplinary research and integrated healthcare strategies.

Table 1: Factors impacting Oral Health in Children and Adolescents

Tooth Disturbances	Systemic Health Conditions	Maternal Health & Child birth	Genomics & Proteomics	Deficiencies	Environment and Others
• Microbes • Diet • Oral Hygiene • Maternal Oral Health • Morphology of Tooth	• Gastrointestinal Diseases • Bone Disorders • Autoimmune Disorders • Asthma Disorder • Cardiovascular • Diabetes	• Mode of Birth Delivery • Preterm • Low birth weight	• Hereditary / Genetic • Microbial peptides	• Vitamin Deficiencies • Iron deficiency • Folic acid Deficiency • Calcium Deficiency • Nutritional Deficiency	• Air Pollution • Climate Change • Social/Psychological/Mental Illness • Hormonal Changes

2. Methodology

This study was registered in PROSPERO (The International Prospective Register of Systematic Reviews) No: CRD42024627441.

Research Question

What is the association between systemic health and oral health status in children and adolescents, and how do these relationships impact clinical outcomes and inform future healthcare approaches?

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Eligibility Criteria and Selection of Studies

Studies examining the association between medical health conditions and oral health in children and adolescents less than 18 years of age were included. Studies focusing on adult populations or published in languages other than English were excluded. To ensure the findings reflect current evidence and practices, only articles published within the last 10 years (from 2015 onwards) were considered. Eligible study designs included observational studies namely cross-sectional, case-control, and cohort studies and as well as experimental studies.

Search Strategy and Data Extraction

Two investigators (PM and LS) individually searched the databases and the articles were included based on the eligibility criteria. To meet the objective of this study, a systematic search of databases such as PubMed, Scopus, Web of Science and grey literature using the search terms (mesh terms) such as “medical health”, “medical problems”, “oral health”, “dental decay”, “dental caries”, “children” and “adolescents”. The data was extracted by two individual authors (PM and LS) and entered in the spread sheet with the reasons for inclusion and exclusion of the studies. The discrepancies in the included and excluded studies were sorted out with the third reviewer (GFP). The data included the title of the article, author name, year of publication, sample population, sample size, ethnicity, objectives of the study, methods, outcome, clinical significance, and future aspects (Table 2). The methodology followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Fig 1).

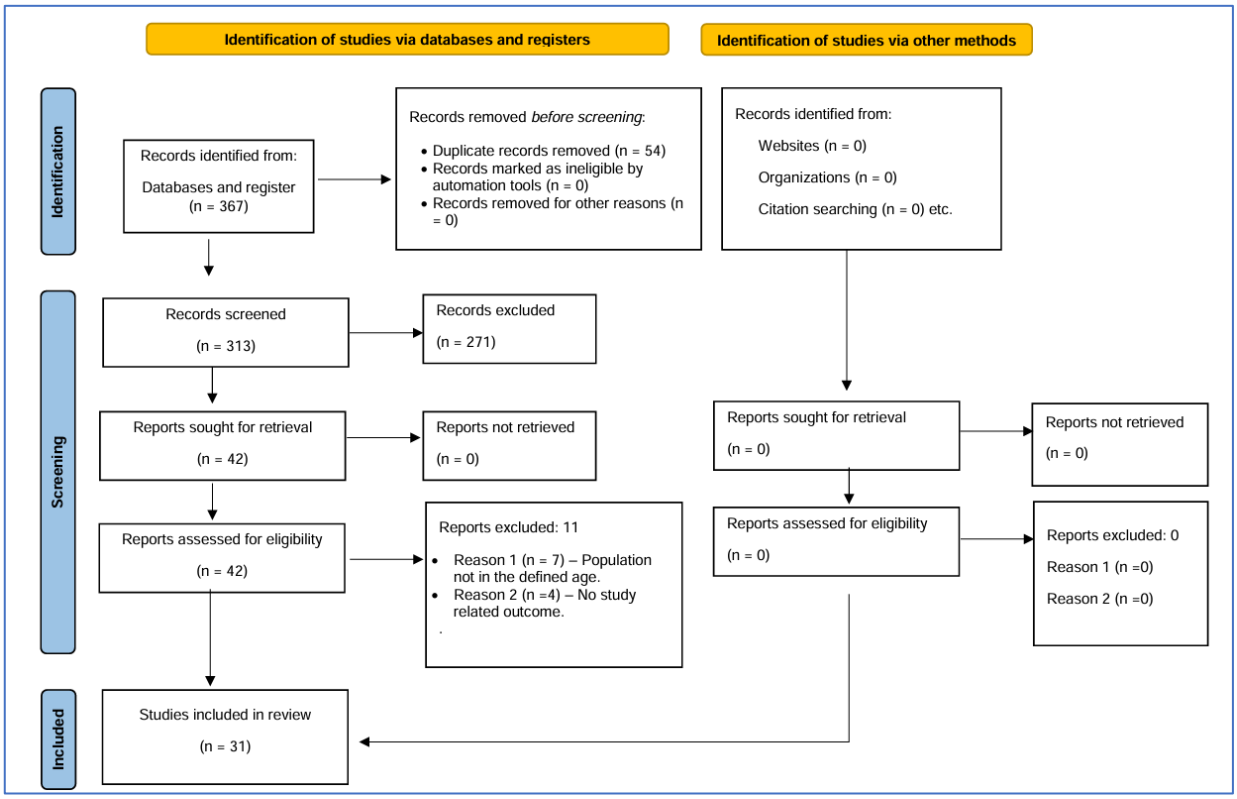

Figure 1: PRISMA flowchart of the selected studies

3. Results

The data search yielded a total of 367 studies and after removing the duplicated studies through title of the article (n = 54) the studies resulted for abstract screening was 313. After the exclusion of articles that did not fit into the objective of this study (n=271) the articles considered for full text retrieval was 42. After excluding the research papers for the reasons of

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population that is not in the defined inclusion criteria (n=7) and studies did not provide the related study outcome (n=4), study assessed 31 full text articles for outcome measurement.

Outcomes of Systemic Health Condition and Oral Health

a) Gastrointestinal Diseases namely Helicobacter pylori and Oral Health

A total of four studies were eligible that reported the Helicobacter pylori (H. pylori) causing numerous gastrointestinal disorders.[13-16] The two pathogens H. pylori and Streptococcus mutans responsible for dental caries has the same characteristics.[13] The prevalence of *Helicobacter pylori* (H. pylori) in dental plaque was significantly higher ($p < 0.05$). H. pylori were detected in 30% of children presenting with severe dental caries. The bacterium was more commonly found in younger children, with a decreasing trend in prevalence observed with increasing age.[13-16]

b) Bone Disorders and Oral Diseases

Only five studies were eligible to be included in this systematic review that finds an association between systemic bone diseases and oral health.[17-21] The studies suggest that there were notable delayed tooth development and eruption. Malocclusions, particularly Class II, were significantly associated with a higher prevalence of tempero mandibular disorders.

c) Autoimmune Disorders and Oral Health

There are three included studies and juvenile idiopathic arthritis was found to have significantly impacting oral health and quality of life, particularly in relation to orofacial symptoms, temporomandibular joint (TMJ) involvement, and overall dental function.[22-24] Children with immune disorders, particularly those on immunosuppressive or corticosteroid therapy, exhibited a significantly higher incidence of dental caries, gingivitis, periodontal disease, and xerostomia ($p < 0.05$), likely due to altered salivary flow and increased susceptibility to oral infections.

d) Asthma and Oral Diseases

Several studies (n=10) have explored this relationship and highlighted both biological and behavioral mechanisms contributing to poor oral health in these populations.[25-34] Children with asthma demonstrated a significantly higher prevalence of dental caries, plaque accumulation, and gingivitis compared to non-asthmatic peers ($p < 0.05$). The use of inhaled anti-asthmatic medications, particularly corticosteroids and bronchodilators, was associated with reduced salivary flow and altered oral pH, creating an environment that favors the growth of cariogenic bacteria ($p < 0.05$). Children with the asthma-obesity phenotype were found to be at an even greater risk for oral health complications.

e) Cardiovascular Diseases and Oral Health

The total six included studies demonstrate that childhood oral infections particularly periodontal and endodontic issues were significantly associated with subclinical atherosclerosis in adulthood ($p < 0.05$), indicating a potential link between early poor oral health and later cardiovascular disease progression.[35-40] Children and adolescents with periodontal infections showed a notable increase in carotid artery intima-media thickness, a validated marker of early atherosclerosis ($p < 0.05$).[39] Plaque accumulation and gingivitis were the most prevalent oral conditions observed in children with or at risk for cardiovascular diseases.[39]

f) Diabetes Mellitus and Oral health

The three studies included in this study reveals that gestational diabetes has been linked to enamel developmental defects, including molar-incisor hypomineralization (MIH).[41-43] Children with diabetes show a significantly higher risk of dental caries, periodontal and gingival problems compared to their healthy peers.[43] A notably high prevalence (45.5%) of periodontitis has been reported in children aged 8–17 years with type 2 diabetes, with disease severity closely correlated to poor glycemic control.[43]

4. Discussion

This study unwinds all the plausible general health conditions influencing oral health in children and adolescents. Though there are sufficient literatures drawing conclusion on the association between general health problems and oral health,[13-43] there still need comprehensive report on the clinical significance and preventative strategies. The collective body of research highlights a significant and well-established link

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between systemic diseases and oral health, particularly in pediatric and adolescent populations.[13-43] These findings underscore the imperative need for early dental screenings and routine oral health monitoring as integral components of comprehensive healthcare. Specifically, systemic disorders such as celiac disease, diabetes mellitus, asthma, immune-related conditions, and cardiovascular diseases demonstrate a bidirectional relationship with oral health, with manifestations often serving as early indicators of underlying systemic dysfunction.

Innovative strategies such as saliva-enhancing therapies, probiotic interventions for microbiome modulation, and reformulated medications with minimal oral side effects could play a transformative role in mitigating dental complications associated with chronic systemic diseases. In addition, patients should be diagnosed using caries risk assessment tools,[44] and systemic diseases should also be considered when developing prevention and treatment strategies. In parallel, the development of tailored oral health programs and caries risk assessment tools will enhance preventive measures. Though National Rural Health Mission (NRHM) is introduced in India to fortify the existing health structure, there is still a demand to render consistent and quality intervention.[45] Moreover, the cost for the treatment of chronic illness are on the higher side, where the affordability is compromised leading to severe illness and mortality.[46] It was also delineated that India has crossed the initial phases of chronic diseases and the burden is even more increasing calling out to have a universal health care system.[46]

Current evidence supports the implementation of interdisciplinary care models involving dentists, pediatricians, endocrinologists, rheumatologists, pulmonologists, and dermatologists to ensure timely diagnosis, prevention, and management of oral and systemic complications.[13-43] The role of oral health as a predictive marker for various systemic conditions reinforces its value within pediatric healthcare strategies. Future research should prioritize longitudinal study designs to establish causal relationships and further elucidate the pathophysiological mechanisms linking oral and systemic health. Investigations focusing on advanced imaging modalities (such as CBCT and MRI), non-invasive and alternative therapeutic strategies, genetic predispositions, and personalized treatment approaches are warranted. Moreover, exploring diverse variables including ethnicity, detection methodologies, and biological sample types (e.g., saliva, dental plaque, and tongue scrapings) will provide more robust and generalizable findings.

The strength of this study is that all possible major health conditions in children and adolescents affecting oral health are recited. However, this study did not consider all the other risk factors (tabulated in Table 1), that are contributing to oral health problems. Future studies should focus on multi-disciplinary preventative strategies that reduce the burden of general health diseases affecting oral health. In addition, cost-effective validated reliable tools for identifying medical and dental diseases at early stages that are suitable for Indian population should be explored.

5. Conclusion

In conclusion, the studies advocate for the integration of oral health within the broader medical care framework, emphasizing its pivotal role in early detection, intervention, and the overall improvement of health outcomes in children and adolescents. Raising awareness among healthcare providers and promoting multidisciplinary collaboration is essential to ensure holistic and effective patient care.

Clinical Significance

Poor oral health can contribute to systemic conditions like diabetes, respiratory infections, and malnutrition, while systemic diseases may present with oral symptoms. Early dental intervention can support overall health, making routine oral assessments crucial in pediatric care.

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Table 2: Data extraction of included studies (n=31)

S. No	Author Name & Year	Study Design	Ethnicity	Age	Sample Size	Objectives	Assessments	Results/Outcome	Clinical Significance
1.Helicobacter pylori and Oral Health - 4									
1	Dane et al. 2016	Case-Control Study	Turkey	5–15 years	70 children	To isolate Helicobacter pylori (HP) from the dental plaque of a selected group of children and to compare the oral and salivary findings of patients with those of a healthy control group.	An intraoral examination - dental plaque and saliva specimens were collected for analysis. Oral health conditions, nutritional habits, tooth brushing frequency, saliva pH levels, flow velocity, and buffering capacities were noted	The prevalence of HP in dental plaque was higher in study group than controls ($p<0.05$). There were no significant differences between groups with respect to DMFT and dft scores, nutritional habits, tooth brushing frequency, saliva pH level or flow velocity ($p>0.05$).	Good oral hygiene could make a positive contribution to the treatment of gastritis. Thus, oral hygiene education should be given to patients.
2	El Batawi HY et al. 2020	Cross-sectional study	United Arab Emirates	4 to 7 years	48 children	Investigated the presence of H. pylori in cavitated carious lesions of children by polymerase chain reaction	Caries status and caries severity were assessed using the dmft and ICDAS caries index. Dentine samples were collected for DNA isolation for the detection of H. pylori by PCR.	30% of the children had H pylori detected in severe caries lesions.	The presence of H. pylori in the cavitated, non-gastric niche of children with severe caries, possibly could serve as a reservoir for microbial dissemination to other sites of the body.
3	Altamimi E et al. 2020	Cross-sectional study	Jordan	4 to 17 years	340 children	To assess the prevalence of H. pylori infection in children using the C-urea breath test.	Questionnaires obtaining data on sociodemographic, clinical symptomatology, and hygienic risk factors were completed. Recruited children underwent a urea breath test.	H pylori is prevalent at early ages and there is a decrease as the age increases	Risk factors like children living in urban area and family history of H.Pylori causes acquisition of oral infection
4	Khdair Ahmad F et al. 2020	Retrospective cross-sectional	Jordan	11 and 16 years	98 children	To measure the histology-based prevalence of H.pylori infection in children	Data collected included epidemiological data, indication for endoscopy, endoscopic findings, and	Moderate to severe active gastritis influences Helicobacter pylori and does not affect anaemia status.	Previous history of gastritis influences dental health.

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S. No	Author Name & Year	Study Design	Ethnicity	Age	Sample Size	Objectives	Assessments	Results/Outcome	Clinical Significance
		study				and to quantify its impact on the gastric inflammation and anaemia.	laboratory data.		
2. Bone Disorders and Oral Diseases - 5									
5	Okawa et al. 2024	Retrospective cross-sectional study	Osaka University Dental Hospital	2-15 years	200 images of healthy participants	To develop a quantitative method to evaluate dentin dysplasia using orthopantamography (OPG) that would allow the values in patients with XLH to be compared with the values in healthy participants of the same age.	200 images were divided into five age groups (2–4, 5–7, 8–10, 11–13, and 14–15 years), with 40 OPG images in each group. Severity of dentin dysplasia was analysed by measuring the pulp cavity area of the tooth using OPG images.	The teeth analysed were mandibular second primary molars and mandibular first permanent molars with complete root formation. Useful in the diagnosis of the dental manifestations of XLH. Early diagnosis of XLH enables oral management and leads to prevention of dental abscesses.	Novel methodology for using orthopantomography to quantitatively evaluate dentin dysplasia from the primary dentition through to the permanent dentition.
6	Garcete Delvalle CS et al. 2024	Cross-sectional, observational and analytical study	Madrid, Spain	6- to 12-year-old children	421 (26 - osteogenesis imperfecta; 395 - control group)	To study the dental development of premolars and the root resorption of primary molars in children with osteogenesis imperfecta (OI) medicated with BPs according to age and sex.	The radiographs of each patient were evaluated for tooth development and root resorption and measurements were made using digital X-ray with a computer.	Children with OI medicated with BPs exhibit delayed dental development of the premolars and delayed root resorption of the primary molars. According to sex, both variables were delayed in boys, but the difference did not remain when data were analysed by age subgroup.	These clinical findings support the importance of clinically and radiographically monitoring the dental development and root resorption of primary teeth in children with OI treated with BPs to avoid alterations of the eruptive process.
7	Malgren et al. 2020	Retrospective cross-sectional study	Stockholm, Sweden	<19 years	45 children & adolescents	Evaluated the effect of Bisphosphonates (BP) therapy on tooth development and eruption of permanent teeth	3 groups: OI who had been treated with BPs (the study group); OI who had not been treated with BPs (control group 1); and healthy, matched controls (control group 2).Conventional screen-film or digital panoramic radiographs of all study participants were analyzed for tooth development, dental age and dental maturity.	BP therapy in OI patients seems to lower the dental age, and delay the dental maturity and tooth eruption. BP administration before 2 years of age might be a contributing factor.	As teeth affected with DGI have more calcified tissue to be resorbed, this could delay tooth eruption.
8	Macri M et al. 2022	Cross-sectional study	Italy	7-15 years	411 participants	To determine the prevalence of temporomandibular disorders (TMD) and to evaluate the association between TMDs and various types of malocclusions.	TMD Diagnosis and malocclusion assessment using angle's classification of malocclusion (Class I, II, III).	Significant correlation between Class II malocclusions and TMD symptoms. Children with malocclusions exhibited a higher prevalence of TMD symptoms compared to those with normal occlusion.	Early detection of TMDs is crucial in pediatric patients, especially those with malocclusion. Orthodontic intervention may prevent progression of TMD in children.
9	Janssens et al. 2024	Retrospective case–control study	France	< 16 years	30 children	To describe changes in dental health during orthodontic treatment in children with XLH compared with matched healthy controls.	Clinical and radiographic assessments along with orthodontic parameters.	Orthodontic treatment was successfully conducted in XLH patients with no increased iatrogenic risks compared to controls.	Children with XLH can safely undergo orthodontic treatment if systemic XLH management (e.g., phosphate supplements) is in place.
3. Autoimmune Disorders and Oral Health - 3									
10	Santos et al. 2015	Cross-sectional study	Brazil	6-14 years	33 children and	To correlate oral health indicators with oral health-related quality of	OHRQoL using SF:13 – B-PCPQ (Brazilian Parental-Caregiver Perceptions	There was found to be no significant differences in overall OHRQoL scores	Despite greater gingival bleeding and high TMD prevalence, children with

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					adolescents	life (OHRQoL) of children and adolescents with JIA, based on caregivers' perceptions and to test the hypothesis that children with	Questionnaire), DMFT/dmft indexes for caries, the Simplified Oral Hygiene Index (S-OHI), the Gingival Bleeding Index (GBI), and the presence of TMDs using the RDC/TMD criteria were performed.	between JIA and control groups. Children with JIA had fewer primary tooth caries but more gingival bleeding. Both groups showed high TMD prevalence, with varying types.	JIA did not show worse OHRQoL compared to healthy peers.
11	Fischer et al. 2020	cross sectional study	Multi centered study (norwegian)	4-16 years	221	To find the prevalence of temporomandibular disorder in children and adolescents with juvenile idiopathic arthritis	Assessment of Temporomandibular Disorder and juvenile idiopathic arthritis (JIA)	Painful palpation of masticatory muscles and decreased vertical unassisted jaw movement are more frequent in children with JIA than in healthy control	Nil
12	Rahimi et al. 2018	Prospective observational cohort study	Denmark	≤20 years	157 participants	To examine long-term changes in self-reported orofacial symptoms and to assess the impact of these symptoms on oral health-related quality of life (OHRQoL) in JIA patients	Orofacial Symptoms and OHRQoL: Child Perception's Questionnaire (31-item validated tool).	At baseline, 53% reported orofacial pain; 36% reported compromised orofacial function. At follow-up, 77% of those with initial pain reported persistent pain; 66% with initial functional disability reported persistent disability.	Orofacial pain and functional disability are common and persistent in JIA patients. These symptoms significantly reduce OHRQoL.
4. Asthma and Oral Diseases - 10									
13	Świątkowska-Bury et al. 2022	Prospective case-control study	Poland	3-17 years	208 children	To assess the effect of inhaled anti-asthmatic medications on the development of dental caries in children.	Dental examinations for caries risk were assessed using DMFT scoring, ICDAS II classification and Nyvad's criteria. Additionally, salivary analysis and data from the medical records were used for assessment.	A significant correlation was observed between higher caries indices and factors such as combined therapy, longer duration of inhaled corticosteroid (ICS) therapy, and the use of dry powder inhalers (DPIs).	Specific factors related to asthma treatment, such as combined therapy, prolonged ICS use, and DPI administration were associated with higher caries indices.
14	Kumar S et al. 2019	Case-control study	India	6-10 years	140 children	To evaluate the oral health status in asthmatic children receiving bronchodilator (salbutamol, salmeterol, etc.) through inhaler and compare them with non-asthmatic healthy children.	Dental caries risk was assessed using WHO criteria, then plaque index and gingival health was scored.	Asthmatic children exhibited significantly higher prevalence and severity of dental caries, plaque accumulation, and gingivitis compared to non-asthmatic controls.	Bronchial asthma and its management with inhaled bronchodilators have a harmful effect on oral health, increasing the risk for dental caries and periodontal diseases.
15	Samec T et al. 2021	Prospective cohort study	Slovenia	2-17 years	106 children	To investigate whether childhood asthma affects the development of dental caries and to compare caries progression over three years between asthmatic children and their healthy siblings.	Caries risk assessment using ICDAS-II (International Caries Detection and Assessment System) and data was collected.	Asthmatic children had fewer sound tooth surfaces compared to non-asthmatic siblings. Progression from sound to decayed surfaces was more frequent among asthmatic participants.	Asthma medications (especially inhalers) may contribute to changes in oral health by affecting salivary flow and pH.
16	Cerimoniale G et al. 2021	Cross-sectional observational study	Italy	Birth to 14 years (Exceptional cases-	563 participants	To gather information on current prescription habits of inhaled corticosteroids (ICS) among Italian pediatricians for	Data collected included frequency and dosage of ICS prescriptions for different respiratory conditions, influence of parental opinions on prescribing decisions and	Pediatricians ICS prescription habits in Italy should be improved, especially in the management of asthma.	The overuse of high-dose ICS, suggests a need for enhanced education and adherence to established guidelines to prevent potential side effects

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				till 16 years)		managing common pediatric respiratory diseases, including allergic rhinitis (AR), asthma, preschool wheezing, and laryngitis.	follow-up practices post-ICS prescription.		associated with high-dose ICS use.
17	Shin J et al. 2019	Retrospective cohort study	South Korea	2-17 years	2,290 children	To compare the effectiveness of low-dose Budesonide inhalation suspension versus oral Montelukast in managing asthma control among children with mild asthma.	Assessments were mostly related to the medication, it's effects on the said patient, frequency of administration and total cost.	Montelukast patients had better adherence, a longer time to loss of persistency, and were less likely to experience an exacerbation-related office visit in the post-index period than BIS patients.	Montelukast was associated with better medication adherence and longer treatment persistency
18	Davidović B et al. 2022	Case-Control Study	Southeast Europe	6 to 16 years	136 children	To evaluate dental status in asthmatic children and evaluate the possible effect of drugs treating asthma on dental health.	Dental exam, DMFT scoring, saliva analysis and asthma status was assessed.	AG had higher dmft/DMFT values than NAG, but differences were not statistically significant.	No significant differences in caries prevalence were found, asthmatic children showed saliva changes that could predispose them to higher caries risk.
19	Wee J.H et al. 2020	Cross-sectional observational study	South Korea	12–18 years	1,36,027 participants	To evaluate the association between self-reported oral health symptoms and the prevalence of asthma, allergic rhinitis (AR), and atopic dermatitis (AD) in Korean adolescents.	Oral health symptoms, allergic conditions and covariates were considered for assessment.	Adolescents with poor oral health had significantly higher odds of having: 1. Asthma 2. Allergic Rhinitis 3. Atopic Dermatitis, with various other factors influencing its occurrences.	A significant correlation between poor oral health and the prevalence of asthma, AR, and AD among Korean adolescents.
20	Bairappan S et al. 2020	Cross-sectional study	India	12-15 years	100 children	To assess and compare the salivary characteristics and oral health and to evaluate the impact of asthma and its medication on dental caries among adolescents with and without asthma.	DMFT index, severity of asthma and extent of medication use was assessed.	Asthma medications had significant impact on salivary characteristics and dental caries among asthmatic adolescents.	Nil
21	Longo et al. 2018	Retrospective cohort study	canada	2-18 years	4621	To assess the association of obesity with time to first exacerbation among children with asthma initiating step 3 maintenance therapies and how it modifies the effectiveness of step 3 therapies .	Patients' demographics, anthropometrics, specialist-confirmed asthma diagnosis, asthma severity and control indicators, environmental triggers, spirometric test results and physician prescription records of all asthma maintenance and/or rescue treatments were recorded.	An asthma exacerbation was defined as a composite end point, including (1) a short course of oral corticosteroids, (2) an acute care visit, or (3) hospital admission related to an asthma exacerbation (ICD-9 code 493.X and ICD-10 code J45.X), whichever occurred first. A lag period of 3 days was instated after cohort entry to exclude pre-existing exacerbations	Obese children with asthma appear to be more susceptible to early exacerbations
22	Bansal V et al 2022	cross sectional study	Bhopal	8-15 years	400	To evaluate and compare oral health status of bronchial asthma patients	The oral health was assessed by measuring caries assessment was done with the decayed missing filled teeth	Oral health was significantly poor in asthmatic patients in comparison with the healthy individuals	The increased frequency of asthma medication use was coupled with increased likelihood of caries

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							index/decayed extracted filled (DMFT/def index) and the periodontal status was measured with community periodontal index (CPI)		experience and increased severity of periodontal disease.
5. Cardiovascular and Oral Diseases - 6									
23	Amade et al. 2023	observational descriptive study	sub Saharan countries	6-15 years	954	To assess the feasibility of simultaneous Rheumatoid heart disease (RHD) and dental caries screening.	RHD screening with 2 stages of first physical examination (cardiac auscultation, direct oral cavity observation) and second with ECG.	Oral and cardiovascular screening children at high risk of heart damage are due to bacterial endocarditis.	Assessment of GAS infection for the preventive strategy of RHD
24	Pussinen et al. 2019	Prospective cohort study	Finland	6-12 years	755	Association between signs of oral infection in childhood with cardiovascular risk factors and sub clinical atherosclerosis in adulthood.	Oral examination and questionnaire based on oral hygiene habits. Estimating BP and cholesterol, triglycerides level from serum, ultra-sonographic studies were performed.	Oral infection in childhood is associated with subclinical carotid atherosclerosis.	Childhood infection associated with cardiovascular profile, chlamydia pneumonia infection assessed plays a major role in lesion development.
25	Rexhepi et al.2022	Case control study	Kosovo	3-15 years	140	To determine the dental health of children with Congenital Heart Diseases (CHD) and to evaluate the parents' knowledge of the importance of oral health and the risk of bacterial endocarditis.	Questionnaire assessing dental history and dental examination were performed.	No difference was observed between healthy and CHD children in caries experience and frequency of daily tooth brushing.	Our findings provide evidence of a lack of knowledge about the importance of oral health and dental prophylactic measures among parents with CHD children.
26	Schulz-weidner et al. 2020	Prospective case control study	Germany	2-6 years	101	Parental awareness of oral health and nutritional behavior in children with congenital heart diseases compared to healthy children	Questionnaire containing general health and oral hygiene	An unacceptable lack of knowledge about the importance of an optimized oral health among parents with CHD children compared to healthy controls.	Nil
27	Pogodina A V et al. 2015	Cross sectional study	Russia	10-17 years	113	To establish significant associations between periodontium status, circadian blood pressure (BP) profile and cardiovascular risk factors in adolescents with high BP.	Oral examination assessing BP, serum uric acid and triglycerides level.	None of the other cardiovascular risk factors showed meaningful relationships with periodontium status in the multivariate analysis. The relationship between periodontium status and blood pressure level exists.	. Timely implementation of prophylactic measures in adolescents with high blood pressure and, recommend BP assessment in adolescents with diagnosed periodontitis.
28	Bsesa SS et al. 2023	Case control study	Syria	4-12 years	300	To investigate oral manifestations and oral health-related quality of life (OHRQoL) of children with CHD and compare them with healthy controls aged 4–12 years.	DMFT assessment, Oral Hygiene Index for oral hygiene, Papillary-Marginal-Gingivitis-Index (PMGI) was done. The questionnaire consists of 36 items that investigate the impact of the condition of teeth, lips, and mouth on the child's life.	Children with CHD have poor oral health, with high percentages of plaque accumulation, untreated carious lesions, gingivitis, and dental abnormalities, in their primary and permanent dentition	Early intervention in CHD patients is required.
6. Diabetes and Oral Diseases - 3									
29	Anastasia et al. 2020	cross sectional study	Greece	6-15 years	144	To compare oral health of young individual with controlled and uncontrolled T1DM.	Diabetes assessed using HbA1C test and DMFs were performed.	Children with poor glycaemic control may be regarded as having a higher risk for future dental disease in comparison with	Assessing the candida sp, S. mutans, lactobacilli in oral cavity is required for prevention of further development of oral health

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								children with well-controlled T1DM.	problems
30	Sangheetha et al. 2018	Cross sectional study	Australia	8-18 years	80	To investigate the oral health of children and adolescents with type 1 diabetes (T1D) and its associations with diabetes-related and lifestyle factors.	Oral examination determined dental caries experience and gingival health. Secondary outcome measures included salivary characteristics, oral hygiene and dietary practices, and diabetes-related factors.	High rates of caries and poor gingival health in children and adolescents with T1D.	Gingival health with T1DM adolescents
31	Todescan et al 2022	Cross sectional study	Canada	8-17 years	121	To determine the prevalence of periodontitis in children and adolescents with type 2 diabetes, and if poor glycaemic control is associated with increasing prevalence of the disease.	Questionnaire related to oral health care was administered to each participant and they then underwent a full-mouth oral evaluation. In addition, clinical and metabolic parameters were extracted from the clinical chart.	Children and adolescents with type 2 diabetes presented high rates of periodontitis	Comprehensive periodontal examination is essential for children and adolescents with type-2 diabetes to prevent, identify, and treat periodontitis early.