

THE INFLUENCE OF CHILDHOOD ORAL HEALTH PROBLEMS ON PHYSICAL AND PSYCHOSOCIAL DEVELOPMENT

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Orapuh Literature Reviews

(Orap. Lit. Rev.)

*Open access internationally
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To cite: Arua, S. O., Ngwu, C. C., & Ucheka, P. I. (2023). The influence of childhood oral health problems on physical and psychosocial development. *Orapuh Literature Reviews*, 3(1), OR010.

JOURNAL INFORMATION

About Orapuh Review

An Orapuh Review is a standalone survey of current scholarly sources on a specific oral and/or public health topic to provide an (updated) overview of knowledge in that area.

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Orapuh Reviews are published in '**Orapuh Literature Reviews**' (*Orap. Lit. Rev.*) – ISSN: **2644-3651**. This journal is open access internationally peer-reviewed online repository of scholarly oral and public health review articles specifically crafted for students, researchers, and academics.

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The influence of childhood oral health problems on physical and psychosocial development

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RECEIVED:

30 August 2021

ACCEPTED:

20 May 2022

PUBLISHED:

19 January 2023

UPDATED:

19 January 2023

ABSTRACT

Oral health problems such as dental caries, periodontal disease, and congenital craniofacial deformities have short- and long-term effects on the general health of infants. Good oral health in children is very important as it has a great impact on their growth, general development, and quality of life. The purpose of this paper was to review the effects that the most common oral health problems found in children have on their physical and psychosocial development. A further aim was to highlight potential actions that could be taken to ensure the achievement of good oral health in children especially those with craniofacial deformities. We searched databases such as PubMed, Google Scholar, MEDLINE, Cochrane Library, and Microsoft Academic to obtain up-to-date literature for this review. We searched for, and reviewed articles published within the past ten years. The importance of prevention, early detection, and management of dental caries and periodontal disease in children cannot be overemphasized. Recognition and correction of developmental abnormalities are very important to the general well-being of children born with congenital craniofacial anomalies.

Keywords: *Cleft lip and palate, micrognathia, ankyloglossia, dental caries, periodontal diseases*

INTRODUCTION

According to Choi (2021), Cherry & Susman (2021), and Mauro & Rahal (2021), child development may be defined as the sequence of changes that occurs in children from birth up to early adulthood. These changes may include but are not limited to physical, emotional, linguistic, and psychosocial changes; involving structural, functional, and cognitive growth processes that occur in children. These processes are useful as the child transitions from dependency on the parents or guardian to the stage of independence. Choi (2021), Cherry & Susman (2021), and Mauro & Rahal (2021) opined that skills relating to social interactions and emotional regulations help the child to build and master self-control and interaction with others. Skills relating to speech and language are useful as the child understands

and masters the art of use of language in reading and communication.

Physiological changes lead to physical growth and mastery of the application of physical skills relating to the use of fingers (fine motor) and the whole body (gross motor). Taking the position further, Choi (2021), Cherry & Susman (2021), and Mauro & Rahal (2021) also stated that Although child development may encompass the full range of various skills that a child may master during this development process, factors such as genetics, environmental, and prenatal exposures may greatly influence these development processes. Erik Erikson's theory of psychosocial development describes the impact of social experience across a whole lifespan (Cherry & Susman, 2021). Furthermore, certain oral health problems found in children may also influence or interfere with a child's development process.

Oral health is a vital element of general health that influences a person's health, and general wellbeing (Cinar et al., 2014; Ganesh et al., 2020; Yactayo-Alburaquerque et al., 2021). This concept has been known and believed by the dental profession for many years. In 2016, the World Dental Federation (FDI), proposed an inclusive definition of oral health, which implies child development (Glick et al., 2016). This redefinition of oral health was an important component of the creation of vision 2020 by the FDI. This definition encompassed three major moderating factors such as physiological function, psychosocial function, and disease and condition status. These factors act as the driving determinants of overall health and general wellbeing (Glick et al., 2016).

The FDI definition stated that oral health is multifaceted and includes the ability to speak, smile, smell, touch, taste, chew, swallow, and convey a range of emotions through facial expression with confidence and without pain, discomfort, or diseases of the craniofacial complex (Glick et al., 2016; Watson, 2017). Going by the new oral health definition, oral health has a direct impact on both the physiological and psychological development of children and younger people. Careful consideration of all the individual components of the definition reveals a direct connection to child development and general wellbeing (Ganesh et al., 2020; Glick et al., 2016).

Furthermore, a healthy oral cavity would be when all the structures and associated organs are morphologically complete, functional, and without deformity, pain, or discomfort. Any deviation from the above state of the mouth indicates the presence of oral health problems or disease(s), resulting in reduced nutritional intake in children. This may harm both the physical and psychological development of a child (Shawn, 2017). An oral health problem, on the other hand, refers to those conditions within or associated with the mouth that structurally and functionally alter the health of the mouth and its associated organs. Oral health challenges that may impact child development include dental caries, periodontal disease, mandibular hypoplasia, ankyloglossia, malocclusion, and many others, (Yoon et al., 2017; Zuo et al., 2018; Almoud et al.,

2019; Beryl et al., 2019; Alois & Ruotolo, 2020; Baxter & Shanks, 2020).

Although deaths from oral diseases are very unlikely, they remain an integral part of the 21st-century public health concern. Dental caries and periodontal disease are still recognized as major components of non-communicable diseases and are the most prevalent oral diseases in children, (World Health Organisation [WHO], 2021). During the Tokyo declaration on dental care and oral health, for healthy longevity, the World Health Organization (WHO) advocated the total inclusion of oral diseases such as dental caries and periodontal diseases into the non-communicable disease prevention and control programs. This is to aid the successful maintenance of healthy functional oral health through the life course (WHO, 2015). There is a global increase in the prevalence of these oral diseases with up to half the world's population affected by either dental caries or periodontal diseases. Also, a great number of children are affected by severe congenital craniofacial disorders resulting in the presence of developmental abnormalities in children (Dye, 2017; WHO, 2021). The physiological and psychosocial development of a child may be hampered more by craniofacial deformities such as, but not limited to microglossia, aglossia, tongue hemiatrophy, cleft tongue, bifid tongue, etc. (Yoon et al., 2017).

With the correct home-based habits, and targeted therapeutic interventions child development may be effectively improved (Frisbee, 2021; Mauro 2021). Therefore, the role of maternal awareness in the prevention and management of oral health-related disabilities in children cannot be over-emphasized (Riggs et al., 2020). Gesase, et al., (2018) and Wagner & Roswitha (2017), stated that pregnant women and mothers of infants play key roles in ensuring the development, growth, and quality of life of their child and that they are not adversely affected by any oral health problem. Mouthon et al. (2019) in their retrospective study of the genetic etiology of micrognathia in 41 fetuses confirmed a genetic cause in 21 cases but still stated that the evidence of genetic association of micrognathia was not sufficient. Secondary

infection or toxic exposure such as fetal alcohol syndrome is also linked to the causes of the defect. Therefore, Mouthon et al., (2019) suggested that this requires that pregnant mothers be advised to undergo the prenatal diagnosis and stop alcohol intake to ensure that the fetus will not have the defect.

THE RATIONALE FOR THE REVIEW

A review published by Yactayo-Alburquerque et al., (2021), shows that oral health complications have adverse effects on child development, growth, and oral health-related quality of life. According to WHO (2021), and Feller et al., (2019), oral diseases have an association with other noncommunicable diseases such as diabetes, pneumonia, cancer, obesity, cardiovascular diseases, etc. The WHO further reported that about 3.5 billion people suffer from oral diseases worldwide (WHO, 2021). Therefore, this research is not only necessary but is also timely as there is a need to review a range of current literature addressing the most prevalent oral diseases and craniofacial disorders that affects both physiological and psychosocial development in children. This review covers oral health problems such as dental caries, periodontal diseases, malocclusion, ankyloglossia, micrognathia, and cleft lip and palate. The article also highlights the steps and actions that could be taken to recognize, prevent, and manage oral health problems in children.

REVIEW AIMS

The purpose of this paper was to review the effects that the most common oral health problems found in children may have on a child's physiological and psychosocial development. A further aim of this article was to highlight potential actions that could be taken to ensure the achievement of good oral health in children, especially those with craniofacial deformities.

DESCRIPTION OF THE ORAL HEALTH CONDITIONS THAT MAY AFFECT CHILD DEVELOPMENT

Dental Caries

Dental caries is the most persistent chronic oral infection affecting the teeth structures of over 530 million children globally (Correa-Faria, 2018;

Gupta et al., 2020; Riggs et al., 2020; WHO, 2021). The term early childhood caries refers to the early onset of dental caries especially in children, which is due to the consumption of high sugar foods and poor oral hygiene (Abdehrahman et al., 2021; Chi & Scott, 2019; Folayan & Olatubosun, 2018; Machiulskiene et al., 2020; Mathur & Dhillon, 2018). In different countries of the world, there are variations in the distribution of dental caries, with up to 90% of school-age children in the industrialized countries affected (Petersen et al., 2012, 2014; "WHO Oral health," 2012). Dental caries remains a global public health issue even though good oral hygiene, maintained through simple regular toothbrushing, with fluoride toothpaste, and adopting a diet low in sugar can effectively prevent it in children ("WHO Oral health," 2012).

Tungare and Pararinje (2020), in their study, found that dental caries affects the ability of a child to eat, chew, drink, and swallow foods because of the accompanying pain, thereby leaving them malnourished. Furthermore, dental caries in children complicate the health of those with already existing special care needs such as those with mental and physical disabilities such as autism (Mohamed et al., 2021). The mean decayed missing filled teeth (DMFT) index of children around the globe has historically varied showing inter-country and intra-country discrepancies in distribution. Children from high-income countries of the Americas and European countries have higher DMFT than children of the same age groups in the developing world (Petersen et al., 2012, 2014). In the epidemiological survey of dental caries, the DMFT is one of the dental indices used to quantify dental health status based on the number of decayed, missing, or filled teeth in a person (Radhika et al., 2017). An analysis of a randomized controlled trial of 6-7 years old school children selected from 16 elementary schools in low-income cities of the French Republic showed that a school-based dental sealant program may be effective in preventing the onset of dental caries in children (Himida and Ucheka, 2017).

Periodontal Disease

Periodontal health is often neglected during daily care of oral health, without recognizing the fact the periodontium is an essential supportive tissue responsible for holding the teeth together and maintaining its form within the dental arch. Alongside dental caries, the WHO has also recognized periodontal disease as a major constituent of the global burden of chronic diseases with great prevalence among children and young people (Petersen 2014; Petersen & Ogawa 2012). Periodontal diseases (gingivitis and periodontitis) are characterized by persistent inflammation, connective tissue breakdown, and alveolar bone destruction (Graves et al., 2011). Periodontal disease usually starts early in life showing an age-related increase in prevalence, progression, and severity (Rodan et al., 2015; Thomson et al., 2013). The severity of periodontal disease is determined by the extent of periodontal attachment loss and the depth of periodontal pockets (Petersen & Ogawa, 2012).

One of the most used scales for measuring the gravity of periodontal disease in children is the WHO-recommended Community Periodontal Index of Treatment Needs (CPITN). Taken as its basis, the scores of the CPI index range from Score 0: healthy periodontal conditions, up to score 4: deep periodontal pockets of up to 6 millimeters or more (WHO 2005). Generally, in children, periodontal diseases usually begin as simple gingivitis, which is a reversible inflammation confined to the gingivae and defined by gingival bleeding (CPI score = 1), occurring in one or more teeth (Preshaw et al., 2012). Gingivitis is the mildest form of periodontal disease (Llambés et al., 2015) and is the most prevalent form of the periodontal disease affecting children and young people globally (Rodan et al., 2015); whereas, plaque-induced gingivitis is the most common form of gingivitis in children (Idrees et al., 2014). Severe forms of periodontal disease prevalent among children and young people from low-income countries such as Nigeria are periodontitis, gingival overgrowth, and Necrotizing Ulcerative Gingivitis (ANUG). Gingival overgrowth has a hereditary background and is associated with specific

medications such as the antiepileptic drug, phenytoin (Faizuddin et al., 2012).

Periodontitis is the major chronic inflammatory periodontal disease. The chronic inflammation associated with periodontal disease represents the host's response to bacterial plaque accumulation from poor oral hygiene (Graves et al., 2011). Characterized by the persistent irritation and infection of the gingivae, periodontitis results in redness and swelling, and an aggressive breakdown of the connective tissues as well as the destruction of alveolar bone. Periodontal attachment loss and eventual tooth loss, which is also common in children with chronic systemic diseases such as diabetes mellitus, are also resultant effects of periodontitis (Morimoto-Yamashita et al., 2012). Periodontitis impact greatly on a child's general health and oral health-related quality of life (Yactayo-Alburquerque et al., 2021). It affects about 10% of the world's population (WHO, 2021). Necrotizing gingivitis and periodontitis if not treated may lead to Cancrum Oris (NOMA), which has up to 90% fatality rate in affected children (WHO, 2021).

Malocclusion

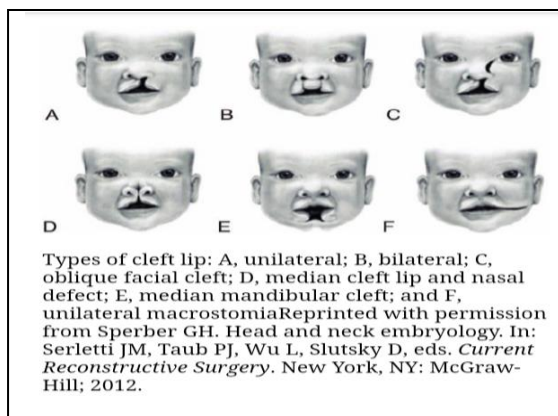
Malocclusion is a craniofacial abnormality resulting in an abnormal jaw relationship between the maxillary and mandibular jaws, which is responsible for anterior open bite, high narrow palate, posterior crossbite, steep mandibular, and sub-optimal facial development (Ganesh et al., 2020; Onofrio, 2019). The study of Patel et al., (2016) shows that malocclusion raises concerns due to its effects on health and function, social and psychological interaction, and largely on the quality of life of infants. Also, the bad impacts of bottle-feeding habits may result in orofacial dysfunction and increase the chances of an infant developing posterior crossbite and anterior open bite (Patel et al, 2019; Yactayo-Alburquerque et al., 2021). However, with the practice of prolonged or exclusive breastfeeding, malocclusion may be prevented.

Cleft Lip and Palate

Cleft lip and palate have been defined as craniofacial congenital anomalies affecting newborns (Alois & Ruotolo, 2020; Khan &

Prashanth, 2020). Reports by several authors have shown the various types of clefts taxonomically based on their location and severity (Alois & Ruotolo, 2020; Khan & Prashanth, 2020; Lewis et al., 2017). As shown in figure 1, different forms of occurrence of clefts have been reported by different authors and may include cleft lip alone, occurring either as a unilateral, or bilateral cleft lip, with or without cleft alveolus, and cleft palate.

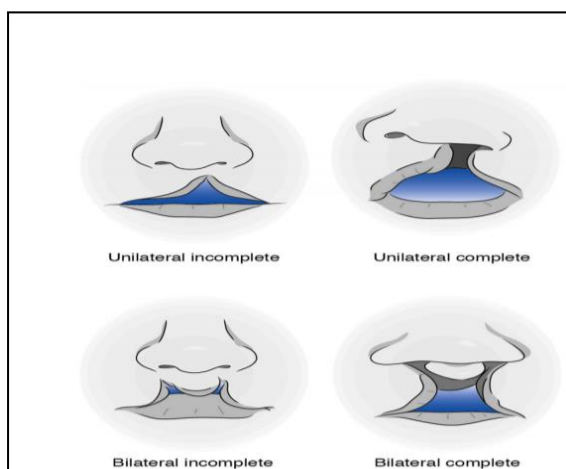
Figure 1:
Pictorial description of different types of cleft lip and palate



(Lewis et al. 2017)

Cleft lip and palate result from the failure of the bronchial arch to complete fusion with the frontonasal process in early gestation, (Lewis et al., 2017). As shown in figure 2, cleft lip was subcategorized by Lewis et al., (2017) as unilateral and bilateral clefts, complete and incomplete clefts, depending on the degree of the cleft extension to the lip and into the nose.

Figure 2:
Pictorial description of the subcategories of cleft lip



(Lewis et al., 2017)

Effect of Cleft Lip and Cleft Palate

Lewis et al., (2017) stated that one of the most common developmental problems associated with cleft lip and palate is Velopharyngeal Insufficiency (VPI), which refers to the difficulty in speech and language common in the affected infants. VPI may still be noticed even after the repair of the anomaly. Children with this deformity may also experience hearing difficulties with associated otitis media with effusion; and learning difficulties with psychosocial effects (Alois & Ruotolo, 2020; Khan & Prashanth, 2020; Lewis et al., 2017).

Precautions and Care of Newborns with Cleft lip and palate

In order to effectively minimize the occurrence and to care for children affected with cleft lips and palates, it is recommended that all women of childbearing age should consume 0.4mg of folic acid daily to prevent spinal bifida and anencephaly (Alois & Ruotolo, 2020; Khan & Prashanth, 2020; Lewis et al., 2017). Pregnant women should be given genetic counselling and be made to undergo thorough prenatal ultrasonography screening to determine the presence of cleft or any craniofacial defects on the unborn baby (Mouthon et al., 2019). If prenatal ultrasonography screening reveals the presence of cleft lip and palate, the parent should be advised to visit a hospital with experience and resources to support newborns with clefts (Alois & Ruotolo, 2020; Khan & Prashanth, 2020). Pregnant women and women of childbearing age should be advised to avoid smoking (Lewis et al., 2017). A study by Lie et al., (2008) suggests that within the first trimester, there could be a dose-response effect of cigarette smoking on the development of cleft lip, with an increased odd ratio in active smokers.

Newborns with any of these developmental abnormalities must be given adequate feeding with feeding devices under the supervision of a specialist to prevent undernourishment. For infants whose cleft palate was not identified by prenatal ultrasonography, there should be an initial physical examination to detect any undiagnosed cleft palate, (Alois & Ruotolo, 2020; Khan & Prashanth, 2020; Lewis et al., 2017). It is

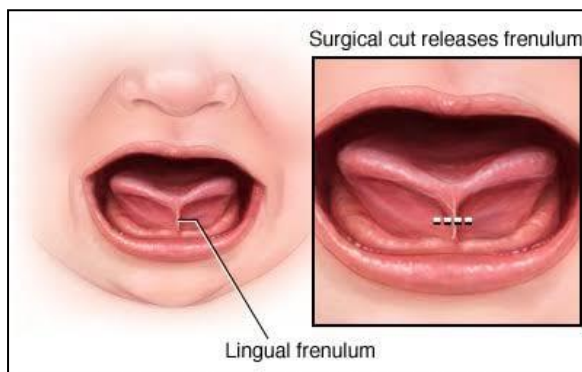
advised that following surgical repairs, regular audiological evaluation, and otolaryngologic assessment should be carried out, accompanied by regular speech assessment by a speech and language therapist (Alois & Ruotolo, 2020; Khan & Prashanth, 2020; Lewis et al 2017). Dental, orthodontic, and prosthodontic treatments may be required to encourage adequate facial growth (Alois & Ruotolo, 2020; Khan & Prashanth, 2020; Lewis et al., 2017).

Ankyloglossia

This is an oral health congenital anomaly characterized by a short lingual frenulum which may result in the restriction of tongue movement and function (Ji & Ruan, 2020; Pompeia, 2017). Yoon et al., (2017) stated that the tongue ought to move upward against the palate during deglutition, but the short lingual frenulum limits the tongue thereby causing it to thrust anteriorly. Ankyloglossia, also known as *tongue-tie* (figure 3) is more common among male infants than females due to its link to the X chromosome and may also be attributed to a lack of assessment of the tongue after birth (Becker & Mendez, 2020; Pompeia et al., 2017).

Figure 3:

A pictorial representation of Ankyloglossia and direction for the surgical cutting to release the frenulum



(Yoon et al. 2017)

Ankyloglossia impedes physiological development in children by limiting the ability of the newborn to breastfeed thereby causing poor weight gain (Becker & Mendez, 2020, Campanha et al., 2019; Pompeia, 2017). Yoon et al., (2017) showed that restricted tongue mobility does not generate enough upward pressure causing a narrow and underdeveloped palate and maxillary hypoplasia. Ankyloglossia also alters the child's ability to master skills relating to the

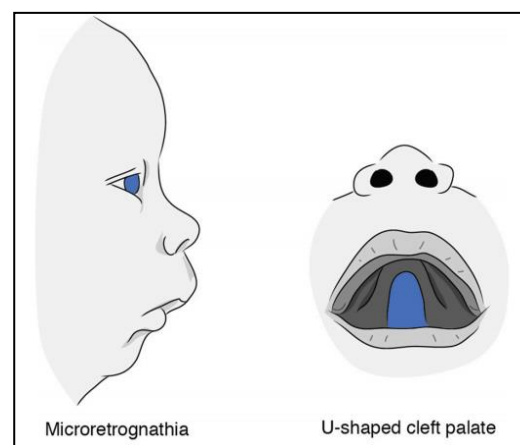
use of speech and language in communication. The diagnosis of ankyloglossia is very simple and the treatment includes *Frenectomy* and *Frenuloplasty*, which requires surgical cutting of the frenulum to increase the free tongue length above 16mm (Becker & Mendez, 2020; Yoon et al, 2017). If untreated, ankyloglossia may have a negative psychosocial impact on the affected children.

Retrognathia and Micrognathia

These conditions are referred to as facial abnormalities of the mandible. While Micrognathia is associated with small mandibular size resulting in the impression of a receding chin, Retrognathia is the posterior displacement of the mandible, not necessarily affecting the size but not in alignment with the maxilla as shown in figures 4 and 5 (Benacerraf et al., 2019; Lu et al., 2020; Mouthon et al. 2019).

Figure 4:

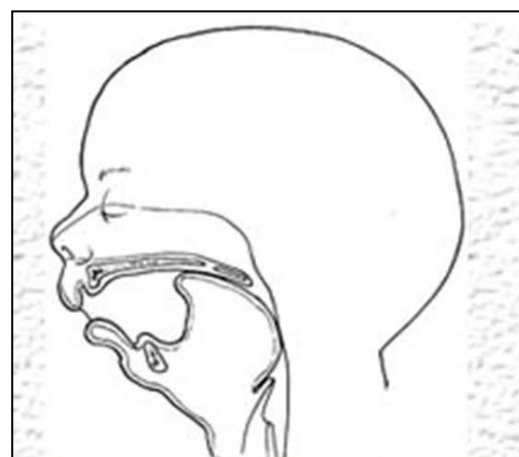
A pictorial representation of Retrognathia and Micrognathia



(Lu et al., 2020)

Figure 5:

A pictorial representation of Retrognathia and Micrognathia



(Lu et al., 2020)

Studies indicate that Micrognathia can be diagnosed at the prenatal stages of pregnancy using ultrasonography and by postnatal evaluation to reveal every possibility of the fetus having the defect (Chen et al., 2020; Kooiman et al., 2020; Kruse et al., 2020; Tidrenzel et al., 2019). Several researchers have suggested that micrognathia with glossoptosis may lead to life-threatening respiratory obstruction immediately after birth (Kruse et al., 2020; Lu et al., 2020; Mouthon et al., 2019). If untreated, these conditions interfere with the physiological and psychological development of children.

EFFECTS OF CHILDREN'S ORAL PROBLEMS ON THEIR PHYSICAL AND PSYCHOSOCIAL DEVELOPMENT

The function and use of the structures that make up the oral cavity are adversely affected by oral health problems such as dental caries, periodontal diseases, craniofacial defects, and orthodontic problems (Centers for Disease Control and Prevention [CDC], 2021; Christopoulos, 2015; Pediatric Dentistry, 2020). These oral health problems if left untreated can impact negatively on the brain, psychology, and the cognitive and physical development of a child (Pediatric Dentistry, 2020). According to Pediatric Dentistry, orthodontic problems such as anterior underbite and open bites alter the speech of a child and impact negatively on the self-esteem of the child. Also, as shown by Alois and Ruotolo, (2020), Becker and Mendez, (2020), and Lu et al. (2020), cleft lip and palate, ankyloglossia, and micrognathia affect the speech of a child. The effects of untreated oral health problems in children go beyond their psychological well-being, by affecting their ability to take or chew and digest foods adequately to provide nutrients to keep them against undernourishment (Pediatric Dentistry, 2020).

CONCLUSION

The development, quality of life, and general health of a child depend on the concerted efforts of parents/guardians and healthcare providers to prevent and manage diseases and abnormalities that may impact the child's developmental process. Dental caries and periodontal diseases discussed in this paper are largely preventable

with routine oral hygiene. Whereas congenital craniofacial deformities covered in his article can be detected during a prenatal examination using ultrasonography. Early postnatal diagnosis and adequate correctional treatment of craniofacial deformities is an important step toward healthy childhood development. Following reconstructive surgeries, it is important to employ the services of occupational therapists, speech and language therapists, and childhood developmental psychologists to monitor the child's developmental progress. It is also worthy of note that untreated oral health problems in children may harm both their physiological and psychological development.

Acknowledgments: All the authors who contributed to the success of this review are highly appreciated. We Also appreciated the authors of all the literature reviews used.

Ethics Approval: Nil needed.

Conflicts of Interest: The authors declare no conflict of interest.

Funding: Nil secured.

Plagiarism: The plagiarism test on this manuscript yielded a 5% score.

Originality: This Review is an original work carried out by the aforementioned authors. It is not copied from elsewhere.

Contributions of authors: Samuel O. ARUA led the drafting of the review paper and searched for articles with assistance from Chika C. NGWU. Promise I. UCHEKA assisted with the re-drafting of the paper, interpretation of the results, development of search strategy, and adding of context to the paper.

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