

The influence of parenteral nutrition on the condition of the oral cavity: literature review

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ABSTRACT

Oral health plays a pivotal role in the overall well-being of patients. This article delves into the intricate interplay between oral health and systemic health outcomes in various patient populations, including those undergoing parenteral nutrition in childhood, individuals with impaired swallowing function, and those reliant on long-term enteral or parenteral nutrition. Through a comprehensive review of existing literature, the multifaceted role of oral health maintenance in optimizing nutritional therapy outcomes and enhancing overall quality of life is explored. Alternative forms of nutrition have a profound impact on Oral microbiota, which in turn is reflected in general health and wellbeing. Despite its significance, the importance of systematic oral health assessments and nurse involvement in providing holistic care to patients with complex medical needs has been underestimated. By elucidating critical connections between oral health and systemic health outcomes, this article aims to underscore the significance of oral health in comprehensive patient care and stimulate further research to advance our understanding of this crucial aspect of healthcare management.

KEY WORDS: parenteral nutrition, enteral nutrition, microbiota

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INTRODUCTION

The evaluation and maintenance of oral health are crucial aspects of caring for patients in intensive care units, as evidenced by numerous clinical studies confirming its effectiveness in preventing ventilation-associated pneumonia, aspiration pneumonia, or hospital-acquired pneumonia [1]. The oral cavity, serving as a dynamic ecosystem, undergoes continual changes in its microflora composition, influenced by various factors including maternal microorganisms, living conditions, dietary habits, and health status. Emerging evidence highlights the profound impact of oral health on overall well-being, with implications extending beyond traditional considerations of digestion and swallowing [2].

This article explores the intricate interplay between oral health and systemic health outcomes in various patient populations, including those undergoing parenteral nutrition (PE) in childhood, individuals experiencing impaired swallowing function, and those reliant

on long-term enteral or parenteral nutrition. Through a comprehensive review of existing literature, this article delves into the multifaceted role of oral health maintenance in mitigating risks associated with systemic diseases, optimizing nutritional therapy outcomes, and enhancing overall quality of life [3].

The importance of systematic oral health assessments and nurse involvement in providing holistic care to patients with complex medical needs has been underestimated in recent decades [4-5]. By clarifying these critical connections, this article aims to underscore the significance of oral health in comprehensive patient care and stimulate further research to advance our understanding of this crucial aspect of healthcare management.

WHAT IS PARENTERAL NUTRITION?

Parenteral nutrition (PN) serves as a vital intervention in patients where enteral or oral nutrition is either unfeasible

ble or inadequate. European and American Guidelines prioritize enteral nutrition (EN) over PN whenever the gastrointestinal tract remains functional and accessible, except in cases of intestinal failure due to various conditions such as short bowel syndrome, inflammatory bowel diseases, high-output fistulas, severe intestinal obstruction, or when the gastrointestinal tract is inaccessible [6-7].

Intestinal failure, characterized by reduced gut function hindering nutrient absorption, necessitates parenteral supplementation, with its severity classified into acute (type I), prolonged acute (type II), and chronic (type III) forms. Type I patients typically receive short-term PN in hospitals, whereas type II and III patients require PN over weeks to months or months to years, often administered at home [8].

Malnutrition, common in hospitalized patients, especially the critically ill, surgical, and cancer patients, necessitates nutritional support, with PN indicated for those with non-functional or inaccessible gastrointestinal tracts. While PN provides crucial nutrition for patients unable to be fed orally or enterally, it comes with complexities and potential complications such as hepatobiliary, infectious, and mechanical issues, alongside metabolic disturbances [9-10]

A study by Salama et al. examined the impact of total parenteral nutrition (TPN) on teething in premature infants, finding that TPN, particularly the intralipid component, is associated with earlier tooth eruption. Conducted on 85 preterm infants, the study underscores the need for further investigation into TPN's effects on dental development, with gender also influencing the timing of tooth eruption. This novel research sheds light on a poorly studied aspect of premature infant care, emphasizing the importance of nutritional considerations in neonatal care protocols [11].

AIM

This article aims to underscore the significance of oral health in comprehensive patient care and stimulate further research to advance our understanding of this crucial aspect of healthcare management.

REVIEW AND DISCUSSION

IMPAIRED SWALLOWING

The relationship between oral health and swallowing function is closely intertwined, with prolonged use of EN or PN increasing the risk of declining oral health and subsequent impairment of swallowing. A systematic review by Drancourt et al. explored this association

in individuals over 65, highlighting factors such as dental status, saliva secretion, and oral motility. Their findings revealed that weakened tongue strength and restricted tongue mobility were significantly linked to diminished swallowing ability. Maintaining optimal oral health, particularly dental health, is crucial for lifelong well-being. Many patients receiving EN are unable to orally consume food, necessitating additional supportive measures, yet the oral hygiene of these individuals is often subpar [12].

GENERAL ORAL HEALTH STATUS

A study investigating oral health status in home parenteral nutrition (HPN) outpatients revealed poorer oral health compared to the UK norm, with higher rates of decay, fewer teeth, and increased risk factors for caries and oral infection, despite similar dental attendance. The findings suggest a need for increased awareness and management of oral health risk factors among HPN patients, including consideration of complications related to bisphosphonates, anticoagulant therapy, and parenteral antibiotic prophylaxis [13].

The other studies underscore the compromised oral health status of Percutaneous endoscopic gastrostomy (PEG) patients, revealing poorer oral health indices compared to the general population even before gastrostomy, with further deterioration observed over three months of exclusive enteral feeding, suggesting the importance of heightened focus on oral hygiene [14].

XEROSTOMIA

The prolonged use of EN and PN can indirectly affect the oral cavity's environment and health. Malnutrition and dehydration, prevalent in patients with conditions like inflammatory bowel disease or extensive small intestine resection, contribute to reduced salivation. Lee et al. reported that 81% of respondents experienced oral discomfort during PN therapy, leading to a persistent change in food choices for 27% ($p < 0.05$) of these patients [15]. Additionally, another study echoed these findings by indicating a higher prevalence of xerostomia among patients with restricted oral intake, weight loss, and reduced independence [16].

IMPORTANCE OF CHEWING

Mastication, the initial and pivotal stage of digestion, necessitates coordination among the tongue, facial muscles, jaw, and teeth, playing a vital role beyond food intake as the masticatory system is closely linked to speech production and overall health, with chewing

also promoting saliva production, thereby indirectly affecting digestive processes [17].

Chronic stress exposure can lead to physical and mental health issues globally, but mastication serves as an effective coping mechanism, potentially modulating stress response pathways, including the hypothalamic-pituitary-adrenal axis and autonomic nervous system, thereby attenuating stress-induced physiological and neurological changes in both animal models and humans [18].

Chewing not only aids in swallowing and digestion but also contributes to stress relief and cognitive regulation, particularly in sustaining attention, as evidenced by the majority of studies reviewed, suggesting its potential utility in enhancing cognitive function, though further research is warranted to elucidate its mechanisms and applications [19].

Temporal changes in cerebral blood flow during jaw movement were investigated through bilateral transcranial Doppler ultrasound examination during clenching, gum chewing, and tooth tapping in healthy volunteers, revealing significant increases in middle cerebral artery blood flow velocity during clenching and gum chewing, indicating the influence of muscle contraction intensity on task-induced cerebral blood flow changes [20].

Onozuka et al. proved chewing leads to a bilateral increase in blood oxygenation levels in areas including the sensorimotor cortex, cerebellum, thalamus, supplementary motor area, and insula [21]. Chuhuaicura et al. proved chewing ability might serve as a protective element in individuals affected by cognitive decline and neurodegenerative disorders, potentially through mechanisms such as enhancing cerebral blood flow [22].

ROLE OF SALIVARY DEFENCES IN MAINTAINING A HEALTHY ORAL MICROBIOTA

The findings of Pedersen et al. emphasise the critical role of saliva in maintaining the delicate equilibrium of the oral microbiota, emphasizing its multifaceted contributions to oral health and symbiosis. Dysfunctions in salivary gland activity and composition can disrupt this balance, increasing the risk of oral diseases such as gingivitis, caries, and fungal infections [23].

Chewing serves as a fundamental mechanism to stimulate salivary flow, thereby contributing significantly to oral health. Salivary glands are activated during mastication, releasing saliva into the mouth. This increased salivary flow serves several important functions that help prevent the development of dental caries [24].

Saliva helps to neutralize acids in the mouth. When we consume acidic foods or beverages, such as citrus

fruits or soda, the pH level in our mouth drops, creating an environment conducive to the erosion of tooth enamel and the proliferation of acid-loving bacteria. Saliva contains bicarbonate ions, which act as a buffer to neutralize these acids, helping to restore the mouth's pH balance and mitigate the harmful effects of acidity on the teeth [25].

Saliva contains antimicrobial components, such as enzymes and antibodies, which help to inhibit the growth of bacteria and fungi in the oral cavity. By promoting saliva production through chewing, these antimicrobial properties are enhanced, further reducing the risk of oral infections and dental diseases [26].

In a study by Pedroso et al., 17 patients, aged 64 ± 10 years, who underwent percutaneous endoscopic gastrostomy due to head or neck cancer (76%) or neurological disorders (24%) were examined. Following a month of exclusive EN, colonization rates of yeast or lactose fermenting gram-negative organisms remained similar. However, there was an increase in patients colonized with candida species (from 76% to 88%) and lactose fermenting gram-negative bacteria (from 24% to 29%). Conversely, lactose non-fermenting gram-negative bacteria or *Staphylococcus* species showed decreased occurrences. Fewer than 30% of subjects exhibited increased colony-forming units, with only two patients showing increased microbiological load across all tested media. Notably, there was a higher rate of isolation of beta-haemolytic bacteria (from 53% to 94%). Overall, the study suggests a reduction in isolation rates and microbial load in the oral cavity after one month of EN, with further follow-up needed to explore these findings in depth [27-29].

PARENTERAL NUTRITION IN CHILDHOOD

The oral cavity in humans constitutes a dynamic ecosystem, where the oral microflora develops during early childhood and undergoes continual changes over time. Initially, maternal microorganisms such as *Lactobacillus* spp., *Staphylococcus* spp., *Streptococcus* spp., *Bifidobacterium* spp., and Gram-negative rod-shaped bacteria of the *Enterobacteriales* contribute significantly to its formation. As time progresses, the composition and stability of the oral bacterial flora are influenced by various factors including external elements like living conditions and dietary patterns, as well as internal factors such as health status and genetic predispositions [30].

A study by Olczak-Kowalczyk et al. concludes that PN in childhood increases the likelihood of dental developmental abnormalities, which are influenced by factors such as malnutrition and antibiotic therapy during infancy while limiting the frequency of meals

and cariogenic snacks, and likely reducing antibiotic use, decreases the risk of caries [31].

A study by Kumaraguru et al. found that compared to the general UK paediatric population, oral issues were less frequent among children in our study who received home parenteral nutrition (HPN), unlike adult patients on intravenous nutrition who exhibited greater oral health concerns than the general public. Nonetheless, the overall prevalence of these issues was similar among both adult and paediatric populations receiving long-term HPN, underscoring the necessity for targeted health guidance in this patient cohort [32].

CONCLUSIONS

The intricate relationship between oral health and systemic well-being is increasingly recognized as a crucial aspect of comprehensive patient care, particularly in populations with complex medical needs such as those undergoing PN, experiencing impaired swallowing, or reliant on long-term EN. The available literature high-

lights the multifaceted impact of oral health maintenance on optimizing nutritional therapy outcomes and enhancing overall quality of life.

From the influence of early childhood nutrition on dental development to the implications of xerostomia and compromised oral health in patients receiving EN or PN, this article emphasises the profound significance of oral health in holistic healthcare management. Moreover, it underscores the importance of systematic oral health assessments and the involvement of nurses in providing comprehensive care to patients with diverse medical conditions.

Despite recent strides in understanding the connections between oral health and systemic health outcomes, there remains a need for further research to deepen our understanding and refine clinical practices. By continuing to explore these critical connections and implementing evidence-based interventions, healthcare professionals can better address the oral health needs of patients, ultimately improving overall health outcomes and enhancing the quality of care

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