

Connection between Oral health and cardiovascular diseases among the Hungarian population

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ABSTRACT

Due to the close interdependence of the various organs and components of the human body, the presence of disease in one organ or component can result in disease development in another part of the body. Over several decades, numerous epidemiological studies have investigated the relationship between oral health and overall health. There appears to be a direct relationship between poor oral hygiene and cardiovascular disease within the context of this discussion. Several competing hypotheses have been proposed to explain their relationship; however, most of these hypotheses focus on mediating an inflammatory response. This association between the oral cavity and disease requires additional research, and health professionals should be aware of the significance of adopting measures designed to promote proper oral health. For this study, research is being conducted to provide an up-to-date understanding of the relationship between oral and cardiovascular diseases.

Keyword : cardiovascular diseases, Oral health, Hungarian health, CVDs risk factors

1. Introduction

Most authors accurately describe a moderate association between the oral cavity and cardiovascular diseases, but they also report a lack of scientific evidence that oral alterations are an independent cause of cardiovascular diseases or that their treatment can contribute to preventing such diseases. Noncommunicable diseases (NCDs) are the most significant threat to health and development in the twenty-first century. Globally, NCDs are the leading cause of death and disability, accounting for approximately 71 percent of global mortality by 2030. It is estimated that more than 85 percent of these deaths occur in low- and middle-income countries. [1].

Researchers and government agencies continue to investigate the possible relationship between periodontal disease and cardiovascular disease. Some studies had shown that bacteria inside the mouth that are involved in the development of periodontal disease can move into the bloodstream and cause an elevation in C-reactive protein, a marker for inflammation in the blood vessels. These changes can, in turn, increase the risk of heart disease and stroke. There is research to both support and refute the possible link between periodontal disease and cardiovascular disease, and more studies are needed to see how the two may be linked. Regardless of the relationship, maintaining optimal oral hygiene is an important component of your overall health

2. Literature Review

Regarding NCDs, the focus has been on the four most prevalent diseases: cardiovascular diseases (CVDs), cancer, diabetes, and chronic respiratory diseases. Most people who die each year from noncommunicable diseases, such as heart attacks and strokes, account for 17,9 million deaths, or 31 percent of all deaths globally. Four primary risk factors can contribute to the onset of cardiovascular disease: Tobacco use, an unhealthy diet, a lack of physical activity, and harmful alcohol consumption are all risk factors. Oral diseases, mental and neurological disorders, autoimmune disorders such as psoriasis, bone, and joint conditions such as osteoporosis and arthritis, and renal, eye, and ear diseases are also associated with the four most prevalent NCDs. [2,23].

These consist of Oral health encompasses much more than simply having healthy teeth; it is crucial to the overall health and well-being of both individuals and the population. In addition, reducing disparities in oral health issues is essential for enhancing population health [3]. Most oral diseases share risk factors with noncommunicable diseases (NCDs) like cardiovascular disease, cancer, diabetes, and respiratory illness. These risk factors include unhealthy diets (particularly high-sugar diets), tobacco use, and alcohol consumption. They contribute to a pattern of disparity between population groups comparable to that caused by the burden of oral and general disease.

A life-course approach to oral health will become increasingly crucial as the global average life expectancy continues to rise. There are age-dependent oral health requirements, and these become increasingly important as people live longer and are more likely to suffer from multiple diseases. For this reason, knowledge and awareness of the close connections between oral and general health and collaboration between professionals working in oral and general health are essential for providing holistic care [3]. These associations between oral health and cardiovascular diseases have been confirmed over the last several decades based on scientific evidence from various epidemiological studies. There has been an increase in studies aimed at elucidating potential correlations. This is an essential action to take in light of the prevalence of this disease and its significance. Nonetheless, there is still a great deal of uncertainty regarding the existing associations, the underlying mechanisms, and the outcomes of treating a particular condition.

Cardiovascular disease is a significant challenge for the population of Hungary. Hungary has the highest prevalence of cardiovascular disease compared to other European nations. 73.2 percent of the affected population in Hungary resides within urban communities. Men and women are equally susceptible to ischemic heart disease, stroke, and hypertensive heart disease [4].

As early as the 19th century, the idea of a link between oral infection and systemic health was raised, and a debate on the oral focal infection theory continues [5]. There was an increased interest in oral health and cardiovascular disease following suggestions by Mattila, Beck, and coworkers in the late 1980s [6]. There has been a persistent interest in this link since then.

Inflammatory periodontitis occurs after bacterial colonization of the gingiva, and it gradually weakens the tissues that connect teeth to alveolar bone. Gingivitis, the mildest form, does not affect the teeth's underlying supporting structures and can be treated. Following bacterial colonization of the gingiva, periodontitis is a chronic inflammatory condition that gradually degrades the tissues that connect the teeth to the alveolar bone. Gingivitis, the mildest form, does not affect the teeth's underlying support structures and can be treated to resolve the issue completely. As many as 46 percent of US adults are estimated to have periodontitis, and its severe form, which often results in tooth loss, affects between 5–15 percent of the world's population.[9].

Atherosclerosis is a multifactorial disease promoted by chronic inflammatory conditions. An activation of systemic inflammation increases the risk for rupture of the atherosclerotic plaques and is considered of importance for the onset of acute coronary syndromes [10]. Atherosclerosis, a Part of cardiovascular disease, is the major cause of mortality in the western world contributing to almost half of all deaths in Europe [12]. Although a multitude of risk factors including smoking, hypertension, dyslipidemia, and diabetes are known to be behind a large proportion of myocardial infarctions (MIs) [13]. There are still gaps in the knowledge regarding causes that contribute to the progress of atherosclerosis and cardiovascular events. It has been postulated that an association between periodontal and cardiovascular diseases may be one of these gaps [14]. Both conditions are promoted by similar risk factors, which may be a likely, but perhaps not the only, reason for the connection. An alternate explanation is that systemic inflammation promoted by periodontitis accelerates the atherosclerotic vascular injury and plaque rupture. Then, periodontitis becomes a cause of, rather than just a condition that co-exists with cardiovascular disease [7,11]. That DNA from oral bacteria has been identified in arterial plaques further support that there is a link between the oral microflora and cardiovascular disease [12]. Together with studies in which periodontal intervention favorably influenced inflammatory markers of cardiovascular risk for up to six months after the intervention [13,14], these findings were taken as evidence of a causal relationship. These studies must, however, be interpreted with caution due to the limited study populations, an aggravation of systemic inflammation during the first days after the

periodontal intervention, the use of surrogate endpoints as a substitute for cardiovascular morbidity and mortality and incomplete information on shared risk factors of potential importance. This was further supported by an American Heart Association (AHA) statement saying “statements that imply a causative association between periodontal disease and specific atherosclerotic vascular disease events or claim that therapeutic interventions may be useful on the basis of that assumption are unwarranted” [15].

A large, Swedish, multicenter, case-control study, PAROK RANK, recently investigated periodontitis and its relation to coronary artery disease, the study recruited 805 patients <75 years old with a first MI and 805 controls matched for age, gender, and geographical area. The main finding was that the presence of moderate to severe periodontitis was independently associated with a first MI, increasing the risk by 28%. This association was particularly apparent in participants below the age of 65 years and among women. Thus, PAROKRANK supports the possibility of an independent relationship between periodontitis and cardiovascular disease [16,17]. The study has several strengths, among them a study population recruited from a nationwide geographical area and covering a variety of educational and socioeconomic conditions. The upper age limit of 75 years and that a first MI, representing both atherosclerosis and plaque vulnerability, was used as the expression of cardiovascular disease made the investigation less influenced by a multiplicity of concomitant disorders. Moreover, the presence and severity of periodontitis was based on alveolar bone loss studied by means of a radiographic method and interpreted at one core center. Still, it is an observational investigation and as such, it cannot be used as proof of a causal relationship.

A pre-planned long-term follow-up of PAROKRANK focusing on the incidence of recurrent cardiovascular mortality and non-fatal events in relation to periodontitis will start during the fall of 2016. Both cases and controls will be studied with the hypothesis that the event rate will be higher among study participants with moderate to severe periodontitis than in those without oral disease. If the hypothesis is confirmed, it will add to the understanding of the true nature of the association between periodontitis and cardiovascular disease, moving it toward a causal relationship. [17,19].

What are the practical consequences of the knowledge derived from PAROKRANK? It is, if not the largest, one of the largest studies of its kind, and it circumvented several shortcomings of previous investigations thereby providing strong support to the assumption that periodontal and cardiovascular diseases are closely linked. A reasonable conclusion may be that it underlines the importance to look for, and when present, treat periodontal disease not only to improve dental but presumably also cardiovascular health. Prevention of periodontitis is of course the preferred option. However, this would put extra demand on regular dental health checks since it usually is a slowly progressing disease that might be totally painless and therefore may remain undetected by those afflicted for a long time. Good oral health can prevent most cases of periodontitis, but how do we get there? Community programs for the preservation of cardiovascular health underlines the importance of exercise, a balanced diet, and smoking cessation, advice that is of importance for oral health as well. In this perspective, education programs promoting the importance of oral health with a goal of preventing systemic diseases may add to the willingness of patients to cope with such instructions. Such programs are best started already in younger ages, as part of school programs, where children and young adults are encouraged to brush and floss teeth daily and to lower sugar and acidic beverage intake. [18,20,21]

That the oral cavity is an important part of the body is obvious to us in the medical profession and hopefully among large parts of the general population. But, when it comes to the health care provision, it seems that there is a tendency to keep the mouth and its problems apart from the rest of the body. Increased collaboration, not the least in the form of educational programs recruiting their audiences both from the dental and medical professions, may be one way to reduce this separation. To look in the mouth and to know what to look for may become an important part of ordinary medical and dental checkups. Likewise, it may be beneficial to ask for risk factors or signs of cardiovascular disease in conjunction with dental exams.

Taking present knowledge into account, it is too early to recommend treatment of periodontitis to prevent future MI. Still, we suggest a closer collaboration between the dental and medical health professionals. Dentists should ask patients with moderate to severe periodontitis about other risk factors and signs of cardiovascular disease. Cardiologists should, besides their stethoscope, be equipped with spatulas and look for periodontal disease and when needed refer the patient to a dentist. Meanwhile, we need further research in this important field of medicine on the border between the two separate medical branches. More studies will hopefully, through continued investigations as discussed above and via detailed analyses of inflammatory markers and other matters of interest, bring additional information on the intriguing relation between the oral cavity and the circulatory system.

3. Methods

The study employs the Global Burden of Diseases (GBD) data coordinated by the Institute for Health Metrics and Evaluation (IHME) to examine the association between CVDs and Oral health between 1990 and 2019 [22]. Pearson Correlation between Cardiovascular diseases and Oral disorders were calculated using IBM SPSS Statistics software.

In addition, WHO reports, reviews, and research articles on oral health and cardiovascular diseases are included. The PubMed and Google Scholar databases will be used to conduct a literature search, and only English-language articles on the relationship between oral health and CVDs will be selected.

4. Results

Figure 1: Hungarian population in the age between 25-49 years old for both sex between 1990 and 2019

		Cardio	Oral
Cardio	Pearson Correlation	1	.609**
	Sig. (2-tailed)		<.001
	N	30	30
Oral	Pearson Correlation	.609**	1
	Sig. (2-tailed)	<.001	
	N	30	30

** . Correlation is significant at the 0.01 level (2-tailed).

The data shows Pearson Correlation between Cardiovascular diseases and Oral disorders prevalence rate among Hungarian population in the age between 25-49 years old for both sex between 1990 and 2019.

Figure 2: Hungarian population in the age between 50-69 years old for both sex between 1990 and 2019

		cardio	oral
cardio	Pearson Correlation	1	.834**
	Sig. (2-tailed)		<.001
	N	30	30
oral	Pearson Correlation	.834**	1
	Sig. (2-tailed)	<.001	
	N	30	30

** . Correlation is significant at the 0.01 level (2-tailed).

The data shows Pearson Correlation between Cardiovascular diseases and Oral disorders prevalence rate among Hungarian population in the age between 50-69 years old for both sex between 1990 and 2019.

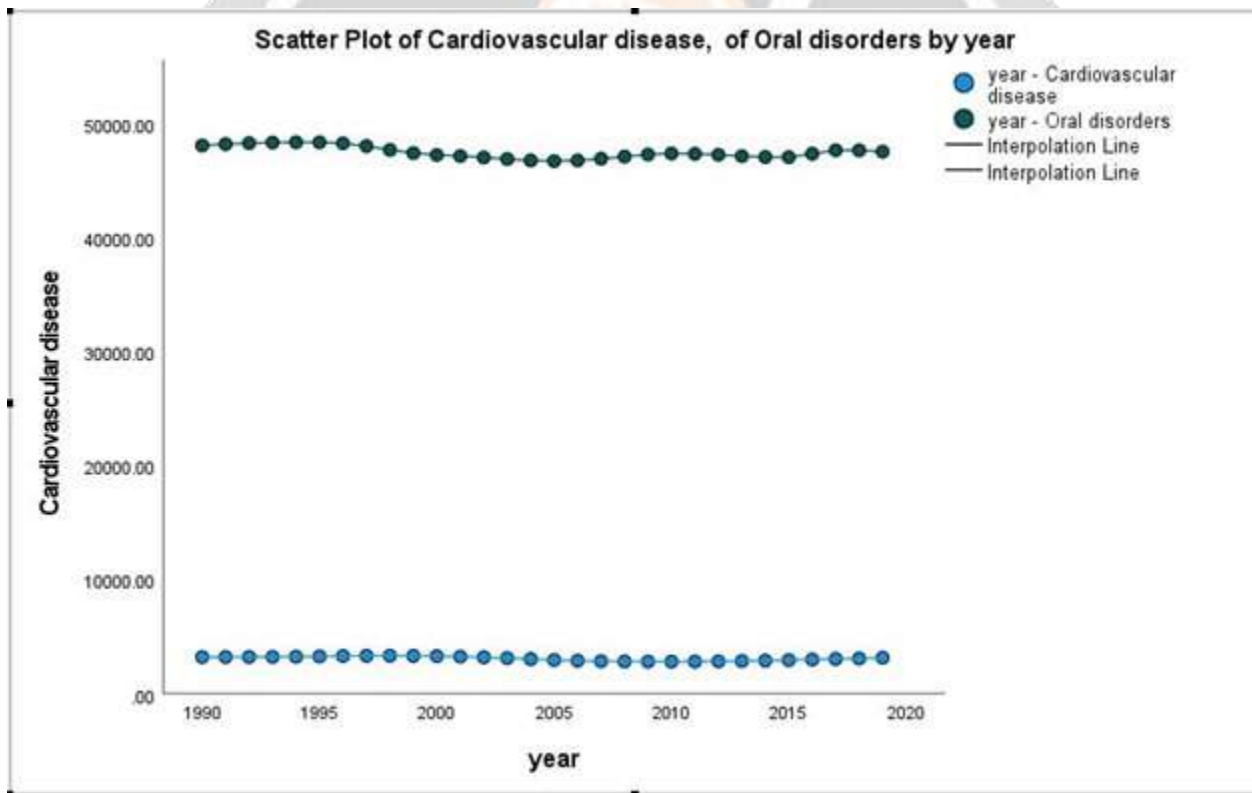
Figure 3: Hungarian population for the age 70 years and over for both sex between 1990 and 2019

		cardio	oral
cardio	Pearson Correlation	1	.535**
	Sig. (2-tailed)		.002
	N	30	30
oral	Pearson Correlation	.535**	1
	Sig. (2-tailed)	.002	
	N	30	30

** Correlation is significant at the 0.01 level (2-tailed).

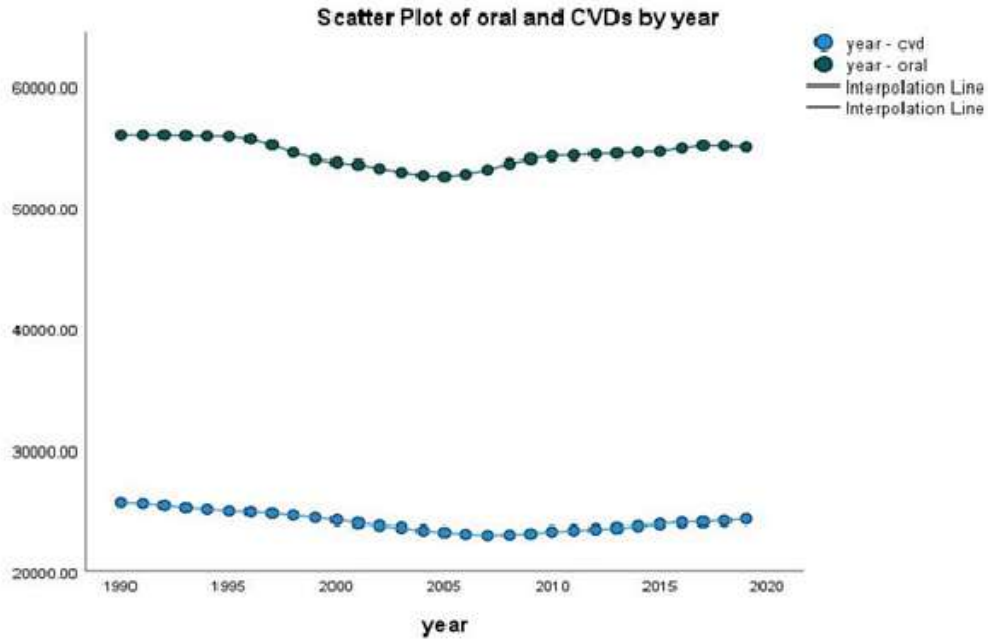
The data shows Pearson Correlation between Cardiovascular diseases and Oral disorders prevalence rate among Hungarian population for the age 70 years and over for both sex between 1990 and 2019.

Figure 4 Hungarian population in the age between 25-49 years old for both sex between 1990 and 2019.



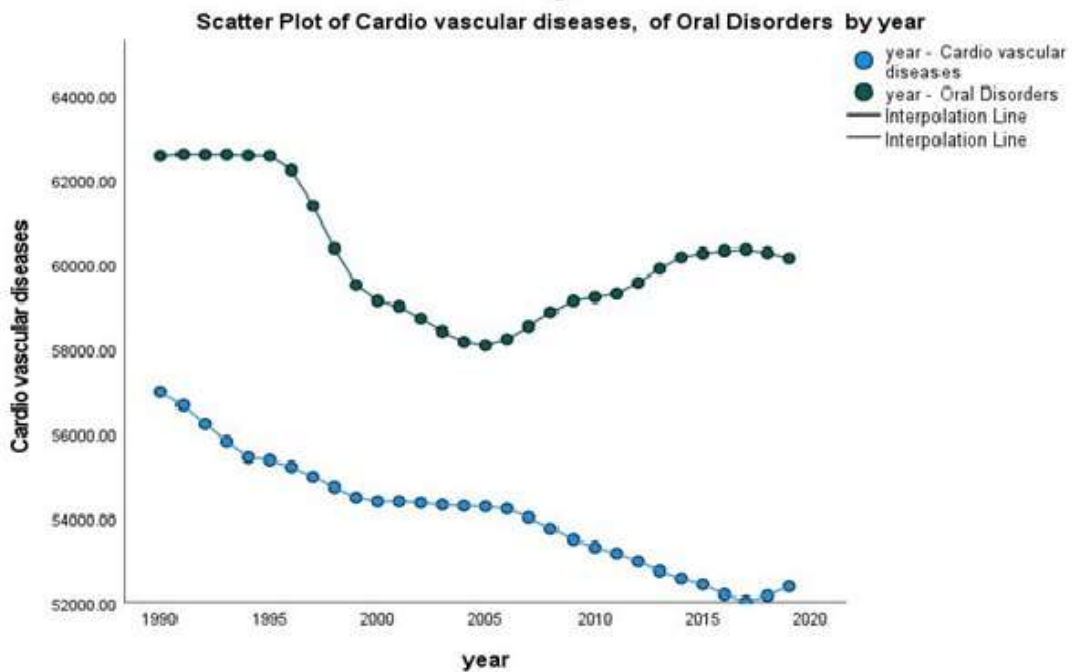
The data indicates cardiovascular diseases and Oral disorders prevalence rate among Hungarian population in the age between 25-49 years old for both sex between 1990 and 2019.

Figure 5 Hungarian population in the age between 50-69 years old for both sex between 1990 and 2019.



Cardiovascular diseases and Oral disorders prevalence rate among Hungarian population in the age between 50-69 years old for both sex between 1990 and 2019.

Figure 6 Hungarian population in the age 70 years and over for both sex between 1990 and 2019



The data indicates cardiovascular diseases and Oral disorders prevalence rate among Hungarian population in the age 70 years and over for both sex between 1990 and 2019

Figure 7 summary for Hungarian population

Model Summary

Age Group	R	R square	Adjusted R square	Std. Error of the Estimate
25-49	.609 ^a	.371	.348	150.05793
50-69	.834 ^a	.695	.684	461.45726
70+	.535 ^a	.286	.261	1171.47786

a. Predictors: (constant), Oral Disorders

This data indicates summary for Hungarian population you can use the same results from paper for this one and other Hungarian results

5. Discussion

The findings presented in this report demonstrate the correlation between cardiovascular diseases and disorders of the oral cavity in Hungary among populations of varying ages and genders and spanning a time span of thirty years, from 1990 to 2019. These data were collected for prevalence rate from the Global Burden of Diseases database provided by The Institute for Health Metrics and Evaluation (IHME) [22]. There is also a comparison made between these data and data collected from the Romanian population and the Australian population. The greatest disease prevalence rate among the studied disorders among Hungarian population was found to be associated with cardiovascular diseases in 1990 among group 70 and over (figure 2), according to the data that was collected from the GBD database. On the other hand, the highest value associated with oral disorders was reported in the same age group in 1991, with a value of 62612.82/100,000 population. (Figure 6).

The disease prevalence rate for people in the age group of 50 to 69 years old who suffered from cardiovascular diseases and oral disorders reached its highest point in 1990 with a value of 25622.93/100.000 population and in 1992 with a value of 55946.70/100.000 population, respectively. (Figure 5)

Both diseases had lower prevalence rates among people aged 25 to 49 years old; however, the rate of cardiovascular diseases was significantly lower, with a peak value of 3336.41/100.000 population in 1997, whereas the rate of oral disorders was significantly higher, with a peak value of 48325.40/100.000 population in 1995. (Figure 4)

A Pearson correlation analysis was performed on the different age groups with prevalence rates from cardiovascular diseases and oral disorders between the years 1990 and 2019, and the results show that there is a significant positive relation between the two disorders among the age groups (25-49) years and (50-69) years, with a relation power value of (+ 0.609) and (+ 0.834), respectively. This is the case for both age groups. And the P value for both was less than 0.001 (Figures 1 and 2). In the case of the age group over 70 years old, the analysis was significant with a positive relation value of + 0.535, and the p value for the Pearson correlation analysis was 0.002. An analysis of the data using linear regression was carried out (Figures 3).

The results showed that the R2 (R-squared) value was highest in the age group 50-69 years old, with a value of 0.695 percent. This was followed by the age group 25-49 years old, which had a value of 0.371 percent, and the age group 70+ years old, which had the lowest value of 0.286 percent.

6. CONCLUSIONS

There is significant positive relation between prevalence rate of oral disorders and cardiovascular diseases among Hungarian population aged over 25 years old based on the studied data, it was the strongest for age group between 50-69 years with positive correlation power of + 0.834 and R2 = 0.695. We advocate increased communication and

cooperation between dental and medical health experts. Dentists should inquire about other risk factors and symptoms of cardiovascular disease from patients with moderate to severe periodontitis.

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Contributions:

Both authors contributed to the study conception and design, Material preparation, data collection and analysis were performed by Ali Alkhayer.

Both authors approved the submission of the manuscript.

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