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ORIGINAL RESEARCH

ASSOCIATION BETWEEN PERIODONTAL HEALTH AND CARDIOVASCULAR RISK FACTORS IN ADULTS

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ABSTRACT

Background: This study explores the association between periodontal health and cardiovascular risk factors among adults, including those with chronic illnesses or coronary artery disease.

Methods: A comparative cross-sectional analysis was conducted involving two groups: individuals at cardiovascular risk and a healthy control group. Clinical assessments included dental examinations, gingival inflammation index (GI), community periodontal index (CPI), and Decayed, Missing, and Filled Teeth index (DMFT). Statistical analysis using SPSS and R software revealed significant differences between the groups.

Results: Periodontal disease was observed in 41.9% of the high-risk group compared to 25.1% in the control group. Chewing difficulty was reported by 40.6% of the high-risk participants, and 17% had communication problems. Logistic regression indicated a significantly higher odds of periodontal disease among high-risk individuals (OR = 1.21, p = 0.028). The GI and CPI scores were elevated in the risk group, and notable associations were found between periodontal disease and hypertension (RR = 1.41), diabetes (RR = 1.31), and smoking (RR = 1.49). Moreover, chewing and speaking difficulties were statistically higher in the risk group.

Conclusion: The findings support the hypothesis that periodontal disease is associated with increased cardiovascular risk, potentially through systemic inflammation. Regular dental checkups and improved oral hygiene should be emphasized, particularly among those with known cardiovascular risk factors. This study highlights the need for integrative healthcare approaches targeting both oral and cardiovascular health.

Keywords: Oral health, Cardiovascular disease, Periodontal disease, Diabetes, High blood pressure, Smoking, Control group and risk group.

INTRODUCTION

The majority of developing countries are expected to see a significant rise in the mortality and morbidity rates associated with cardiovascular disease over the course of the next several decades [1,2]. A number of variables, including the prevalence of risk factors and an aging population, are responsible for this. The risk factors contributing to the convoluted aetiology of cardiovascular disease include inherited factors, socioeconomic variables, and environmental circumstances. At the same time, a number of studies have been conducted in recent years to investigate the role that inflammation plays in cardiovascular disease (CVD), and the evidence is mounting to show that inflammation is a significant contributor to the development of CVD [3]. When it comes to cardiovascular disease, there is evidence that periodontal disease and mouth infections may raise the probability of developing the condition [4].

One of the most common infections that might trigger a moderate inflammatory response throughout the body is chronic periodontal disease [5,6]. In addition to a person's overall health, dental health is also important. Several epidemiological studies found that periodontal disease elevated the risk of cardiovascular disease by 25%. According to the findings of a research [7], periodontal disease impacted 84.4% of persons who had cardiovascular disease, whereas only 22.5% of those who did not have the illness were affected by it. According to the findings of a recent meta-analysis [8], periodontal disease and poor tooth health may be risk factors in the development of cardiovascular disease. Instead of doing clinical oral examinations, the research reviewed the literature to determine which risk factors were associated with both diseases. Finding the connection between these risk variables was the driving force for the study. The researchers set out to find out if there was any correlation between cardiovascular disease risk and periodontal health, microbiological plaque, and the condition of the teeth and gums.

A correlation between poor oral health and cardiovascular disease is seen in Figure 1.

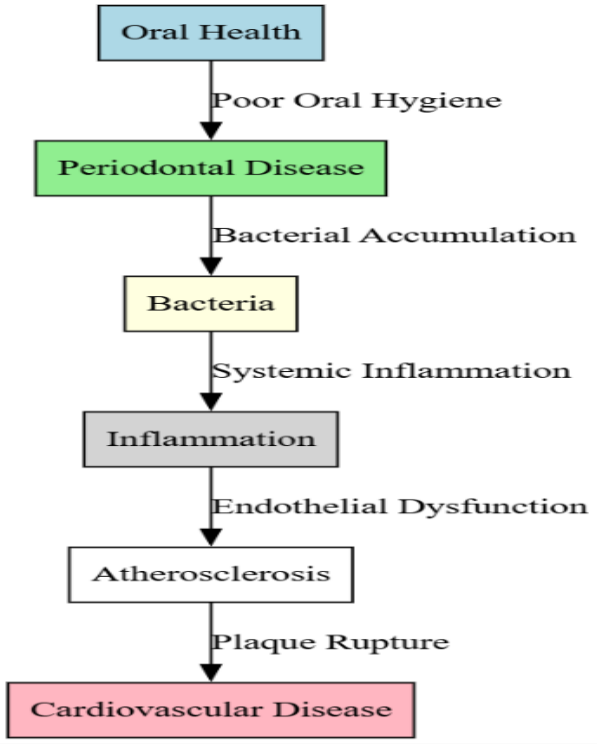

Figure 1. Link between oral health and cardiovascular disease the risk of cardiovascular disease.
were used in the computation of the GI and CPI ratings

Poor dental hygiene increases cardiovascular disease risk, according to many research. Many studies have linked periodontal disease (gum disease) to cardiovascular disease. Because germs may enter the

circulation via the oral cavity, it is possible for them to spread to other organs, including the heart, once they have entered the circulation. The inflammation that is brought on by periodontal disease has the potential to develop into atherosclerosis, which is synonymous with the hardening of the arteries. It is possible that endothelial dysfunction will result from the inflammation that is induced by periodontal disease. There is a possibility that this inflammation may cause damage to the endothelium, which is the protecting lining of blood vessels. If periodontal disease is the source of systemic inflammation, then there is a possibility that the risk of cardiovascular disease will increase. Patients who already have periodontal disease may have an exacerbation of their condition if they have hypertension, which increases the risk of cardiovascular disease.

MATERIAL AND METHODS

The academic archives of the internet were searched for research publications on risk factors for cardiovascular disease, and these articles were selected [9–16]. Readings of blood pressure that were at least 140/90 mm Hg and a body mass index (BMI) that was between 25 and 29.9/30 or above were considered for inclusion in the trials. Table 1 presents the demographic data.

Table 1. General demographic data

Groups	Risk Group (n=60)	Control Group (n=60)	t/X^2	P
Gender				
Male	35 (50.43)	34 (53.18)	0.025	0.783
Female	25 (46.51)	26 (43.56)	0.029	0.813
Age (years)	59.14±10.15	58.01±12.18	0.088	0.914
Weight (Kg)	59.15±4.28	58.13±4.86	1.002	0.356
Smoking status				
Smokes	35 (62.23)	36 (63.33)	0.001	0.982
Does not smoke	25 (35.17)	24 (34.14)	0.001	0.992
High blood pressure				
Has	37 (64.31)	38 (62.31)	0.001	0.974
Does not have	23 (37.63)	22 (36.57)	0.001	0.982
Obesity status				
Yes	34 (65.31)	35 (66.31)	0.001	0.974
No	22 (36.63)	21 (35.57)	0.001	0.982

A number of observations were made about the number of teeth that were affected, whether or not there were any signs of sickness, and whether or not there was microbiological plaque present. The DMFT, which is an acronym that stands for decay, missing teeth from caries, and filled teeth, was calculated for each and every unique participant. For the objective of determining the state of gingival health, the traditional Silness-Leo gingival inflammation index (GI) was used [17]. Scales ranging from 0.1 to 1.0 were used to evaluate mild gastrointestinal inflammation, scales ranging from 1.1 to 2.0 were used to evaluate moderate inflammation, and scales ranging from 2.0 to 3.1 were used to evaluate severe inflammation. In order to examine the teeth of the index patients, sextants were used, and the community periodontal index (CPI) was utilized in order to assess the overall periodontal health state of the patients [18]. A score of 0 indicates good health, 1 indicates bleeding during probing, 2 indicates supra- or subgingival calculus, 3 indicates a pocket depth of 4–5 millimeters, and 4 indicates a pocket depth of more than 6 millimeters.

The suggestions that were used in the computation of the GI and CPI ratings were supplied by the reference located at [18]. Following that, a multivariate poisson regression model was used in order to assess the levels of oral health indicators.

Statistical Analysis

In order to determine what differentiated one group from the others, the researchers conducted exhaustive statistical analysis on their data. In order to carry out the statistical analysis, we made use of SPSS 21.0 in conjunction with the R program. A chi-square test was used for the aim of attaining this objective. A logistic regression analysis was carried out on a sample that was representative of the population in order to determine the elements that put persons at risk for cardiovascular disease. The goal of this research was to find the factors that placed individuals at risk.

RESULTS

According to the results, 99% of the cases showed visible plaque, and 33% of the participants had an acute or chronic dental infection that affected an average of 2.5 teeth. 20% of the people had full dentures, compared to four percent who did not. The most common conditions among research participants were calculus present (CPI score = 2) and moderate gingival irritation (GI score = 2). The gastrointestinal (GI) score varied significantly across age groups and genders ($p < 0.0001$ and $p = 0.03$, respectively) (Table 2). In all age groups, dentate persons had an average DMFT of 12.47 (Table 3), their average MT score was 11.96 (Table 4), their average DT score was 10.03 (Table 5). Table 6 show that the CPI

scores that varied significantly ($p < 0.001$). Table 7 displays the findings of the regression model's pre- and correlation assessment, which takes cardiovascular disease risk factors into account.

Table 2. GI comparison

Groups	Risk group (n=60) (Odd Ratio)	Control group (n=60) (Odd Ratio)	t	P
Cardiovascular disease-Yes	21.42±4.19	21.55±3.35	0.245	0.745
Cardiovascular disease-No	59.02±4.26	43.25±4.26	12.767	<0.001
t	37.561	28.674		
P	<0.001	<0.001		

Table 3. DMFT comparison

	Risk group (n=60) (Odd Ratio)	Control group (n=60) (Odd Ratio)	t	P
Cardiovascular disease-Yes	18.35±3.38	18.53±3.82	0.456	0.617
Cardiovascular disease-No	29.25±3.58	21.78±3.02	9.563	<0.001
t	12.450	6.432		
P	<0.001	<0.001		

Table 4. MT comparison

Group	Risk group (n=60) (Odd Ratio)	Control group (n=60) (Odd Ratio)	t	P
Cardiovascular disease-Yes	22.13±6.34	23.34±6.45	0.334	0.748
Cardiovascular disease-No	60.25±8.45	41.15±7.97	12.042	<0.001
t	23.990	12.145		
P	<0.001	<0.001		

Table 5. DT comparison

Group	Risk group (n=60) (Odd Ratio)	Control group (n=60) (Odd Ratio)	t	P
Cardiovascular disease-Yes	61.47±4.01	58.33±5.89	0.445	0.667
Cardiovascular disease-No	38.45±3.96	48.45±3.87	10.765	<0.001
t	29.451	15.234		
P	<0.001	<0.001		

Table 6. CPI comparison

Group	Risk group (n=60) (Odd Ratio)	Control group (n=60) (Odd Ratio)	t	P
Cardiovascular disease-Yes	59.25±3.81	59.15±2.95	0.216	0.835
Cardiovascular disease-No	35.01±2.45	41.98±4.06	11.645	<0.001
t	56.002	28.453		
P	<0.001	<0.001		

Table 7. Periodontal disease and their correlation with CVD

Group	Risk group (n=60)	Control group (n=60)	x^2	P
Difficulty in chewing associated with CVD	58 (98.13)	39 (63.45)	23.720	<0.001
Periodontal disease associated with CVD	60 (100.00)	15 (25.03)	71.152	<0.001
Periodontal disease with high blood pressure	58 (96.67)	36 (61.64)	22.314	<0.001
Periodontal disease with diabetes	57 (95.00)	31 (50.34)	31.445	<0.001
Periodontal disease with smoking	58 (96.00)	48 (81.02)	6.126	0.062

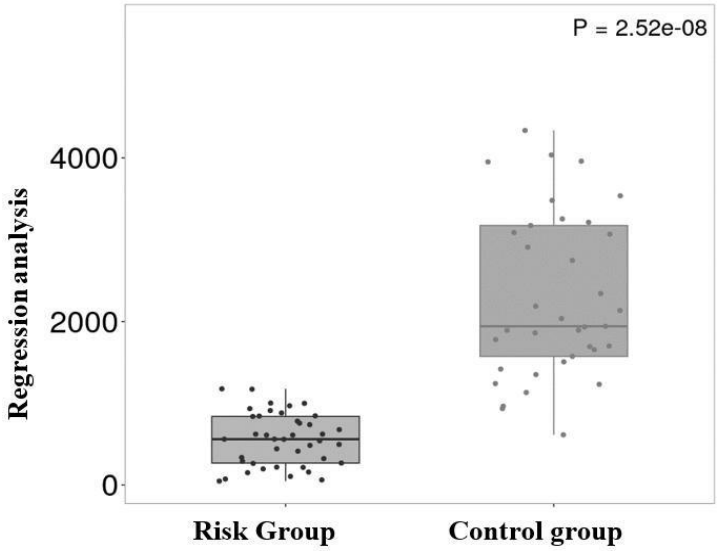

Figure 1. Regression analysis for GI with cardiovascular disease

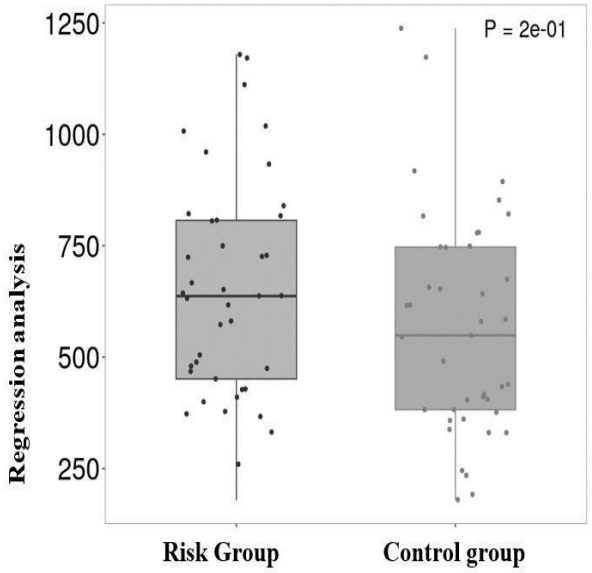

Figure 2. Regression analysis for GI with cardiovascular disease

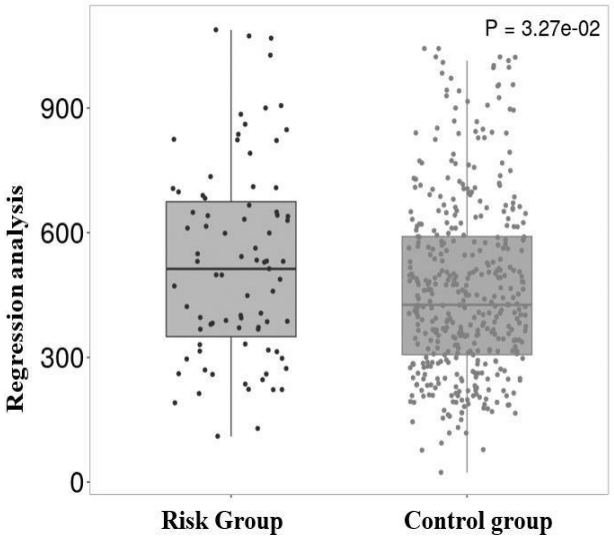

Figure 3. Regression analysis for DMFT with cardiovascular disease

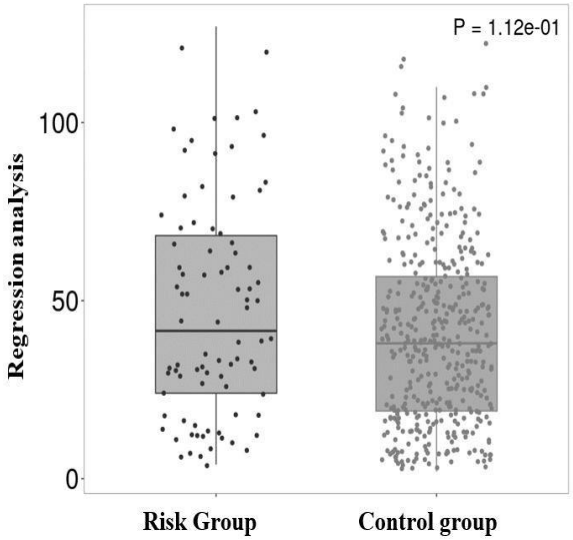

Figure 4. Regression analysis for MT with cardiovascular disease

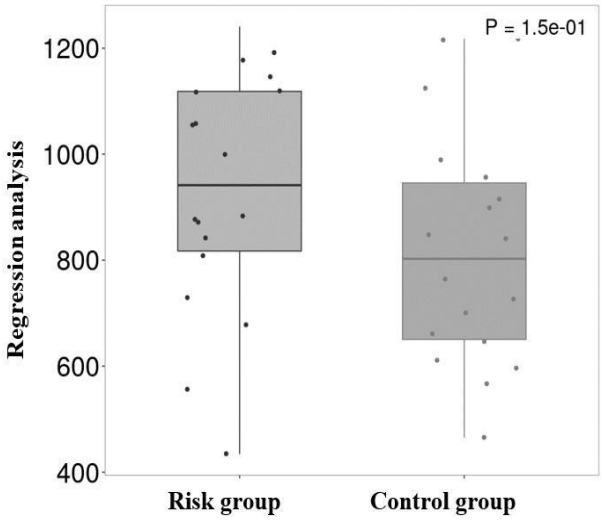

Figure 5. Regression analysis for DT with cardiovascular disease

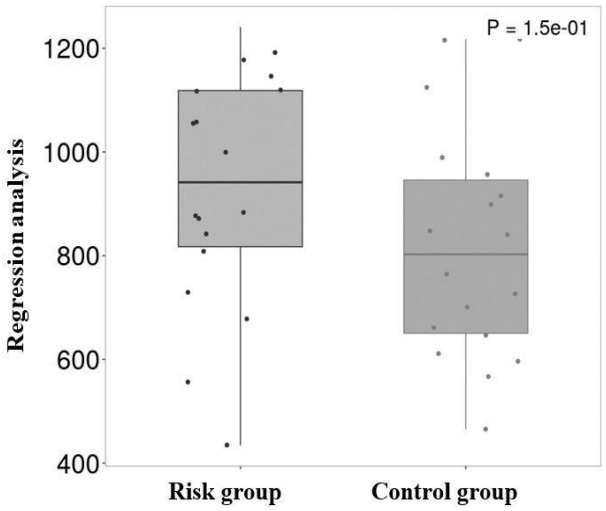

Figure 6. Regression analysis for CPI with cardiovascular disease

The relative risk of GI rising from 1.54 to 1.89. Throughout the investigation, gingival inflammation did not correlate with any other cardiovascular disease risk factors, even after controlling for age, gender, and other possible variables. The periodontal disease index (CPI) increased from 2.7 to 3.88 among those who are at relative risk. When a number of factors, including known risk factors for cardiovascular disease, were considered, the only ones that elevated the risk of periodontal disease were high blood pressure (relative risk=1.41), diabetes (related risk=1.31), and smoking (relative risk=1.49). We examined data from individuals under 45 to see if DMFT was linked to other cardiovascular disease risk factors. When specific risk factors were present, such as smoking (relative risk = 3.05), the score increased. Chewing difficulties were reported by 40.6% of the risk group compared to 34.8% of the control group (p = 0.039). Furthermore, the risk group reported considerably more communication issues (18.7%) than the control groups (13.2%) (p = 0.013). Compared to the group without periodontitis, they found that the prevalence of periodontitis was 1.21 (95% CI: 1.020-1.436) times more likely to be linked to cardiovascular disease (figure 1-7).

DISCUSSION

In this particular research, the primary objective is to evaluate the connection that exists between a variety of indicators of oral health and other risk factors known to be associated with cardiovascular disease. In the same way that some characteristics, such as age, may be connected with an increased risk of cardiovascular illness, a number of the same factors may also be related with oral health problems, as shown by the results of the research. A number of well-known risk factors for cardiovascular disease, such as smoking, were revealed to be related with an increased frequency of cavities, according to the results of the research. Among these risk factors was the prevalence of cavities. Even after taking into account the effects of other factors, this remained the case. There is a wide range of potential causes that might result in the development of periodontal disease and tooth caries [19-22]. Some of these factors include becoming older, smoking cigarettes, and having systemic illnesses like diabetes. Other factors include things like having diabetes. The variables that were analyzed revealed a greater chance of increased gingival inflammation and periodontal problems. This was the case even when a number of risk factors were taken into account. There is a strong correlation between the results of this study and those that have been discovered in earlier investigations.

There is a correlation between having healthy teeth and gums and having a decreased risk of developing cardiovascular disease (CVD), according to the findings of a number of research [23–25]. One side of the coin is that it is general knowledge that keeping a clean mouth is crucial for maintaining optimum oral health. This is the other side of the coin. Research has shown that periodontal disease and oral infections have the potential to trigger an inflammatory response, which in turn increases the likelihood of cardiac events happening. This, in turn, may lead to an increase in the risk of cardiac events. Aside from that, the results of this research are significant from two additional points of view, which are broken down as follows: Before anything else, the data came from a cross-section of the population that was representative of the entire; past research has explored the link while excluding certain demographics or those who previously had already been diagnosed with cardiac difficulties [26–28]. The second line of reasoning is that,

despite the fact that there is a paucity of research on the topic, it seems that there are risk factors that are shared between dental disorders and cardiovascular disease that make both medical problems more severe. This is the second line of argument.

With the exception of smoking cigarettes and having diabetes, the findings of the research indicated that there is no association between oral health and any other attribute. The only exceptions to this rule were those who smoked cigarettes and those who had diabetes. These two conditions, which are risk factors for cardiovascular disease (CVD), have the potential to have an impact on oral health and are also associated with the chance of dental problems.

Nevertheless, there is the potential of a circuitous connection in addition to an alternative way. Both of these factors are possible. A number of individuals who have several environmental risk factors for cardiovascular disease already have a lot going on in their bodies, and as a result, taking care of their teeth and gums is not a top concern for them. This is because of the increased likelihood that they may develop cardiovascular disease. In spite of the fact that this research did not find any evidence of a relationship between the risk factors for cardiovascular disease and the oral health status of the participants, it did make a prediction about the presence of specific risk variables for both diseases. According to the findings, which indicate that these ubiquitous characteristics are often seen, they have the potential to operate as risk factors for health conditions such as heart disease and poor dental health on their own. Taking into consideration the prevalence of both illnesses and the significant amount of attention that they are receiving from the public health sector, it is feasible that preventative efforts that are based on a shared risk approach could eventually prove to be the most effective technique for preventing both diseases. Recent studies [29, 30] came to the conclusion that those who smoked, did not use oral care products, and did not obtain regular dental checkups were more likely to have periodontitis. This was the conclusion reached by the researchers.

The findings of research [31–33] suggest that smoking has a negative influence on periodontal health, while physical activity has a positive impact on periodontal health in general. It is possible that you may reduce the likelihood of having cardiovascular disease and periodontal disease by making certain adjustments to your lifestyle, such as giving up smoking and increasing the amount of physical activity you receive. It was shown that risk group members were more likely to acquire periodontal disease than healthy control group members. Dental hygiene items utilized by the risk group were considerably different from those used by the healthy

control group. Neglecting to practice proper oral hygiene may have far-reaching consequences for one's dental health, including an increased risk of periodontitis, cavities, gum disease, tooth infections, and even tooth loss. These are just some of the potential consequences. In addition to this, it has the capability of contributing to difficulties in eating, speaking, and swallowing [34, 35].

When the adult risk group was compared to the healthy control group, the healthy control group had a frequency of 36.2%, which suggests that they had a much-reduced possibility of getting periodontal disease. It seems from this that the risk group, which is formed of persons who undergo dental treatment on a more regular basis, is more likely to have dental disorders such as periodontitis. This is in contrast to the group that receives dental care less often. Due to the fact that this is the case, it is of the highest importance to educate persons who are at risk for cardiovascular disease about the relevance of dental care and preventative management. This should be done rather than concentrating on the older population. The performance of the risk group was superior to that of the control group in terms of all areas of oral health, including the number of dental extractions and oral treatments that were carried out.

Chewing problems were more common in elderly risk group members than healthy control group members. Compared to the healthy control group, which had a rate of 13.2% of people experiencing difficulty speaking, the risk group had a rate of 18.7% of individuals experiencing difficulty speaking. This is a significant difference. All of the findings of this study were in accord with the findings of the research that was conducted before to this one when it was conducted. When it comes to cardiovascular disease, it is likely that better dental hygiene practices might reduce the chance of developing the condition [36, 37]. Moreover, the risk of periodontal disease, tooth decay, and tooth loss may be decreased via the use of these activities. This provides more evidence that appropriate dental hygiene practices, such as having regular dental examinations and cleanings of the teeth, may benefit healthy persons in reducing the likelihood that they would have cardiovascular events in the future via the use of these activities.

Interventional studies and longitudinal clinical investigations are crucial components of the research that will be carried out in the future with the purpose of evaluating whether or not periodontal care may successfully prevent cardiovascular disease. The study will be undertaken in the future. In addition, there is a need for more study to be carried out in order to ascertain the characteristics that are necessary for predicting the efficacy of programs that are concentrated on dental hygiene and general oral health which are designed to prevent cardiovascular disease.

CONCLUSION

After taking into account the presence of chronic illnesses that had been present in the past, the purpose of this research was to analyze the relationship between oral

health, hygiene practices, and the risk of cardiovascular disease. There was a statistically significant difference in the prevalence of periodontal disease between the adult risk group and the healthy control group. This difference affected the adult risk group. This disparity was shown to be of considerable importance. The risk group, on the other hand, was demonstrated to have a much higher frequency of dental abnormalities associated to chewing and speaking when compared to the healthy control group. This was in contrast to the fact that the control group was healthy. It is for this reason that medical professionals need to maintain a close eye on the oral health of their patients in order to reduce the likelihood of cardiovascular disease in those who have a history of chronic disorders, especially adults. The significance of this cannot be overstated when it comes to those who have a history of both of these illnesses. In addition to this, they should provide assistance to these patients in the scheduling of regular dental checkups and in the treatment of periodontal disease.

DECLARATIONS

Competing interest

The authors declare that there are no competing interests.

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Ethical Approval

"Not applicable" **Consent for publication** "Not applicable"

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