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Determination of Infective Endocarditis Development Risks and Knowledge Levels of Individuals Applying for Dental Treatment

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Abstract

Objective: In the study, it was aimed to determine the risk and level of knowledge of individuals who applied to the clinic for dental treatment. **Methods:** The research consisted of 713 adult individuals who went to the dental clinic for dental treatment between 01 March and 31 August 2020, who were willing to participate in the study and who met the inclusion criteria. The questionnaires developed by the researchers were used to determine the risks of developing infective endocarditis, and the knowledge levels of Oral and Dental Health and Infective Endocarditis in individuals who attended dental treatment. Descriptive statistical analyzes were made. **Results:** In the study, the rate of agreeing that "oral and dental health problems are as important as other health problems" ($p = 0.005$) and that "infective endocarditis disease is an infection of the heart and its valves" ($p = 0.009$) was found to be significantly higher in females than males. It was determined that the majority of the individuals (38.7%) were indecisive about the idea that "antibiotics should be used before dental treatment". When the infective endocarditis risk factors were evaluated in the study, it was found that 8.1% had piersing in their body, 28.3% had problems such as gingivitis, bleeding and swelling. **Conclusion:** The most important issue in preventing the development of infective endocarditis is to increase the awareness of individuals. The society should be made aware of the risk factors that may cause infective endocarditis and their knowledge level should be increased.

Keywords: Risk factors, cardiovascular disease, endocarditis, heart valve diseases, oral health.
Abbreviations: IE-Infective Endocarditis, AHA-American Heart Association, SPSS-Statistical Package for Social Sciences.

Introduction

Infective Endocarditis (IE) is a microbial infection of the endocardial surface of the heart, usually caused by gram-positive cocci. Although valves are mostly involved, the disease also occurs in other parts of the endocardium, ventricular septal defect surface and chordae tendinea. The prolongation of life causes degenerative-atherosclerotic valve disease and prosthetic valves to become widespread and increase the frequency of exposure of patients to nosocomial infections. Therefore, the incidence of IE is gradually increasing. More than 50% of elderly individuals have calcified aortic stenosis. Fever is less common and anemia is more common in elderly individuals, especially because of the high rate of IE due to S. bovis, where chronic lesions are common and can cause occult bleeding. Older age has been associated with a poor prognosis in most recent studies. As new social factors, the increase in the use of intravenous drugs and piersings also contributes to the increased incidence of IE in young adults. Body piersings are popular and are becoming a major problem in young adults. Implanted devices (implanted cardioverter defibrillator ICD, pacemaker insertion) can cause damage to the endocardium. In addition, the risk of IE is very high in individuals undergoing hemodialysis. The incidence of IE during pregnancy has been reported to be very low (0.006%). However, pregnant women with unexplained fever and heart murmur should be evaluated [1-3].

The most important risk factor in infective endocarditis is pre-existing heart damage. Lesions occur in deformed and artificial valves. Other conditions that increase the incidence of infective endocarditis include poor oral and dental hygiene, prolonged hemodialysis and diabetes mellitus. Other important risk factors of subacute infective endocarditis are dental treatment, invasive procedures and infections [1]. Bacteremia can also be observed in patients with poor dental health, regardless of dental interventions, and post-intervention bacteremia rates are higher in this patient group. These findings emphasize the importance of good oral hygiene and regular dental examination in the prevention of IE [3]. The presence of rheumatic valve disease in developing countries still maintains its importance in terms of the risk of endocarditis, although the risk of IE is now less than 20% [1]. As a result of the prolongation of life expectancy and the increase in the geriatric population in developed countries, mostly calcific valve lesions occur on the basis of infective endocarditis [2].

There is a strong relationship between bacteremia incidence of infective endocarditis bacteria and poor oral hygiene and gum disease. American Heart Association (AHA) guidelines have long emphasized the importance of oral health in preventing infective endocarditis, emphasizing the importance of focusing on prevention of dental and gum disease for individuals at risk of infective endocarditis, and the provision of routine dental care and oral and dental health [4]. Prevention of infective endocarditis is vital in susceptible individuals.

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Individuals with known heart disease or specific risk factors such as murmur should be informed about the precautions to be taken. The possibility of recurrence of infective endocarditis is also very high. For this reason, it is important to inform individuals about this issue as well. Oral and dental care should be regularly performed and controlled by the dentist in individuals with high and moderate risk for infective endocarditis [1]. For this reason, it is of primary importance to determine the risk factors and knowledge levels of individuals about infective endocarditis and to direct them correctly. There are quite a few studies showing the determination of individuals who apply to the clinic for dental treatment in terms of infective endocarditis risk and the measurement of the knowledge levels of patients. Especially in the literature, it is very difficult to reach studies that question the level of knowledge of individuals in terms of infective endocarditis risk. Therefore, in this study, it was aimed to determine the risk and level of knowledge of individuals who applied to the clinic for dental treatment.

Methodology

Purpose and type of the research: It was planned and implemented as a descriptive study to determine the risk of developing infective endocarditis and their level of knowledge about infective endocarditis of individuals who applied to the clinic for dental treatment. In the study, "What are the knowledge levels of individuals applying for dental treatment about infective endocarditis?" and "What are the risks of developing infective endocarditis of individuals who apply for dental treatment?" answers were sought.

Research Sample: The universe of the study consisted of individuals who were informed about the purpose of the research and the expectations from the research and who were willing to participate in the study, who went to the dental clinic for dental treatment between March 01 and August 31, 2020. When the sample was calculated according to the population of the study, it was calculated that 260 individuals should be interviewed by calculating with 5% margin of error at 95% confidence interval. The sample of the study consisted of 713 adult individuals who came to the dental clinic, met the inclusion criteria and were willing to participate in the study, in line with the purpose of the study. Individuals aged 18 and over who agreed to participate in the study were included in the study. Individuals who were not willing to participate in the study, who used narcotic analgesics at a level that would affect their perception of questions and communication, and who were diagnosed with severe mental disease and cognitive dysfunction were not included in the study.

Data Collection Tools: The form, which was created by the researchers by reviewing the literatüre [1-5], evaluating the sociodemographic characteristics of the individuals and their status related to dental treatment and cardiovascular disease (19 items) was used to collect data. The study also used a questionnaire to determine the presence of infective endocarditis signs and symptoms (11 items; yes, no; 2-point Likert type), the risk of developing infective endocarditis (20 items; yes, no; 2-point Likert type), and the level of knowledge of Oral Dental Health and Infective Endocarditis (17 items; strongly disagree, disagree, undecided, agree, strongly agree; 5-point likert type) created by the researchers in accordance with the literatüre [5-10]. The questionnaire used in the study consists of 67 items in total.

Statistical Analysis: All analyzes were performed using the Statistical Package for Social Sciences (SPSS) 21 software program (IBM Corp., Armonk, NY, USA). Significance value was accepted as p <0.05. In the study, descriptive statistical analyzes were performed to evaluate the sociodemographic characteristics and disease information of the individuals, the oral health of the individuals who applied for dental treatment and the knowledge levels of infective endocarditis, signs and symptoms of infective endocarditis, and infective endocarditis risk factors.

Ethical Issues: The necessary institutional permission and ethical permission from a state university ethics committee (with the decision numbered 2019/177) was obtained for the study to be carried out in the dental clinic between March 1 and August 31, 2020. Patients invited to the study were included in the study after being informed verbally about the purpose and expectations of the study in accordance with the Declaration of Helsinki, and after obtaining verbal and written consent that they were willing to participate in the study.

Results

A total of 713 individuals, 68% female, 32% male, were included in the study. In the study, it was determined that 63.5% of them "went to the dentist for a dental examination in the last year", 29.9% of them "received antibiotic treatment by the dentist before dental treatment" **(Table 1)**. When the oral and dental health and infective endocarditis knowledge levels of the individuals included in the study were evaluated, it was found that the rate of agreeing that "oral and dental health problems are as important as other health problems" was found to be significantly higher in females than males (p = 0.005). In addition, it was found that the status of participating in "infective endocarditis disease is an infection of the heart and its valves" was significantly higher in females than males (p = 0.009) (Table 2). It was determined that women who absolutely disagree with the statement "Inflammation in my gums and tooth decays are not effective in the development of infective endocarditis (p = 0.001)" and "Oral and dental health problems have no effect on heart health (p = 0.03)" were found to be higher than men. Generally, it was determined that 39% of the individuals were indecisive, 11.6% and 14.6% of them definitely agreed and agreed with the statement "Having inflammation in my gums and caries in my teeth is not effective in the development of infective endocarditis" **(Table 2)**.

However, when the individuals agreeing with the statement "Antibiotics should be used before dental treatment" was examined, it was determined that the majority of the individuals agreed and agreed with this idea (respectively 16.3%; 23.7%), and 38.7% were undecided. In addition, 15% of the individuals stated that they did not participate either. Similarly, it was found that individuals strongly agreed and agreed with the statement "poor oral and dental health affects heart valves badly" (respectively 33.4%; 29.7%,), but it was found to be higher in unstable (31.8%) (Table 2). In the study, 18-40 age group compared to other age groups "Oral and dental health problems can affect heart health badly (p = 0.002)", "My teeth are important to me" (p = 0.03), "Gum disease is a risk for developing heart disease (p = 0.03). = 0.007)", "Poor oral and dental health increases the risk of bacterial infection (p = 0.002)", "Heart disease is associated with oral and dental health (p = 0.02)", "Poor oral and dental health affects heart valves badly (p = 0.03)" expressions stated that they strongly agree. In addition, it was determined that the 18-40 age group did not agree with the fact that their problems with their teeth were not a priority for them (p = 0.03). It was determined that the majority of those who definitely agreed with the statement "Infective endocarditis is the infection of the heart and its valves" were from the 18-40 age group, however, those who were undecided on this issue were mostly the 18-40 age group (p = 0.01) (Table 2).

In this section, the risk factors of individuals participating in the study for developing infective endocarditis were evaluated. In this research, 3.2% of the individuals were drug addicted intravenously, 3.8% had cocaine use, 8.1% had piersing in their body, 2.8% had a recent prosthetic heart valve surgery, 3.1% in the last 2 days 2.5% were hospitalized in the last 48 hours, 2.9% received dialysis treatment, 3.9% had valvular disease, 2.1% had ICD, 2.5% had pacemaker, 28.3% had gingivitis, bleeding 26.9% of them had recently had dental calculus cleaning, and 16% had recently undergone root canal treatment **(Table 3)**. It was determined that 5.9% of the individuals had very high fever, 17.3% had joint, back and headache complaints, 27.5% felt weak and malaise, 2.8% of them have tiny red-colored bleeding in the white areas of their eyes, 3.9% had tiny red-colored bleeding on their lips, mouth, palate and cheeks, ankles, 5% had new-onset heart palpitations, and 8.8% of individuals had anemia within 1-2 weeks after the last dental treatment **(Table 4).**

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Features		n (%)
Gender	Female	485 (68.0)
	Male	228 (32.0)
Age group	18-40	424 (59.5)
	41-60	255 (35.8)
	61 and above	34 (4.8)
Marital status	Married	341 (47.8)
	Single / widow	372 (52.2)
Health insurance	Available	644 (90.3)
	No	69 (9.7)
Income rate	Comfortably spending money for daily necessities	295 (41.4)
	Can meet their daily needs	340 (47.7)
	I can only meet their essential needs	61 (8.6)
	I hardly meet even their mandatory needs	17 (2.4)
Smoking status	Yes	214 (30.0)
	No	499 (70.0)
Alcohol status	Yes	204 (28.6)
	No	509 (71.4)
Presence of Congenital heart disease	Yes	10 (1.4)
Presence of rheumatic heart disease	Yes	8 (1.1)
Heart surgery or valvular surgery in the coming days	Yes	4 (0.6)
Previous artificial heart valve surgery	Yes	2 (0.3)
Previous training on oral and dental health, heart health, etc.	Yes	225 (31.6)
Antibiotic treatment status before dental treatment	Yes	213 (29.9)
Visiting a dentist for a dental examination in the last year	Yes	453 (63.5)
Taking medication for heart disease	Yes	31 (4.3)
Using medication	Cardiac medications	24 (3.4)
	Diuretics	2 (0.3)
	Antihypertensives	6 (0.8)
	Antidepressants	2 (0.3)
	Antibiotics	3 (0.4)
	Analgesics	7 (1.0)
Existing heart diseases	Coronary heart disease	13 (1.8)
	Myocardial infarction	4 (0.6)
	Heart valve disease	13 (1.8)
	Sinus tachycardia	6 (0.8)
Concomitant diseases	Leukemia	1 (0.1)
	Hypertension	46 (6.4)
	Systemic lupus erythematosus	1 (0.1)
	Chronic bowel disease	7 (1.0)
	Diabetes Mellitus	32 (4.5)
	Colon cancer	1 (0.1)
Current dental treatment initiative	Pulling teeth	110 (15.4)
	Dental filling	238 (33.4)
	Tartar removal	192 (26.9)
	Root canal treatment	98 (13.7)
	Implant	21 (2.9)
	General control	67 (9.4)
	Prosthesis	17 (2.4)
	Orthodontics	9 (1.3)
	Dental Crown	10 (1.4)

Table 1: Sociodemographic Characteristics and Distribution of Disease Information (N=713).

Discussion

In the study, it was aimed to determine the risk of developing infective endocarditis and their level of knowledge about infective endocarditis of individuals who applied to the clinic for dental treatment. Of the individuals participating in the study, 32% were men, 68% were women, 59.5% were 18-40 years olds, 35.8% were 41-60 years old, 4.8% were 61 years old and over and 30% smoked was detected (Table 1). Smoking is an important risk factor for both cardiovascular disorders and oral health. Smoking is known to cause endothelial dysfunction [11]. Studies have shown that smoking increases the frequency and severity of periodontal disease [12]. Although it increases plaque and stone build-up and aggravates disease progression in smokers, there are fewer clinical and gingivitis symptoms, and it has been reported that this is due to smoking masking gingivitis [13]. Infective endocarditis is a serious infection of the endocardial surface of the heart and its valves and is associated with high morbidity and mortality. It has been reported that infective endocarditis most frequently develops in patients with congenital heart disease, prosthetic

heart valve and infective endocarditis [14]. In this study, it was determined that 1.4% of individuals had congenital heart disease, 1.1% had rheumatic heart disease, 0.3% had previous artificial heart valve surgery (Table 1).In the study, it was found that 29.9% of the individuals were given antibiotic treatment by the physician before dental treatment (Table 1). In addition, it was determined in the study that 16.3% of the individuals definitely agreed that antibiotics should be used before dental treatment, and 23.7% agreed (Table 2). European Society of Cardiology guidelines recommend antibiotic prophylaxis in various dental procedures for patients at high risk of infective endocarditis. However, it is also stated that unnecessary use of antibiotics may cause the development of antibiotic resistance of microorganisms and anaphylactic reactions during dental procedures [15]. For this reason, antibiotic prophylaxis is quite limited in the guidelines, and it is emphasized that good oral hygiene and regular dentist controls are more important than prophylaxis in order to prevent IE [16]. It has been noted that there is an increase in the high-risk population susceptible to IE, such as procedures resulting in bacteremia, the elderly, patients with diabetes mellitus, renal failure, chronic dialysis, and those with intra-cardiac prosthetic devices [17]. In the study, it was found that 4.5% of the individuals were diagnosed with diabetes, 6.4% with hypertension, and 1.8% with coronary heart disease (Table 1).

Risk factors	Yes	No
	n (%)	n (%)
1. Presence of drug addiction administered intravenously	23 (3.2)	690 (96.8)
2. Cocaine use status	27 (3.8)	686 (96.2)
3. Piersing on your body	58 (8.1)	655 (91.9)
4. Having a recent prosthetic valve surgery	20 (2.8)	693 (97.2)
5. Hospitalization within the last 2 days (for the presence of nosocomial infection)	22 (3.1)	691 (96.9)
6. Hospitalization before the last 48 hours (for the presence of non-nosocomial infection)	18 (2.5)	695 (97.5)
7. Dialysis treatment status	21 (2.9)	692 (97.1)
8. The presence of valvular disease	28 (3.9)	685 (96.1)
9. The presence of a battery (ICD) that shocks the heart	15 (2.1)	698 (97.9)
10. Presence of pacemaker that regulates heart rhythm	18 (2.5)	695 (97.5)
11. Recent intravenous drug administration status	59 (8.3)	654 (91.7)
12. Recent dental treatment	211 (29.6)	502 (70.4)
13. Recent severe influenza infection	126 (17.7)	587 (82.3)
14. Insulin use status	32 (4.5)	681 (95.5)
15. Steroid treatment status	28 (3.9)	685 (96.1)
16. Recent attempts for cardiac catheterization such as angio, balloon, etc.	24 (3.4)	689 (96.6)
17. Previous infective endocarditis	25 (3.5)	688 (96.5)
18. Problems such as gingivitis, bleeding, swelling	202 (28.3)	511 (71.7)
19. Recent dental calculus removal	192 (26.9)	521 (73.1)
20. Recent dental root canal treatment status	114 (16.0)	599 (84.0)

Table 3: Distribution of Individuals for Infective Endocarditis Risk Factors (N=713).

Infective endocarditis is usually caused by bacterial, which is the result of invasive dental treatments. Studies have shown that even ordinary daily activities such as tooth brushing and chewing gum cause low and continuous bacteremia. If the patient's oral hygiene is poor, bacteremia caused by daily activities such as tooth brushing carries a higher risk of IE than bacteremia that occurs during dental treatment [16]. Bacteremia can be caused by invasive dental procedures such as chewing, brushing teeth, using dental floss, tooth extraction or periodontal treatment. Inflammatory markers can be produced locally in the oral cavity and released into the bloodstream [11]. In a study, it was found that patients diagnosed with infective endocarditis had tooth extraction (2.7%), surgical intervention (0.8%), calculus removal (3.9%), periodontal treatment (2.4%) and endodontic treatment (% 2.4) within 12 weeks before hospitalization [18]. In this study, when the risks of developing infective endocarditis were evaluated, the reasons for applying to the dental clinic were tooth extraction (15.4%), dental filling (33.4%), tartar removal (26.9%), root canal treatment (13.7%), implant (2.9%). (Table 1).

Within 1-2 weeks after your last dental treatment	Yes	No
	n (%)	n (%)
1. Have you ever had a high temperature?	42 (5.9)	671 (94.1)
2. Have you had complaints of shivering, excessive sweating, excessive sweating at night?	31 (4.3)	82 (95.7)
3. Have you had complaints such as joint pain, back pain, headache?	123 (17.3)	590 (82.7)
4. Have you had any weight loss complaints?	44 (6.2)	669 (93.8)
5. Have you ever felt weak, tired, or down?	196 (27.5)	517 (72.5)
6. Have you had painful and tender red or purple pea-sized spots on your fingers and toes?	12 (1.7)	701 (98.3)
7. Have you had painless small red spots on your palms and soles?	12 (1.7)	701 (98.3)
8. Have you had tiny red-colored bleeding in the white areas of your eyes?	20 (2.8)	693 (97.2)
9. Have you had tiny red colored bleeding on your lips, mouth, palate and cheeks, ankles?	28 (3.9)	685 (96.1)
10. Have you had an incipient heart palpitations?	36 (5.0)	677 (95.0)
11. Have you ever had anemia?	63 (8.8)	650 (91.2)

Table 4: Distribution of Infective Endocarditis Signs and Symptoms of Individuals (N=713).

Infective endocarditis is a disease caused by a bacteremia that affects different organs or tissues, including the oral cavity. Although it has a low incidence, it can pose a potential threat to the life of the affected individual. It predominantly tends to develop on previously damaged heart valves, the most common location being the mitral valve, followed by the aorta and, in rare cases, the pulmonary valve [19]. It has been reported that patients with prosthetic valves or prosthetic materials used for cardiac valve repair, those with a history of IE and congenital heart disease are at the highest risk of infective endocarditis. Risky dental procedures include dental procedures in which the gingiva or periapical area of the tooth is manipulated, or perforation in the oral mucosa (including tartar removal and root canal attempts) [15].

Periodontitis contributes to the global burden of chronic oral diseases and is a major public health problem worldwide. It is a bacterial infection that causes dental plaque development and tooth loss [10]. Periodontitis has been associated with impaired cardiovascular health, endothelial dysfunction, and atherosclerosis [11]. When the risk factors for developing infective endocarditis were evaluated, 29.6% of the individuals had a recent dental treatment and 17.7% had severe flu

infection, 28.3% had problems such as gingivitis, bleeding, swelling, and 26.9% had a recent tartar removal, 16% had recently undergone dental root treatment, 8.3% had a recent vascular drug application, 8.1% had piersing in their body, 2.1% had an ICD and 2.5% one of them was found to have a pacemaker (Table 3).

Strom, et al., (2000) in their study, found an increased risk of IE in toothless cases infected with dental flora, and stated that they found a risk reduction among those who use dental floss daily[20]. This result suggests that oral hygiene practices are beneficial, especially for those with high risk of IE. Peter, et al., (2009) found that oral hygiene and gum disease indices were significantly associated with bacteremia associated with IE after tooth brushing. They stated that when the plaque and tartar scores were examined, the participants were at increased risk of bacteremia. It has been reported that bleeding after tooth brushing increases the risk of developing bacteremia approximately eight times. The risk of bacteremia after tooth brushing has been found to be associated with poor oral hygiene and bleeding gums after tooth brushing. It has been reported that provision and maintaining oral hygiene can reduce the risk of developing IE [21].

In this study, it was found that the majority of those who agreed that gum disease is a risk for developing heart disease (Table 2). However, it was determined that there was a majority (39%) of those who were hesitant to agree that inflammation of the gums and tooth decay were not effective in the development of infective endocarditis. It was determined that there were those who absolutely did not agree with the statement that oral and dental health problems had no effect on heart health (33.7%) and the majority (43.8%) definitely agreed that heart disease and oral-dental health were related. Those who definitely agree that infective endocarditis is an infection of the heart and its valves (36.2%) and those who were undecided (37%) were in the majority (Table 2).

Improving oral health is essential in patients at risk of endocarditis. This is the best way to reduce the need for surgery in these patients. However, this aspect of dental treatment is often neglected and a high percentage of patients in the cardiology clinic suffer from a periodontal disease. In addition, there is no reliable evidence that oral hygiene methods such as electric toothbrushes, irrigators, or other similar devices can pose a health risk [19]. While oral health is so important, it is striking that individuals stated in the study that problems with their teeth are not important (10.4%; 15.3%) (Table 2). Considering the possibility of recurrence of infective endocarditis and the high risk of mortality if it is not detected and treated early, it is important to determine the level of knowledge of individuals about infective endocarditis and to reveal risk factors. When the literature is examined, it has been found that epidomiological studies investigating the relationship between periodontal disease and cardiovascular diseases, studies in which the level of knowledge of dentists on antibiotic prophylaxis are determined, and studies evaluating the knowledge level of the families of children with congenital diseases have been found. However, it has been found that the studies in which the knowledge levels of individuals about oral health are determined are very limited. In a systematic review, it was reported that the protection of oral health in cardiovascular diseases is important, however, it was neglected during cardiac care [22].

There is no study in which the level of knowledge, especially about the development of infective endocarditis, risk factors and symptoms are determined. However, it will be an important public health initiative to determine the infective endocarditis symptom findings, risk factors, and the level of knowledge of individuals about infective endocarditis in order to raise awareness and to disseminate such studies. It is reported that very few individuals with cardiovascular disease go to the dentist for dental care despite having dental problems. The reason for this is seen as the lack of oral health awareness. In the guidelines, it is recommended to recognize the relationship between periodontal disease and cardiovascular disease, and to implement treatment and preventive approaches to reduce the risk of primary and secondary cardiovascular disease. The international general view is that all

cardiovascular patients should receive oral health education on the importance of oral health [22]. In a study of individuals with cardiovascular heart disease, it was reported that they had high awareness of the need for regular dentist visits when they had heart disease, regular flossing, and common symptoms of gum disease (loose teeth, bad breath) (68-75% correct answers). Areas of poor knowledge have been reported to be about cardiac medications causing dry mouth and the effect of this condition on overgrowth of the gum, the association between poor oral health and an existing cardiac condition (12-53% correct response) [10]. The individuals participating in this study also stated that they agreed that going to the dentist regularly would prevent oral and dental health problems (65.9%) and that they went to the dentist immediately (54.3%) when they had problems with their teeth (Table 2).

In a study that investigated the infective endocarditis awareness levels of the parents of children with congenital heart disease, which is one of the few studies about IE in the literature, it was found that 64.8% of the parents knew that there was a relationship between oral hygiene and endocarditis, and 35.2% did not. In the same study, it was stated that 31% of the parents knew about prophylaxis before the procedure, while 69% did not. In the study, although the awareness of parents about oral-dental health and heart relationship was moderate, the level of awareness about endocarditis and pre-procedure prophylaxis was found to be low [16]. Da Silva, et al., (2002), in a study they applied to the families of 104 children between the ages of 2 and 17 with the risk of IE, 9.6% of the families knew the meaning of IE, 60.6% of them are knowledgeable about heart problems that may be experienced after oral treatment procedures, 72.1% of them stated that they were aware of the necessity of antibiotic use before the oral treatment procedures [23].

Smith and Adams (1993) stated in their study that the rate of families who knew the meaning of IE was 42.3%. Also, in the same study, 76.9% of the families reported that they were conscious of the necessity of antibiotic use before oral treatment procedures, and that 41.3% of the families saw good oral hygiene as a precaution against the risk of infection [24]. In a study evaluating the level of knowledge of the families of children with congenital heart disease about infective endocarditis, it was determined that the knowledge of the families about endocarditis and its prevention was insufficient. It was determined that only 16.7% of the families interviewed gave the correct answer to the question of what is endocarditis. He stated that only 43.3% of the families could count the dental procedures and 56.7% of them could not answer at all when asked about the risk procedures for the development of IE. In the same study, 55.6% of families stated that they received information about oral hygiene care. 1.1% of the families stated that they do not know the name of the drugs given before dental treatment. The authors stated that families neglect oral and dental care because they have cardiac and respiratory diseases [25]. In another study, the majority of individuals (83.4%) stated that their dental health is more important than their general health. 41.1% of the families stated that they do not know the name of the drugs given before dental treatment.

The authors stated that families neglect oral and dental care because they have cardiac and respiratory diseases [25]. In another study, the majority of individuals (83.4%) stated that their dental health is more important than their general health. Most participants reported that they cleaned their teeth or prostheses two or more times a day (60.4%). It was stated that the majority of individuals (90.9%) used fluoride toothpaste, only one third (34.6%) used dental floss or other aids to clean between their teeth. In the same study, more than half of the individuals reported that they went to the dentist once in the last 12 months (58.8%) and more than a quarter of the individuals went to the dentist more than two years ago [10]. In this study, it was determined that the number of people who went to a dentist for dental examination in the last year was 63.5% (Table 1). It is seen that the number of those who do not go to the dentist for dental care and control, but only when there is a problem, is also substantial. Sanchez, et al., (2019) stated that only 10.7% of the individuals who participated in their research received any information after their cardiac diagnosis, while less than

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half (40.6% n = 13) of all participants with valvular disease (n = 32) reported that they received any oral health information. However, they were generally more likely to receive information than those with other cardiovascular disorders (40.6% vs 7.4%, p <0.001).

It was found that less than half of the participants received information even in the patients with valve disease that had to be cleaned before the surgery. In this study, 31.6% of the individuals reported that they had received training on oral and dental health and heart health (Table 1).

Knowledge level	Category*	Total (n-%)	Age			χ^2, p**	Female (n)	Male (n)	χ^2, p**
			18-40 (n)	41-60 (n)	61 and above (n)				
1. Decayed teeth in the mouth cause bad appearance.	1	595(83.5)	361	208	26	χ^2=8.95 p=0.34	414	181	χ^2=8.91 p=0.063
	2	101(14.2)	56	37	8		60	41	
	3	14(2.0)	5	9	0		10	4	
	4	2 (0.3)	1	1	0		0	2	
	5	1 (0.1)	1	0	0		1	0	
2. Oral and dental health problems can adversely affect heart health.	1	430(60.3)	237	173	20	χ^2=25.97 p=0.002	297	133	χ^2=4.94 p=0.29
	2	178(25.0)	103	63	12		117	61	
	3	90 (12.6)	70	18	2		62	28	
	4	13 (1.8)	12	1	0		9	4	
	5	2 (0.3)	2	0	0		0	2	
3. Oral and dental health problems cause other health problems if not treated.	1	507(71.1)	294	192	21	χ^2=9.23 p=0.32	348	159	χ^2=5.46 p=0.24
	2	167(23.4)	109	48	10		111	56	
	3	33 (4.6)	18	13	2		24	9	
	4	2 (0.3)	1	1	0		0	2	
	5	4 (0.6)	2	1	1		2	2	
4. My teeth are important to me.	1	598(83.9)	364	210	24	χ^2=13.89 p=0.03	411	187	χ^2=4.83 p=0.184
	2	95 (13.3)	54	32	9		59	36	
	3	19 (2.7)	6	12	1		15	4	
	4	-	-	-	-		-	-	
	5	1 (0.1)	-	1	-		0	1	
5. Oral and dental health problems are as important as other health problems.	1	556(78.0)	332	201	23	χ^2=8.73 p=0.36	392	164	χ^2=14.90 p=0.005
	2	126(17.7)	76	41	9		72	54	
	3	26 (3.6)	15	10	1		20	6	
	4	4 (0.6)	1	2	1		1	3	
	5	1 (0.1)	-	1	-		0	1	
6. When I have problems with my teeth, I go to the dentist without wasting time.	1	387(54.3)	220	145	22	χ^2=7.45 p=0.48	255	132	χ^2=2.29 p=0.68
	2	232(32.5)	151	74	7		162	70	
	3	72 (10.1)	38	30	4		53	19	
	4	18 (2.5)	12	5	1		12	6	
	5	4 (0.6)	3	1	-		3	1	
7. Regular visits to the dentist prevent oral and dental health problems.	1	470(65.9)	281	167	22	χ^2=7.69 p=0.46	320	150	χ^2=1.88 p=0.75
	2	178(25.0)	108	61	9		124	54	
	3	52 (7.3)	28	23	1		34	18	
	4	10 (1.4)	5	3	2		5	5	
	5	3 (0.4)	2	1	-		2	1	
8. Problems with my teeth are not a priority for me.	1	74 (10.4)	50	21	3	χ^2=16.73 p=0.03	42	80	χ^2=5.48 p=0.24
	2	109(15.3)	49	53	7		73	53	
	3	82 (11.5)	47	33	2		55	27	
	4	178(25.0)	108	64	6		125	36	
	5	270(37.9)	170	84	16		190	32	
9. Gum disease is a risk for developing heart disease.	1	302(42.4)	175	117	10	χ^2=21.08 p=0.007	207	95	χ^2=0.15 p=0.99
	2	182(25.5)	98	75	9		123	59	
	3	199(27.9)	134	54	11		135	64	
	4	17 (2.4)	11	5	1		11	6	
	5	13 (1.8)	6	4	3		9	4	
10. Infective endocarditis is an infection of the heart and its valves.	1	265(36.2)	159	98	8	χ^2=19.32 p=0.01	198	67	χ^2=13.60 p=0.009
	2	163(22.9)	91	66	6		110	53	
	3	264(37.0)	163	84	17		167	97	
	4	10 (1.4)	6	4	-		6	4	
	5	11 (1.5)	5	3	3		4	7	
11. Poor oral and dental health increases the risk of bacterial infection.	1	425(59.6)	257	148	20	χ^2=24.61 p=0.002	291	134	χ^2=1.84 p=0.76
	2	198(27.8)	117	73	8		130	68	
	3	83 (11.6)	48	31	4		60	23	
	4	3 (0.4)	-	3	-		2	1	
	5	4 (0.6)	2	-	2		2	2	
12. Loss of teeth can be a risk for heart disease.	1	222(31.1)	131	79	12	χ^2=16.73 p=0.03	146	76	χ^2=7.03 p=0.13
	2	182(25.5)	99	77	6		124	58	
	3	245(34.4)	160	77	8		176	69	
	4	44 (6.2)	23	15	6		30	14	

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Statement		Total (%)				χ² / p			χ² / p
	5	20 (2.8)	11	7	2		9	11	
13. Oral and dental health are associated with heart disease.	1	312(43.8)	183	117	12	χ²=17.70 p=0.02	217	95	χ²=6.36 p=0.17
	2	192(26.9)	101	79	12		120	72	
	3	180(25.2)	122	51	7		127	53	
	4	21 (2.9)	14	6	1		17	4	
	5	8 (1.1)	4	2	2		4	4	
14. Antibiotics should be used before dental treatment.	1	116(16.3)	76	33	7		79	37	
	2	169(23.7)	98	65	6		117	52	
	3	276(38.7)	167	98	11	χ²=7.14 p=0.52	191	85	χ²=1.17 p=0.88
	4	107(15.0)	61	39	7		69	38	
	5	45 (6.3)	22	20	3		29	16	
15. Poor oral and dental health affects heart valves badly.	1	238(33.4)	144	86	8		163	75	
	2	212(29.7)	107	94	11		143	69	
	3	227(31.8)	150	64	13	χ²=16.76 p=0.03	153	74	χ²=4.47 p=0.97
	4	23 (3.2)	13	8	2		17	6	
	5	13 (1.8)	10	3	-		9	4	
16. The inflammation of my gums and tooth decay are not effective in the development of infective endocarditis.	1	83 (11.6)	53	25	5		50	33	
	2	104(14.6)	54	46	4		59	45	
	3	278(39.0)	179	88	11	χ²=11.17 p=0.19	185	93	χ²=17.90 p=0.001
	4	118(16.5)	60	51	7		91	27	
	5	130(18.2)	78	45	7		100	30	
17. Oral and dental health problems have no effect on heart health.	1	63 (8.8)	41	20	2		39	24	
	2	84 (11.8)	46	35	3		47	37	
	3	168(23.6)	113	50	5	χ²=12.10 p=0.14	111	57	χ²=10.45 p=0.03
	4	158(22.2)	81	66	11		114	44	
	5	240(33.7)	143	84	13		174	66	

Table 2: Distribution of Oral and Dental Health and Infective Endocarditis Knowledge Levels of Individuals by Gender and Age Groups (N=713).

Studies have shown that good oral hygiene and gum health are factors that reduce the risk of developing infective endocarditis [21]. Oral infections, especially periodontal disease, increase the level of systemic inflammation and worsen systemic diseases such as diabetes, respiratory disease, cardiovascular disease and osteoporosis [26]. Nguyeni et al., (2020) [26] found that 33% of individuals go to the dentist every 6 months, 33% go to the dentist every 12 months, 21% every 12-18 months, and 12% only go to the dentist if there is pain.

Limitations of the Study
Studies evaluating the level of knowledge about infective endocarditis were very insufficient. Therefore, the discussion was conducted with a limited resource. Since the COVID-19 pandemic was declared after our data collection process for the research started, there were problems in the data collection process. We would like to state that our meeting with individuals is limited, especially due to pandemic limitations in dental clinics, and this is reflected in the number of samples.

Conclusion and Suggestions
As a result; It was determined that the rate of participation of the individuals participating in the study was high because oral and dental health problems could cause other health problems. However, it was found that infective endocarditis disease of the individuals was an infection of the heart and valves, and those who did not know that the loss of teeth could be associated with the development of heart disease were found to be at a considerable level. In addition, it is seen that there is a high rate of those who think that antibiotics should be used before dental treatment. The most important issue in preventing the development of infective endocarditis is to increase the awareness of individuals. It is necessary to raise awareness of the risk factors that may cause infective endocarditis in the society.

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