Universidad Europea

GRADUATION PROJECT

Degree in Dentistry

DENTAL APPROACH IN PATIENTS WITH CARDIOVASCULAR DISEASE

Madrid, academic year 2022/2023

Identification number: 177

ABSTRACT:

Introduction: Cardiovascular disease is common nowadays. More than 11 million cases are discovered every year in Europe. In Spain in 2015 around 55 000 males and 65 000 females die from cardiovascular disease. All of the countries in the world are not affected equally for example in Russia more than 1 million die every year from cardiovascular disease. The most common cardiovascular diseases that can be encountered in the dental clinic are hypertension, ischemic heart disease, stroke, cardiac arrhythmias, infective endocarditis and valvular heart disease; **Objectives:** To determine the clinico - epidemiological characteristic associated with cardiovascular pathologies and to study the preventive therapeutic approach to these processes among patients attending a dental office; **Materials and methods:** To perform this study various databases were used. In total 66 articles were included in the review and 28 were analyzed in the discussion; **Results:** Cardiovascular disease are influenced by age, sex, gene or race, smoking, cholesterol, hypertension, lack of physical exercise, weight, stress, alcohol and also the socio-economic status. The most common clinical characteristic appears to be chest pain. Hypertension appears to be most of the time asymptomatic and blood pressure has to be checked before treatment. Antibiotic prophylaxis should be prescribed if the patient is at risk and depending on the treatment. Patients taking warfarin as an anti-coagulant drug need to have their INR checked. In case of myocardial infraction, avoid treatments in the first 6 months or inter-consult with the cardiologist of the patient; **Conclusion:** One of the most frequent clinical characteristics of cardiovascular disease is chest pain. Depending on the cardiovascular disease different protocols need to be followed. To avoid any emergency situation checking vital sign prior to treatment is recommended.

KEYWORD: Dentistry, Cardiovascular disease, Risk factor, Preventive measure, Emergency

RESUMEN:

Introducción: La enfermedad cardiovascular es común en la actualidad. Cada año se descubren más de 11 millones de casos en Europa. En España en 2015 alrededor de 55 000 hombres y 65 000 mujeres murieron por enfermedades cardiovasculares. Todos los países del mundo no se ven afectados por la igualdad, por ejemplo, en Rusia, más de 1 millón mueren cada año por enfermedades cardiovasculares. Las enfermedades cardiovasculares más frecuentes que se pueden encontrar en la clínica odontológica son la hipertensión, cardiopatía isquémica, ictus, arritmias, endocarditis y valvulopatía; **Objetivos**: Determinar las características clínico-epidemiológicas asociadas a patologías cardiovasculares y estudiar el abordaje terapéutico preventivo de estos procesos en pacientes que acuden a un consultorio odontológico ; **Material y método:** Para realizar este estudio se utilizaron diversas bases de datos. En total se incluyeron 66 artículos en la revisión y 28 se analizaron en la discusión; **Resultado:** Las enfermedades cardiovasculares están influenciadas por la edad, el sexo, el gen o la raza, tabaquismo, colesterol, hipertensión, falta de ejercicio físico, peso, estrés, alcohol y también el nivel socioeconómico. La característica clínica más común parece ser el dolor torácico. La hipertensión parece ser asintomática la mayor parte del tiempo y es necesario controlar la presión arterial antes del tratamiento. Se debe prescribir profilaxis antibiótica si el paciente está en riesgo y dependiendo del tratamiento. El paciente que toma warfarina como medicamento anticoagulante debe controlarse el INR. En caso de infarto de miocardio evitar tratamiento en los primeros 6 meses o interconsulta con el cardiólogo; **Conclusión:** Una de las características clínicas más frecuentes de la enfermedad cardiovascular es el dolor torácico. Dependiendo de la enfermedad cardiovascular, se deben seguir diferentes protocolos. Para evitar cualquier situación de emergencia, se recomienda verificar los signos vitales antes del tratamiento.

PALABRA CLAVE: Odontología, Enfermedad cardiovascular, Factor de riesgo, Medida preventiva, Emergencia

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1. INTRODUCTION

1.1 Definition of cardiovascular disease and risk factor

1.1.1 Definition of cardiovascular disease

According to the World Health Organization cardiovascular disease (CVDs) are a group of disorders of the blood vessels and heart. It includes different types of diseases such as peripheral arterial disease, congenital heart disease, coronary heart disease, deep vein thrombosis, cerebrovascular disease, rheumatic disease and pulmonary embolism (1).

1.1.2 Risk factor

Cardiovascular disease is a multifactorial disease and some aspect of life can affect positively the chance of suffering from this type of disease, this is called a risk factor. Cardiovascular disease presents various risk factor, some of them can be changed and depend on the person and others do not depend on the individual. Tabacism, cholesterol, age, sex, high blood pressure, diabetes, obesity, ethnicity, family history, chronic kidney disease, stress, and alcohol intake (2,3).

Tabacism is considered as a risk factor because it affects the blood supply by diminishing the amount of oxygen in the artery, the artery walls are also damaged. Blood becomes viscous and this create a reduction of the blood flow and blockage can occur (4).

Cholesterol is a substance created by the body, but when it's created in excess it can lead to plaque in the coronary arteries and this will reduce the oxygen and blood supply to the heart. High cholesterol is mainly due to an excess of food with saturated and trans fats (5).

There is also a relation between the sex of the individual and cardiovascular disease. This relation is due to hormones receptor. Women from 40 years are more susceptible to get a cardiovascular disease than men of the

same age. In women the risk of cardiovascular disease increases mostly after menopause. During menopause estrogen decreases and estrogen is normally known as a cardio protector (6).

Hypertension can significantly increase the risk of having a stroke, myocardial infarction and kidney failure. This can overload the heart and arteries. Arteries can appear less elastic which will decrease the blood flow and oxygen to the heart (7).

Diabetes is strongly related to cardiovascular disease. Women with diabetes are more susceptible to contract a cardiovascular disease. This type of patient suffer change in the microvascular function. A damage in the nerves that are controlling blood vessel and heart can occur due to a high sugar level in the blood (8).

Obesity can lead to an augmentation of the fat cells and a hormone is released which will created an inflammation. This inflammation will lead to a defect in the insulation efficiency and the body can present some difficulty to regulate the sugar in the blood. Individuals with obesity can have an increase in cardiac output and high blood pressure because the body will need more pressure to make the blood circulate correctly (9).

Ethnicity is also considered as a risk factor. For example, black people are at high risk of hypertension as well as Mexicans and Americans. This is due to health services which are not equal over the world. Education, healthcare access, money, living environment will affect the risk of getting a heart affectation (10).

Alcohol consumption present some effect on the cardiovascular system, it will depend on the dose of alcohol and frequency of consumption. An increase in blood pressure can be observed when the individuals drinks more than 5 standard drinks in a single moment so the risk of heart failure increased (11).

Family history can have an impact on the heart condition. Some conditions are inherited. Sometimes the heart condition is not related to genes but the fact that a family is sharing the same way of life and living environment (12).

Chronic kidney disease is also affecting the heart, as the kidney is not working correctly more stress on the heart occur because heart need to pump harder, this permits the blood to arrive correctly in the kidney. A secondary effect of chronic kidney disease is a change in blood pressure (13).

Heart score permit to identify patient with high risk of cardiovascular disease. The objective is to reduce the cardiovascular disease and death. SCORE (Systematic Coronary Risk Evaluation) only includes fatal cardiovascular disease but nowadays cardiovascular disease is not always fatal. Also, country is not included. To resolve this SCORE 2 has been created and this includes fatal and non-fatal cardiovascular diseases in European people from 40 to 69 years old that didn't suffer from diabetes or previous cardiovascular disease. SCORE2-OP is calculated for European people aged over 70 years old. Based on age, tabacism history, age and cholesterol heart score calculates a 10 years risk of stroke, myocardial infection and cardiovascular mortality. The advantage of using SCORE2 and SCORE2-OP is that age, sex and European region are considered. Also, it permits to establish a common language of the risk for clinicians and demonstrates how risk rises with age. Heart score is calculated with the age of the patient, sex, systolic blood pressure, total of cholesterol, HDL and LDL cholesterol, and if the patient is smoking or not (14,15).

1.2 Most common cardiovascular disease

1.2.1 In the world

Cardiovascular disease is present all round the world. Some conditions are more frequent than others and the population suffering from this type of condition vary according to geographical area. In 2019 coronary heart disease and strokes were the two most frequent cause of death in the world. In men, 5 millions died

due to coronary heart disease and 3.3 millions due stroke. In women, 4.2 millions died due to coronary heart disease and 3.2 million died from strokes (16).

The highest number of death due to cardiovascular disease in 2019 is in China, follow by India, Russia, United states of America and Indonesia (17).

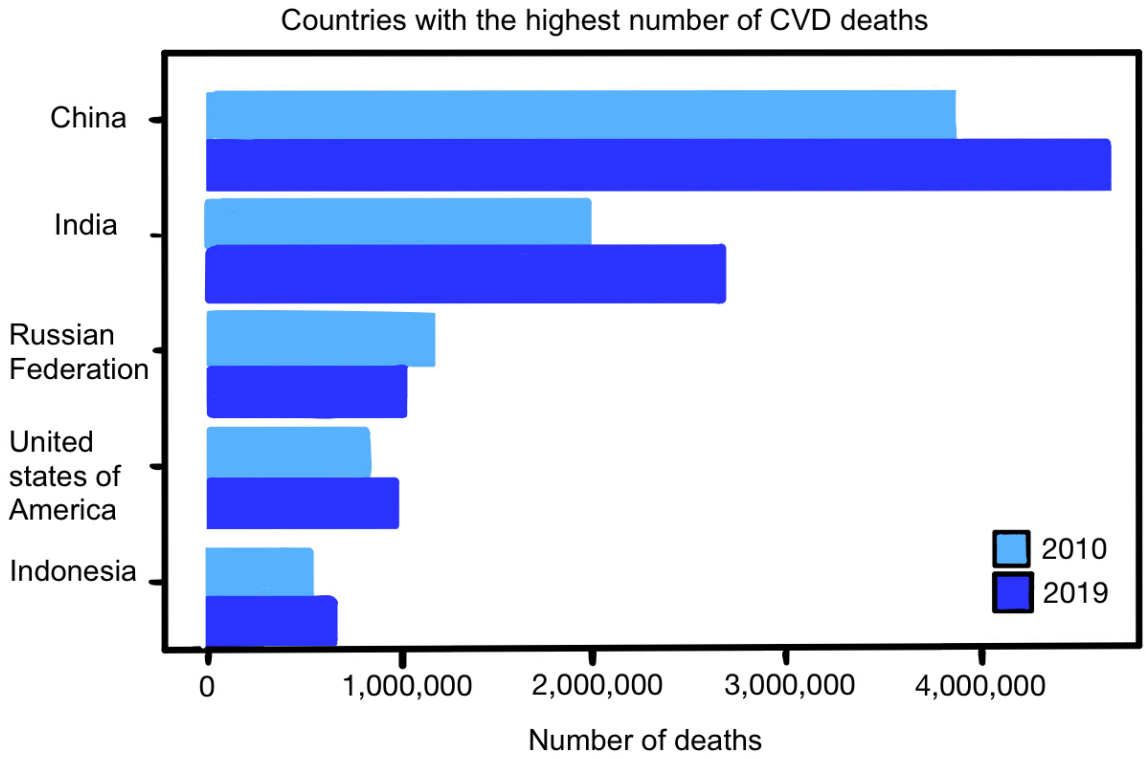

Figure 1. Number of CVD death (17)

It appears that China represent one of the highest rates of smoking in the world since 1981. In 2015 more than 52.1% of the male's population over 15 years old were smoking. Also, the prevalence of hypertension had an increase of 17.6% between 1991 and 2002. In 2012 more than 25.2 of individuals aged 18 years old or more presented hypertension. An increase in obesity was also observed, between 2002 and 2012 obesity had increased by 7.3%. Deaths from cardiovascular disease is superior than from cancer (21,22).

1.2.2 In Europe

Cardiovascular disease is frequent in the population and one of the most frequent causes of death in Europe and around the world. Cardiovascular

disease is responsible for 3.9 millions deaths every year in Europe and around 11 millions of new cases are detected each year in Europe (19).

The number of death due to ischemic heart disease and strokes appears higher in Eastern and Central Europe than in Southern, Northern and Western Europe. Nowadays the rate of mortality is decreasing in most of the European country even in Eastern Europe. Over the two last decades fat and energy consumption has increased. Also, the prevalence of diabetes has increased over 50% in the past 10 years. Tabacism is still present and has decreased in some parts of Europe, normally the higher percentage of individuals smoking are from countries of the former Soviet Union (20).

In Europe some countries have a higher rate of cardiovascular disease, Italy, Portugal, Greece represents a moderate risk. France, Spain, England have a lower risk (14).

In Spain the first cause of death in men is ischemic heart disease with approximately 100/100 000 death in 2015 and strokes in women with around 50/100 00 death. In 2015 around 55 000 males and 65 000 females died from a cardiovascular disease in Spain (21).

1.2.3 At the dental clinic

Nowadays cardiovascular disease is affecting a lot of individual around the world with different profiles and symptoms and the dental team should be aware of the different types heart of disease. In the dental clinic the most common cardiovascular alteration is: hypertension, ischemic heart disease, stroke, cardiac arrhythmias, infective endocarditis and valvular heart disease (22,23).

Hypertension is one of the most common affectation and it should be monitored as it can lead to more serious cardiovascular alterations. For example, in India more than 200 millions are affected. Different types of hypertension exists, we can have primary hypertension in which no underlying cause can be encountered or secondary hypertension in which a cause is present such as

vascular disease or hyperthyroidism. The most frequent type is the primary hypertension also called essential hypertension (23).

Ischemic heart disease (IHD) can also be called coronary heart disease (CHD) and it's defined by an imbalance between the demand of oxygen by the myocardium and the supply, this is due to a decrease in the cardiac blood flow. Less oxygen arrives to the heart muscle and it is usually due to a blood clot. It can be sudden and complete (23).

Strokes affect the brain with a poor blood flow leading to cell death as they are not receiving oxygen or nutrients. Two type of stroke can be found: ischemic or hemorrhagic. Ischemic stroke is created by an absence of blood flow and a hemorrhagic stroke is due to bleeding. Ischemic stroke is most frequent (24).

Cardiac arrhythmias or dysrhythmia is an alteration in the creation or conduction of the cardiac electrical impulse. The heart can beat too fast with more than 100 beats per minute or too slow with less than 60 beats per minute (25).

Infective endocarditis is due most of the time by a bacterium that create injuries on the endocardium. This affectation can be mortal (26).

Valvular heart disease is a disease of the different heart valves: mitral, aortic, pulmonary and tricuspid. Two types of affectation can occur such as stenosis and insufficiency. Stenosis creates a difficulty in the blood flow at the level of the valve. Insufficiency occurs when the closure of the valve is incomplete and reflux to the preceding cavity occur (27).

1.3 Epidemiological profile

It appears that cardiovascular disease affection in the world is uneven, with some regions more affected than others and some individuals more likely to suffer from cardiovascular disease than others. Cardiovascular disease is responsible for premature death, this means individuals under 65 years old. It represents 31%

of worldwide deaths. These diseases represent also an important healthcare cost (28).

Mortality in developed country has decreased in recent years but the prevalence of individuals affected has increased due to an augmentation in the presence of risk factors and also populations living longer (29).

Cardiovascular risk factor is influenced by various factors such as the region of birth, economic status, level of education and living environment. Place of birth is a determinant factor of health, immigrant population with a low socioeconomical level are suffering inequities due to worse working and living condition, they have a decreased access to health care. Immigrant populations are more susceptible to live with cardiovascular risk factor such as hypertension, obesity and diabetes than a native European. Low socio-economic status has more chance to present cardiovascular risk factor and present a higher rate of mortality. Unemployment has shown a positive evidence with obesity and low level of physical activity. Poor psychological factor can lead to tabacism, poor eating habits, decreased physical activity and so increase the chance of suffering from any cardiac condition as they are all are cardiac risk factors (29,30).

1.4 Clinical manifestation of cardiovascular disease

1.4.1 Acute manifestation of cardiovascular disease

Various types of cardiovascular disease exist, they do not affect the same part of the heart and can present different types of manifestations. They can present an acute manifestation which means that they occur very quickly and the patient will get better once they are treated. The most common cardiovascular disease in the dental clinic are hypertension, ischemic heart disease, stroke, cardiac arrhythmias, infective endocarditis and valvular heart disease (22,23).

Hypertension is a very frequent disease and around 46% of those affected are not aware they have this condition (31). This affectation appears without any symptoms. In case organ are injuries due to hypertension some symptoms such

as pain at the level of the chest, shortness of breath, hypertensive encephalopathy and pulmonary edema (32).

Acute coronary syndrome or myocardial infraction is one of the most frequent cardiovascular condition. It can be defined as a condition associated with a reduced blood flow to the heart, it occurs suddenly. It may be manifested by a discomfort in the chest or chest pain, shortness of breath, sweating, nausea, also discomfort or pain can be felt in one or both arms, neck, jaw, stomach or even the back. The chest pain felt during an acute coronary syndrome is called angina. It can evolve in a feeling of pressure in the chest (33,34).

Ischemic heart disease or coronary heart disease occurs when the vessel surrounding the heart suffers from a partial or complete blockage, which will reduce the blood flow to the heart muscle. Ischemic heart disease can be called coronary heart disease. This disease occurs without any pain, this is called a silent ischemia (35).

Strokes are also called a cerebrovascular accident. Strokes occur suddenly and can be seen as an altered level of consciousness or confusion and speech difficulty, the common signs and symptoms observed are sensory deficits, hemiparesis, facial drop, diplopia, dysarthria, nausea or vomiting, severe headache, double or troubled vision can also be experienced due to an increased intracranial pressure. It is difficult to differentiate an ischemic to hemorrhagic stroke (36).

Cardiac arrhythmias are a condition which affect the cardiac rhythm. It can appear with no symptoms to a sudden cardiac arrest, 50% of patients die due to this sudden change in heart rhythm. Symptoms can be palpitations, increase in the heart rhythm, dizziness and feeling of weakness (25).

Acute infective endocarditis is a due to a microbial infection of the endocardium and appears with flu like illness. Fever, fatigue, aching joints and muscles, persistent cough, fast heart rate, swelling in the feet, legs or abdomen

can also be observed. Most rarely Osler nodes, Janeway lesions or Roth spots are seen (37).

The heart is composed of four valves; mitral, aortic, pulmonary and tricuspid. Sometimes these valves do not work correctly and valvular heart disease occurs. Normally evolves for a long time without any symptoms but some people can feel symptoms suddenly: it can be chest pain or palpitation, swollen ankle, feet or abdomen, shortness of breath, fatigue and weakness (38).

1.4.2 Chronic manifestation of cardiovascular disease

Some affectations appear as a chronic disease, chronic disease can be defined as an affectation that has a duration superior of 1 year and requires constant medical care or restrict everyday activity or both. Chronic disease is responsible for 41 million deaths every year and cardiovascular affectation is responsible of 17.9 million deaths every year (39,40).

Chronic coronary syndrome (CCS) can also be called stable angina. Pain in the chest can be felt by the patient during physical exercise. Most of the time it does not last for more than 5 minutes. Pain is relieved by medicine or rest. The pain can be felt in the back or arms. It can be confused with indigestion (41).

The term chronic stroke can be used 6 months after an attack. Patient can present cognitive impairment, dementia. Problem in attention, orientation, language or memory are part of the cognitive disfunction (42).

Cardiac arrhythmias may appear asymptomatic but some symptoms can be felt such as palpitations, chest pain, dizziness, fast heart beating and a feeling of weakness (23).

Chronic infective endocarditis can also be called subacute endocarditis, it evolves for weeks. Symptoms appear as fatigue, breathlessness and weight loss (43).

During a heart valve disease, symptoms worsen gradually with time. Symptoms have to be tracked to study the evolution. Symptoms are chest pain or palpitation, swollen ankle, feet or abdomen, shortness of breath, fatigue and weakness (44).

1.5 Preventive measure at the dental clinic

After a cardiovascular accident has occurred patients recover and can most of the time go back to a normal life but at the dental clinic some precaution have to be taken to avoid any new crisis or attack.

To treat a patient with hypertension it is important to check their blood pressure every time he comes to the clinic. If the patient presents a blood pressure inferior at 160/100 mmHg the dental treatment can be performed normally. In case the patient presents a blood pressure superior at 160/100mmHg the measurement has to be taken again. If the blood pressure decreases the dental treatment can be performed but if not, the patient shouldn't be treated and sent to his doctor. It is recommended to give morning and short appointments to this type of patient. Also, the use of anxiolytic agent such as diazepam can be used to reduce stress and anxiety. Positional change has to been done slowly. The use of anesthetic must be done correctly to avoid any intravascular injection (23).

Coronary ischemic heart disease cannot be treated in the first 30 days, only emergency dental treatment can be performed at the hospital with the consent of the cardiologist. Patient can be treated at the dental clinic with caution after 30 days if he is not referring any symptoms. Short appointments during morning are preferable. Anxiety, pain or fear have to be minimized during the dental appointment as it can be a trigger angina. To reduce this the use of anxiolytics can be recommended such as nitrous oxide or oral anxiolytic. The use of anesthesia with vasoconstrictor should be used carefully as it can increase the heart rhythm. The concentration of vasoconstriction has to be of 1:100 000 or lesser (23).

Patients who had a stroke in the last 6 months cannot be treated at the dental clinic. An inter consultation with their doctor is necessary. After 6 months, patients can be treated at the dental clinic. Appointments in morning are recommended. Dental team have to monitor oxygen saturation and blood pressure. Anesthetic solution with epinephrine has to be used with a limited dose. Most of these patients are taking antiplatelet or anticoagulant drugs. If the patient is taking warfarin, the INR has to be checked before surgical procedure and it should be between 1.5 to 3.5 (45).

Patients with valvular disease have a high risk of endocarditis infection. To minimize this risk an antibiotic prophylaxis will be necessary for treatments considered at risk. First of all, the patient should perform a mouthwash of chlorhexidine before starting the treatment. If after the treatment patient present fever, the dental team have to send him to his cardiologist (27).

Patients with cardiac arrhythmia have to avoid stressful situations, for these complex dental procedures and when various extractions have to be performed they have to be done over several appointments. This will permit to limit the drug administered to the patient and also reduce stress. This type of patient is normally taking anticoagulants. International Normalized ratio has to be between 2.0 to 3.5. Inter consultation with his doctor can be done if the arrhythmia is not well controlled or undiagnosed. Adrenaline shouldn’t be used in the gingival sulcus or to control bleeding (46).

If previously a patient has suffered from an infective endocarditis some precautions has to be taken, the patient will have to perform mouthwash with chlorhexidine before starting each treatment. It permits to reduce bacteria in the mouth. Endodontics treatment are the treatment of choice over extraction. Antibiotic have to be prescribed before each treatment and 7 days have to be respected between each appointment. If the delay of 7 days cannot be respected an alternative antibiotic regiment is done (22).

1.6 Intervention of the dentist in situation of cardiovascular emergency

Sometimes despite all the preventive measure a cardiac emergency occurs and the dental team should be able to help the patient.

If an hypertensive crisis occurs treatment should be stopped or shift to another day (22).

During the dental treatment if the patient starts to experience chest pain we can suspect an angina. Treatment have to be stopped and the dental team should immediately administrate oxygen to the patient as well as nitroglycerin 0.4-0.8 mg sublingually. The dose of nitroglycerin can be repeated after 5 minutes. If the patient is not feeling better after 15 minutes with the use oxygen with nitrates and nitroglycerin emergency medical assistance will be needed (47).

In case arrhythmias occur during the dental treatment we should stop the treatment and take the tension, heart rhythm and the level of consciousness of the patient. Oxygen can be administered and patient should to be placed in the Trendelenburg position. If the patient is referring chest pain, nitroglycerin can be administered. Patient having arrhythmias may experience cardiac arrest, if this occurs cardiovascular reanimation should be performed (27).

If a patient with a previous history of infective endocarditis comes back with fever after a dental procedure we shouldn’t prescribe any antibiotic to this patient and we have to send him to the hospital (27).

If a stroke occurs, the emergency services have to be called as soon as possible. Aspirin should not be given before the patient arrives to the hospital because intracerebral hemorrhage has to be discarded (48).

1.7 Therapeutic consideration at the dental clinic

Cardiovascular disease normally spawns various drugs, most of the time patients can be prescribed with anticoagulant, antiplatelet, angiotensin

converting enzyme inhibitors, beta blockers, calcium channel blockers, digitalis preparations, diuretics or vasodilators (50). Dental treatment can be classified according to the risk of bleeding, scaling and root planning, endodontics treatment, simple extraction, dental restorative treatment is considered as low risk of bleeding, apicoectomy, alveolar surgery, multiple tooth extraction, head and neck surgery are considered as a high risk of bleeding. In case performing a dental treatment that is considered as a high risk of bleeding some measures can be take into consideration (49).

Anticoagulant drugs are normally used to prevent to formation or enlargement of blood clots. Different types of anticoagulant drugs exists: direct oral anticoagulant (DAOC) such as apixaban, dabigatran, rivaroxaban, edoxaban and also vitamin K antagonist (VKA) such as warfarin (51).

In case of direct oral anticoagulant, interruption of the treatment is not recommended but if the patient is going to undergo a treatment with high risk of bleeding the dental team should advice the patient to miss one dose in case of apixaban or dabigatran or delay the morning dose the day of the dental intervention in case of rivaroxaban or edoxaban. Sutures and the use of hemostatic agent is recommended (52).

In case the patient is taking warfarin, the International Normalized Ratio (INR) has to be verified at least 24 hours before the treatment. To perform the treatment the patient should present an INR inferior at 3.5 if it's superior the dental team has to send the patient to his doctor (52). Sutures and the use of hemostatic agent is recommended. After treatment that involve bleeding such as extraction a close monitoring and follow up should be performed (51).

Antiplatelet drugs are normally prescribed to prevent clot formations. In the family of antiplatelet drugs, we can find: aspirin, clopidrogel, prasugrel, ticagrelor or dipyridamole. Sometimes patient will take aspirin with another antiplatelet drug and this is called a dual antiplatelet therapy. Due to the treatment this type of

patient will have an increase bleeding time (51). No discontinuation of the treatment is needed to treat this patient at the dental clinic (52).

1.8 Justification

This review is done to understand that cardiovascular diseases are frequent all over the world. In the dental office the staff is going to face many people that can be suffering from various cardiac affectation without being aware of it. This is why it is important to know the profile of patient mostly affected by heart condition, the clinical characteristic that can faced in the dental office and how to manage a cardiac patient. Sometimes despite all the preventive measures cardiovascular emergencies occur and as health professional dental team should be able to manage the patient.

2. OBJECTIVES

2.1 General objective

To determine the clinico - epidemiological characteristic associated with cardiovascular pathologies and to study the preventive therapeutic approach to these processes among patients attending a dental office.

2.2 Specific objectives

- To study the clinico – epidemiological characteristic in patients with cardiovascular pathology presenting to a dental office.
- To determine therapeutic and preventive action protocols to be considered in the dental office to treat patients with cardiovascular disease.
- To study protocols for action in cardiovascular emergency situations in the dental office.

3.MATERIALS AND METHODS

3.1 Digital research

To realize this work online research were perform using Pubmed, Medline plus, American Heart Association Journals, College of Dental Hygienists of Ontario and Dimensions of Dental Hygiene.

To respond to the objectives the search equation was as follows:

DATABASE	KEYWORDS
Pubmed *Medline plus, AHA Journals, College of Dental Hygienists Of Ontario And Dimensions of Dental Hygiene.*	• (Cardiovascular disease) AND (Risk factor) AND (Disparities) • (Risk factor) AND (Cardiovascular disease) • (Hypertension clinical characteristic) • (Coronary syndrome clinical characteristic) • (Stroke clinical characteristic) • (Cardiac arrhythmia clinical characteristic) • (Endocarditis clinical characteristic) • (Global burden cardiovascular disease) • (Cardiovascular disease in Spain) • (Dental care) AND (Myocardial infraction) • (Dental care) AND (Hypertension) • (Dentistry) AND (Endocarditis) • (Dental care) AND (Anticoagulant) • (Dental care) AND (Antithrombotic drug) • (Dental care) AND (Arrhythmias) • (Dental care) AND (Stroke) • (Vital emergency) AND (Dental office) • (Dental considerations in cardiovascular patient)

Table 1. Keywords used in this review

To realize the introduction other database were used such as: WHO, National heart, lungs, and blood, IMR press, Asanar, IHME and Walsh Medical Media. Article used are from the last 10 years.

3.2 Inclusion and exclusion criteria

The inclusion criteria were articles published in the last 10 years, review, meta-analysis articles or cross-sectional study, article or medical encyclopedia about dental consideration in patient with cardiovascular disease and articles written in English, Spanish or French.

Exclusion criteria were articles published before 2013, articles not speaking about dental care, dentistry or cardiovascular disease and clinical case with only one patient.

4. RESULTS

The first step of the research was done manually with the previous keywords, in total before applying any criteria a total of 59 176 articles was found. After applying the inclusion and exclusion criteria a total of 1 173 articles was obtained. Using title and reading the abstracts of the article a selection of 131 was made. Finally, after a complete lecture of the articles 28 articles were included in this review.

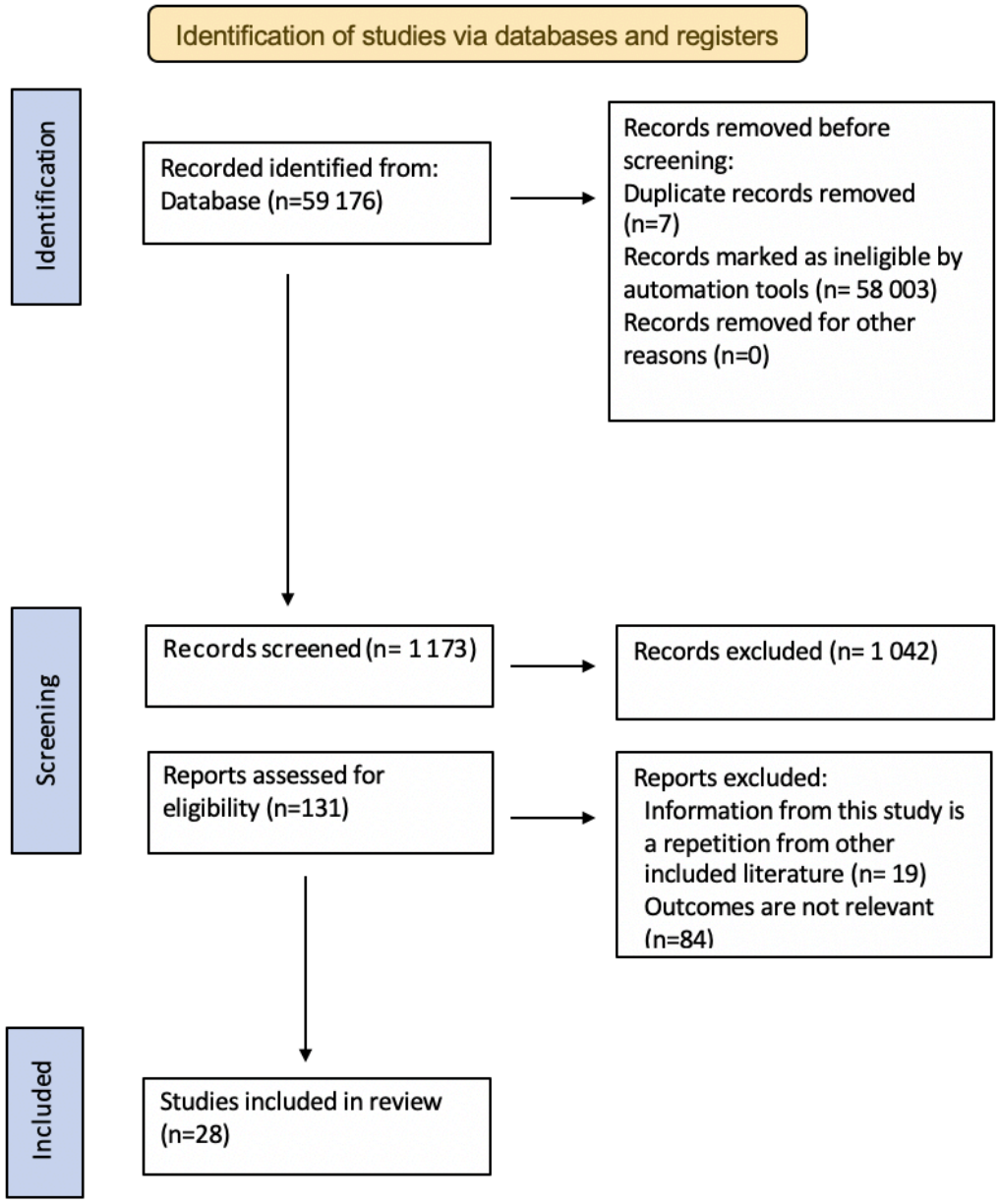

Figure 2. Flow chart

Table 2. Data review from selected articles

Authors and year	Type of study	Result
Roth GA et al. (17) 2019	Review	The prevalence of cardiovascular disease has been multiplicated by 2 between 1 990 to 2016. In 2016 it was estimated 523 millions of individual affected.
Bueno H and Pérez-Gómez B. (21) 2019	Review	The prevalence of cardiovascular disease has decreased in Spain between 1995 and 2015.
Thomas S. (3) 2022	Medical encyclopedia	Risk factor are age, sex, gene or race, smoking, cholesterol, hypertension, lack of exercise, obesity, stress and alcohol.
Schultz et al. (30) 2018	Review	Socio economic status represents a great importance regarding the chance of suffering from a cardiovascular disease.
Psaltopoulou T. et al. (53) 2017	Review	Socio economic factor influence the risk factor of cardiovascular disease.
Iqbal AM and Jamal SF (32)	Review	Hypertension appears without any symptoms in the majority of the case.

Table 2. Data review from selected articles

2023		
Oparil S et al. (54) 2018	Review	Hypertension is asymptomatic.
Yallowitz AW and Decker LC (55) 2023	Review	Most common symptoms of endocarditis are chest pain, fatigue or temperature.
Holland TL et al. (26) 2016	Review	Most common symptoms of endocarditis is fever.
Du-guan Fu (25) 2015	Review	Symptoms of arrhythmias are palpitation, acceleration of the heartbeat, sensation of weakness and dizziness.
Desai DS and Hajouli S. (56) 2023	Review	Different symptoms can occur according to the type of arrhythmias but the most frequent one appears to be difficulty in breathing, palpitation and syncope. Some type of arrhythmias can also appear without any symptoms.
Singh A et al. (34) 2023	Review	Acute coronary disease always appears with symptoms. Most common symptoms is pain in the chest that can be explained by pressure or crushing sensation.

Table 2. Data review from selected articles

Smith JN et al. (57) 2015	Review	Coronary syndrome can be felt as a pain at the level of the chest as well as in the mandibula or epigastric region. Pain can radiate to the left or both arm or right shoulder.
Khaku AS and Tadi P. (36) 2023	Review	Symptoms of cerebrovascular accident appears as a weakness or numbness in the arm, droop in the face of the patient, speech difficulty.
Tadi P and Lui F. (24) 2023	Review	Symptoms of a stroke can be observed as sickness, headache, alteration of the consciousness or mental statue.
Daly CG. (58) 2017	Review	AHA recommend antibiotic prophylaxis in patient with cardiac risk that are going to suffer risky dental treatment. NICE recommend antibiotic prophylaxis only in specific case.
Robinson AN and Tambyah PA (59) 2017	Review	Prescribe antibiotic if the patient present high risk of endocarditis.
Ghimire P et al. (60) 2022	Review	Hypertension: avoid vasoconstrictor, maximum dosis of 2 carpules. Angina pectoris: treatment depends on the level of the angina. Myocardial infraction: similar consideration as angina pectoris.

Table 2. Data review from selected articles

		Anticoagulant therapy: in case warfarin check shows INR <3.5. No change is necessary.
Chaudry S et al. (22) 2016	Review	Hypertension: check blood pressure before doing any treatment. Angina pectoris: prescribed nitroglycerin. Myocardial infraction: in the 6 first months only urgent treatments, performed in the hospital. Arrhythmia: stop the treatment in case of crisis Anticoagulant drug: check INR in case of warfarin, should be between 2 to 4.
Courtney P. Rudick (45) 2015	Review	Avoid treatment in the first 6 months after the stroke.
College of Dental Hygienist of Onatario (61) 2017	Review	No treatment if symptoms are present or in the first six months after the stroke.
Dézsi CA et al. (52) 2017	Review	Direct Oral anticoagulant: no alteration is necessary expect in case of surgery with high risk of bleeding Vitamin K anticoagulant: no alteration is necessary.

Table 2. Data review from selected articles

Martínez-López F et al. (62) 2013	Review	Most of the time alteration of the antiplatelet or anticoagulant treatment (direct oral anticoagulant or vitamin K antagonist) is not necessary. In high risk of bleeding a direct anticoagulant can be skip on the morning of the surgical procedure.
Renata SZ et al. (47) 2019	Review	Dental treatment can be done 6 weeks after the myocardial infraction. Anesthesia with vasoconstrictor is limited at 0.004mg.
Seminario-Amez M et al. (63) 2021	Review	Using anesthesia with vasoconstrictor up to 2 carpules is safe in coronary disease.
Tom J. (64) 2016	Review	Inter consultation with the cardiologist is recommended.
Mohideen K et al. (65) 2021	Cross-sectional study	70% of the participant doesn't know how to identify a medical emergency. In case of cardiac arrest only 15% would start the cardiopulmonary resuscitation.
Kumarswami S et al. (66) 2015	Cross-sectional study	38.5% of the participants take blood pressure, temperature, respiration and pulse before each treatment.

5. DISCUSSION

In the study of Roth GA et al. an augmentation of death can be observed between 2010 and 2019. The most common cause of death is ischemic heart disease with 49.2% followed by ischemic stroke with a representation of 17.7% of death. Regarding hypertension an augmentation between 1 990 to 2019 can be observed, in 1990 2.18 billions of individuals were affected versus 4.06 billions in 2019 (17).

Regarding the study of Bueno H and Pérez-Gómez B, a slight decrease in the cardiovascular disease can be observe including ischemic heart disease and cerebrovascular disease. A decreased of 3.5% can be observed every year. In 2015 431 600 new cases of cardiovascular disease were diagnosed (21).

According to these studies inequalities in the repartition of the cardiovascular disease can be observed. This difference can be due to the fact that in some countries the risk factor is more present and at a younger age. Also, a difference between the preventive measures and information given to the population can create this difference.

According to the study of Thomas S. et al. the cardiovascular risk factor can be modifiable or not. Regarding the non-modifiable cardiovascular factors we can find age, sex, gene, familial antecedent or race. Before women get menopause, men are more susceptible. Some are more susceptible than others such as African Americans, Mexican American, American Indians, Hawaiians and some of the Asian Americans. In the risk factors that we can modify we have smoking, cholesterol, diabetes, diet and stress (3).

According to Schultz et al. the risk factors of cardiovascular disease are hypertension, dyslipidemia, diabetes, family history of premature coronary heart disease obesity, poor diet, physical inactivity and smoking. The socio-economic level also impacts the chance of suffering from a cardiovascular disease. Low incomes are associated with a higher risk of cardiovascular disease as well as

death due to cardiovascular disease. At the level of education and employment status it appears that an individual with a low level of education are more susceptible to have a cardiovascular disease. Disadvantaged areas also increase the incidence of cardiovascular disease (30).

The study of Psaltopoulou T. et al. says that risk factor of cardiovascular disease is family history, diabetes, hypertension, obesity, diabetes, smoking and physical inactivity. Socio economic level affect the cardiovascular risk due to income level and occupational and educational status. It appears that a lower education level, income and status are related to a higher risk of cardiovascular disease. Obesity is related to a low level of educational and also a poor environment (53).

Regarding all of these studies it appears that authors mostly agree on every risk factor. We can observe that the socio-economic status influences the health of the individuals, having a low social or economic level create a disparity in the chance of suffering from a cardiovascular event.

According to the study of Iqbal AM and Jamal SF hypertension usually appears without symptoms but if an organ is damaged due to the hypertension symptoms such as pain in the chest, pulmonary edema, shortness of breath or symptoms similar to stroke can be felt by the patient (32).

In the study of Oparil S et al. no symptoms are felt in case of hypertension (54).

According to these results we can say that hypertension usually does not present any symptoms.

Regarding the study of Yallowitz AW,and Decker LC in case of inflammation of the endocardial surface of the heart symptoms such as sepsis or temperature can be experienced by the patient as well as headache, anorexia, weakness, pain in the chest, orthopnea, dyspnea or a decrease in the tolerance

of physical exercise. In most of the cases symptoms are chest pain, fatigue or temperature (55).

In the study of Holland TL et al., the most common symptoms regarding endocarditis is temperature (26).

In case of endocarditis we can see that authors agree on symptoms, it seems to appears that the most frequent is temperature.

In the study of Fu D guan, symptoms that can be perceived in case of arrhythmias are breathlessness, loss of consciousness, pain in the chest, dizziness and strong and fast pulsation of the heart (25).

In the study of Desai DS and Hajouli S., depending on which type of arrhythmias the patient suffers from symptoms which will be different. Some of them can present symptoms and others do not. Symptoms that can be encountered are breathlessness, palpitations of the heart, difficulty breathing, and in some cases hypotension and loss of consciousness can appears (56).

These results show that authors mostly agree on the symptoms that can be encountered in case of arrhythmias but in one study they also say that it can be asymptomatic.

According to the study of Singh A et al., in case of coronary syndrome patient can feel some symptoms such as a pain located in the chest with a sensation of pressure or squashing. The pain can be felt in the left arm of the patient as well as the jaw. Most of the time patient also refers dyspnea, sensation of losing balance, pain located in the epigastric part, sickness and feebleness (34).

In the study of Smith JN et al. we can see that patient presents symptoms when suffering from a coronary syndrome. Symptoms such as pain in the area of the chest as well as the epigastric region or in the mandibula, some difficulty

when breathing, sickness, tiredness or syncope. The pain can also be felt at the level of the right shoulder, left arm, or in both arms. It appears that in some patient and some cases any symptoms are felt (57).

We can see through these studies that authors agree on the symptoms of a coronary syndrome. The only difference is that one studies say that the pain can be felt in the left arm and the other one adds right shoulder or both arms.

In the study of Khaku AS and Tadi P, patient suffering from a stroke can present symptoms such as a droop on the face, a weakness in the arm, difficulty in speaking or unclear speech, confusion, trouble of the vision and walking and severe migraine (36).

In the study of Tadi P, Lui F., we can see that during a stroke patient can feel various symptoms such as migraine, sickness or vomiting, alterations of the conscience or pain at the level of the neck. Also the patient can suffer from an alteration of the vision and an hemiparesis (24).

These results show that authors agree on the clinical characteristic in case of stroke. Various symptoms such as hemiparesis, difficulty in speaking, trouble of vision and debility in the arm are present.

The study Daly CG agree on the actualization of the American Heart association in 2007 that only recommend antibiotic prophylaxis in patient at high risk of developing endocarditis with 2 grams of amoxicillin 1 hour before the procedure. Europe, New Zealand and Australia follow these guidelines. It appears that in 2008 in the United Kingdom the use of antibiotic prophylaxis is not used anymore. Nowadays United Kingdom do not recommend antibiotic prophylaxis for invasive dental procedure, they follow the National Institute for Health and Clinical Excellence (NIICE) guideline. However USA, Australia and Europe recommended the used of antibiotic prophylaxis in patient at risk. To reduce the risk of bacteremia and then endocarditis it appears that optimal oral

health is important. Adverse effects of antibiotic need to be taken into consideration before prescribing antibiotic prophylaxis (58).

The study of Robinson AN and Tambyah PA show that the American heart association (AHA), American college of cardiology (ACC) and European society of cardiology recommended the use of antibiotic prophylaxis to high risk patients. They do not recommend antibiotic prophylaxis for low or moderate risk patients (59).

The study of Ghimire P et al. say that in case antibiotic prophylaxis is needed we should prescribe to the patient 2g of amoxicillin 1 hour before the dental procedure. If the patient cannot take oral medication 2 grams of ampicillin intravenously or muscularly are administered. In case patient present allergy to penicillin we should give him 600mg of clindamycin or 2 grams of cefalexin 1 hour before the dental procedure (60).

It appears that a lack of evidence is found, no clinical trials has been performed and this can explain the difference between country. Also, existent study perform in the same country are contradictory some of them say the antibiotic prophylaxis is useful to prevent endocarditis and some of them tell the contrary (58). Changes in the use of antibiotic prophylaxis varies in function of the geographical region and change over years.
These results show that in most of the countries antibiotic prophylaxis is recommended in high risk patient with 2 gram of amoxicillin 1hour before the treatment if the patient do not present any allergy to this medication.

In the study of Chaudry S et al. they say that if the patient is medicated with warfarin INR needs to be checked in case of surgery but it will not be necessary if the dental procedure is noninvasive. INR will have to be check 72h before the surgery and has to be between 2 to 4 (22).

Regarding the study of Dézsi CA et al. they show that the American College of Chest and Physicians do not recommend any alteration in the vitamin

K antagonist (VKA) treatment but to add the administration of a proheamostatic agent. The British guidelines in most of the cases do not recommend the interruption of the VKA. INR of the patient needs to be checked 24 hours before the procedure in case of surgery with a high risk of bleeding, it has to be inferior of 3.5. If it's superior a delay in the procedure is necessary. If patient is going to go through a surgery with minor risk of bleeding no changes in the treatment is necessary. It is advised to performed dental treatment between the doses of DAOC. In case this type of patient require a high-risk bleeding surgery some precautions can be taken: the patient is taking rivaxaban or edoxaban delay the morning dose, patient is taking apixaban or dabigatran skip one dosis of the twice delay drugs. If patient take his doses of edoxaban or rivoxaban on the evening modification of the intake of the drugs is not necessary. Performing the surgery in the morning is a good option (52).

The study Martínez-López F et al. explain that it is recommended to not perform any change on the anti-coagulant drug in case of minor surgery but it is recommended to check patient INR at least 72h before the surgery and it is preferable to do it 24 hours before the surgery. INR should be between 2 to 4 with an optimal value at 2.5. Regarding the new oral anticoagulant, checking INR is not necessary. If the specialist decides to stop the anti-coagulant treatment of the patient and he has a normal renal activity the drug will be stop 24 hours before the surgery and if he presents an abnormal renal function interruption of the treatment will be done between 4 days to 24 hours before the procedure, in case of dabigatran and in case of rivaroxaban it will be done between 2 days to 24 hours. The re-introduction of the treatment will be performed 24 hours after the surgery. Some authors advice to re-introduce the treatment as soon as possible in the 4 to 6 hours with a half dose (62).

In the study of Ghimire P et al. in case patient is under anticoagulant drugs INR should be between 2 to 3, in patient with high risk situations such as prosthetic heart valve the recommended INR is between 2.5 to 3.5. Under warfarin INR have to be checked at least 72 hours before the dental surgery. No

change in the treatment is necessary in case of minor or major surgery if INR is between 2 to 3.5 (60).

Regarding warfarin most of the studies recommend to check the INR before treatment at least 24 hours before and some of them up to 72 hours before the surgery. It appears that INR will have to be between 2 to 3.5 in most of the studies and up to 4 in other. If the INR is superior postponement of the treatment needs to be done.
Regarding the DAOC checking the INR is not necessary and most of the studies do not recommended changing the treatment of the patient. In case of treatment with a high risk of bleeding delay in the usual doses can be perform depending on the drug the patient is taking but, in all cases, if change in the treatment is needed a consultation with his doctor will be necessary.

The study of Dézsi CA et al. says that anti platelet treatment does not present a significant risk of bleeding as well as post operatory bleeding (52).

In the study of Martínez-López F et al. we can see that they do not recommend any special consideration (62).

We can see that most of the studies agree that antiplatelet treatment do not need any special consideration or pre-operative measure.

In the study of Renata SZ et al. we can see that according to the AHA guidelines dental treatment needs to be avoided in the first six month after the myocardial infraction but now it is not recommended as surgery reparation has evolved. Still the doctor has to give his approval for dental treatment, it's recommends to wait 4 to 6 weeks after a myocardial infraction. Before this time only emergency can be performed in a hospital environment. After 4 to 6 weeks if the cardiologist of the patient does not contraindicate it dental procedure can be realized. It appears that antibiotic prophylaxis is recommend by some authors during the 30 days after the cardiac surgery. The supine position is not ideal in this type of patient. In case of unstable angina, the use of vasoconstrictor is

contraindicated. In stable patient dental treatment can be performed. Caution should be taken with adrenaline and no more of 0.04mg of adrenaline should be administered to the patient. Equivalent at 2 carpules of anesthesia with adrenaline at a dilution of 1:100000 (47).

The study of Seminario-Amez M et al. recommended to not give to the patient more than 1 or 2 carpules of anesthesia with vasoconstriction with a concentration of epinephrine of 1:80 000, 1:100 000 or 1:200 000 (63).

According to the study of Ghimire P et al. in case the patient needs a surgical procedure such as implant placement, it's recommended to postpone the procedure if the last myocardial infraction was inferior to 12 months ago. After 12 months the risk is considered mild but if a general anesthesia is necessary the patient will have to be hospitalized (60).

In the study of Chaudhry S et al. short appointments are recommended in this type of patient with a reduction of anxiety. In first 6 months after myocardial infraction if the patient needs urgent invasive treatments such as extractions or root canal treatments it has to be performed in a hospital environment. After these 6 months, this type of patient can be treated in the same way as a patients having a stable angina (22).

According to these studies we can say that performing a dental treatment safely can be done 6 months after the myocardial infraction or at 4 to 6 weeks with the agreement of the doctor. The use of vasoconstrictor is restricted at 2 carpules. In case a patient needs a treatment before being stable the treatment will be performed in a hospital environment.

According to the study of Ghimire P et al. if patient is affected by coronary heart disease depending on the severity of the angina various protocol can be followed. If the patient presents a mild angina non-surgical treatment can be done normally but nitroglycerin has to be prescribed and vital signs have to be checked during the dental procedure. In case patient need surgical treatment, it should be

postponed or nitrous oxide has to be administered. If anesthesia is needed no more than 0.004 to 0.005 mg of adrenaline can be used. If the patient presents a moderate angina, it's necessary that the patient take a sublingual dose of nitroglycerin before extensive treatment. In case patient presents unstable angina dental surgeries are strictly contraindicated, only examination procedures are allowed (60).

In the study of Chaudhry S et al. they say that morning appointments are better and pre-medication with nitroglycerin or anxiolytic are recommended. Anesthesia with vasoconstrictor such as epinephrine 1:100000 can be used (22).

In case patient has a coronary heart disease some nitroglycerin can be given before the procedure, also the use of anxiolytics can be recommended.

According to the study of Chauldhry S et al. in case of hypertension, the dental team needs to take the blood pressure before performing some treatments such as long restorative treatments, placement of implant, periodontal surgery and oral surgical procedure (22).

Regarding the study of Daly CG abrupt changes need to be avoid in patient with high blood pressure to not create orthostatic hypotension. It's recommended to give them morning appointment and to check blood pressure before treatment, if the blood pressure is superior to 180/110 treatment need to be postpone. Regarding local anesthesia the use of vasoconstrictors need to be avoided or used in small doses such as 1 or 2 carpules of lidocaine with epinephrine at 1:100 000 (58).

If patient is affected by hypertension dental team should check his blood pressure and be careful with vasoconstrictor.

In the study of Courtney P. Rudick, in the first 6 months after the stroke dental treatment can only be performed in case of emergency. After this time

there is no contraindication but they recommend taking blood pressure and limit the use of vasoconstrictor (45).

In the study of College of Dental Hygienist of Ontario, invasive dental treatment is contraindicated in the first 6 months after the stroke as well as if the patient presents some symptoms. Some patients can be treated early depending on their case but inter consultation with his doctor is recommended (61).

Regarding strokes dental treatments need to be avoided in the first 6 months. Inter consultation with the doctor of the patient can be done in case dental treatments need to be realized before.

In the study of Renata SZ we can see that the use of vasoconstrictor is contraindicated especially if automatic defibrillator is implanted (47).

The study of Tom J. says that caution with electrosurgery in this type of patient as it can affect the pacemakers. Also, in case of MRI we have to be prudent because some pacemakers are not compatible (64).

Regarding these studies we can say that the use of vasoconstrictor and electrical devices should be done carefully. Before performing MRI make sure that the pacemaker of the patient is compatible.

According to the study of Chauldhry S et al in case of hypertensive crisis it is recommended to stop the treatment or to postpone it if we haven't started it and send the patient to the hospital (22).

The studies of Ghimire P et al. says that in case of increased blood pressure postpone treatment (60).

In the study of Renata et al. if angina occurs dental treatment needs to be stopped and a sublingual nitroglycerin need to be given to the patient (0.4 to 0.8mg) also oxygen is recommended, 3 liters per minutes. if the patient still feels

pain after 5 minutes another doses of nitroglycerin can be given. If in the 15 minutes the patient has not recovered he should be sent to the hospital (47)

In the study of Ghimire P et al. they say that if an angina attack occurs the treatment needs to be stopped, place the patient in semi or upright position, oxygen and sublingual nitroglycerin is administered (0.3 to 0.6 mg). if patient does not resolve in the 3 minutes give him another doses of nitroglycerin and a third dose can be given after 3 min. In case the pain persists patient needs to go to the hospital (60).

According to the study of Chauldhry S et al. in case a patient suffers from an arrhythmia's crisis, the dentist has to stop the treatment and administered oxygen can be necessary. A monitoring of the vital function of the patient is recommended (22).

We can say that in case of cardiovascular emergency treatment should be stopped. Regarding angina administer a dose of nitroglycerin can help the patient to recover.

On the study of Mohideen K perform on dental student, it appears that 70% recognize the sign and identify correctly a medical emergency. Regarding cardiovascular emergency only 37% of them could recognize signs of an ischemic accident and 30% have been capable of identify symptoms of angina. It appears that in case of cardiac arrest only 11% of the students would start the cardiopulmonary resuscitation and also call emergency service. On the participant to this study only 30% feels confident to treat any medical emergency. They recommend actualizing the medical history of the patient and checking blood pressure, respiratory frequency, temperature, pulse rate before doing any treatment. (65).

In the study of Kumarswami S et al., we can see that 38.4% of the participants check the vital sign before performing any treatment. Only 7.6% of them had participate to any workshop on emergency training. Regarding the

confidence on the management of any medical emergency situation, 94% of them feels comfortable. In this study they recommend to update the medical history and vital signs before any treatment. In case the patient is medically complex the inter consultation with his doctor is recommended. It appears that 42.1% of dentists affirm having received training in medical emergency management during their under or post graduate education and only 7.6% had attended to this workshop. In another study 92% of the dentists have already participated at least once to an emergency training (66).

According to these studies we can say that dental workers presents a lack of training regarding the detection and actuation in case of cardiovascular emergency.

6. CONCLUSIONS

1. Cardiovascular disease is a frequent condition, in fact 11 million of new cases are detected each year in Europe. It appears that the socio-economic profile and risk factors present in life such as smoking can affect the heart condition. The symptoms that can be experienced by the patient are similar in cardiovascular disease, pain at the level of the chest appears frequently.

2. In the dental office it appears that the most common cardiovascular affectation is hypertension, ischemic heart disease, stroke, cardiac arrhythmias, infective endocarditis and valvular heart disease. Depending on the cardiovascular alteration some precautions have to be taken before starting any treatment.

   In case of high blood pressure dental team need to check the blood pressure. The use antibiotic prophylaxis to prevent endocarditis is controversial but recommended in most of the country.

   If the patient is under anticoagulant drug with warfarin, INR has to be verified.

   Patient who have suffered from a myocardial infraction or stroke, treatment need to be avoided in the first six month or the agreement of the cardiologist is needed.

   In case of coronary heart disease, it is recommended to give a dose of nitroglycerin to the patient.

   Regarding arrhythmia, precautions have to be taken with electrical devices in case patient is wearing a pacemaker.

3. Cardiovascular emergency can occur during dental treatment and if this occurs treatment has to be stopped. To avoid this type of accident dental team has to update the medical history and take blood pressure, respiratory rate, temperature and heart pulsation before any treatment.

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8.ANNEXES

CVD: Cardiovascular Disease
NICE: National Institute for Health and Care Excellence
AHA: American Heart Association
MRI: Magnetic Resonance Imaging
DAOC: Direct Acting Oral Anticoagulant
VKA: Vitamin K Antagonist
INR: International Normalized Ratio
SCORE: Systematic Coronary Risk Evaluation