UNIVERSIDADE FERNANDO PESSOA

THE IMPACT OF MEDICAL COMORBIDITIES ON POSTOPERATIVE COMPLICATIONS IN DENTO-ALVEOLAR SURGERY: A STUDY IN A POPULATION FOLLOWED UP IN A UNIVERSITY DENTAL SCHOOL SETTING

[O impacto das comorbilidades médicas nas complicações pós-operatórias em cirurgia dento-alveolar: um estudo numa população acompanhada numa escola universitária de medicina dentária]

Dissertação de Mestrado Integrado em Medicina Dentaria

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Orientadores:

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ABSTRACT

Due to the increasing number of patients with chronic medical problems, a thorough evaluation is essential to the successful dental management of a medically compromised patient. During dentoalveolar extractions, several post-operative complications can arise. These unforeseen events may be due to the possible comorbidities that these patients suffer.

To understand the repercussion of these different comorbidities on the possible complications following dental extractions within an academic setting, data collected in continuation of the retrospective observational study titled "Characterization of the Profile of Antibiotic Prescription in Dentoalveolar Surgery - A Study in a UFP Population", previously approved by the Ethics Committee of the Fernando Pessoa University, will be analysed.

The aim of this dissertation is to outline the medical problems of patients attending for dentoalveolar extraction, and to highlight the impact that some comorbidities might have on the development of post-operative complications.

According to the results of our study, we were able to show that the two most frequent comorbidities in our cohort were cardiovascular problems and type 2 diabetes. Clinical protocols should be well-defined in oral medicine and surgery consultations for the management of these patients. Additionally, no association was found between smoking habits and postoperative complications, or between comorbidities and postoperative complications.

Key-words: medical comorbidities ; postoperative complications ; dento-alveolar surgery ; smoking habits.

RESUMO

Devido ao número crescente de pacientes com comorbilidades, uma avaliação minuciosa é essencial para o sucesso do tratamento médico-dentário de um paciente medicamente comprometido. Durante as extrações dento-alveolares podem surgir várias complicações pós-operatórias, entre os fatores descritos na literatura que podem contribuem para a sua ocorrência encontram-se as comorbilidades que os pacientes apresentam.

Para compreender a repercussão destas diferentes comorbilidades nas possíveis complicações após extrações dentárias em ambiente académico, em continuidade ao estudo observacional retrospetivo intitulado "Caracterização do Perfil de Prescrição de Antibióticos em Cirurgia Dentoalveolar - Estudo numa População da UFP", previamente aprovado pela Comissão de Ética da Universidade Fernando Pessoa, serão analisados os dados recolhidos

O objetivo desta dissertação é delinear os problemas médicos dos pacientes que recorrem à extração dento-alveolar, e realçar o impacto que algumas comorbilidades podem ter no desenvolvimento de complicações pós-operatórias.

De acordo com os resultados do nosso estudo, foi possível demonstrar que as duas comorbilidades mais frequentes na nossa coorte foram as doenças cardiovasculares e a diabetes tipo 2. Protocolos clínicos devem ser bem definidos nas consultas de medicina e cirurgia oral para a abordagem desses pacientes. Adicionalmente, não foi encontrada associação entre as comorbilidades e complicações pós-operatórias, nem entre os hábitos tabágicos e complicações pós-operatórias.

Palavras-chave: comorbilidades médicas ; complicações pós-operatórias ; cirurgia dento-alveolar ; hábitos tabágicos.

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LIST OF ABBREVIATIONS, SYMBOLS OR ACRONYMS

ACE inhibitors - Angiotensin-Converting-Enzyme inhibitors

AKI - Acute Kidney Injury

ALD - Alcoholic Liver Disease

AMI - Acute Myocardial Infarction

ASPR - Age-Standardized Prevalence Rate

BCG - Bacillus Calmette–Guérin

CKD - Chronic Kidney Disease

COPD - Chronic Obstructive Pulmonary Disease

CVA - Cerebrovascular Accident

EFIC - European Federation of Pain

EU - European Union

FPU/UFP - Fernando Pessoa University

HAV - Hepatitis A Virus

HBV - Hepatitis B Virus

HCV - Hepatitis C Virus

HIV - Human Immunodeficiency Viruses

HPV - Human Papillomavirus

IDF - International Diabetes Federation

MASLD - Metabolic Dysfunction Associated Steatotic Liver Disease

NAFLD - Non-Alcoholic Fatty Liver Disease

NSAID - Non-Steroidal Anti-Inflammatory Drugs

OECD - Organization for Economic Cooperation and Development

PCFH - Pedagogical Clinic of the Faculty of Health Sciences

PDMC-FPU - Pedagogical Dental Medicine Clinics of the Faculty of Health Sciences at Fernando Pessoa University

pmarp - per million age related population

pmp - per million population

RRT - Renal Replacement Therapy

TRH - Thyrotropin-Releasing Hormone

TSH - Thyroid Stimulating Hormone

WHO - World Health Organization

WPWS - Wolff–Parkinson–White syndrome

I. INTRODUCTION

The quality of patient care in dentoalveolar surgery is critically impacted by the thoroughness of preoperative clinical assessments. Among the pivotal elements of these assessments is the anamnesis or medical history, which comprehensively gathers and evaluates a patient's past medical events, current symptoms, previous treatments, allergies, lifestyle habits, and existing risk factors. This systematic collection of health data not only facilitates tailored and effective treatment plans but also enhances diagnostic accuracy.

1. Anamnesis and its importance in Dentoalveolar Surgery

The anamnesis, also known as the medical history, is an essential process in the clinical assessment of patients.

It involves gathering detailed information about medical history, current symptoms, previous treatments, allergies, lifestyle habits and risk factors. The history provides the healthcare professional with a comprehensive overview of the patient's health and well-being, enabling effective, personalised care to be provided. By listening carefully to the patient and asking pertinent questions, the doctor can obtain valuable clues for making an accurate diagnosis and defining an appropriate treatment plan. A thorough history is particularly important, as it helps to identify potential risk factors, detect underlying diseases and understand the patient's concerns, thereby promoting a holistic approach to health (Nichol et al., 2023).

During a consultation at the Pedagogical Clinic of the Faculty of Health Sciences (PCFH) at the Fernando Pessoa University, each patient is be asked to complete an information sheet. This information sheet contains details of the patient's identity, medical history (surgical operations, illnesses, medication, allergies, etc.) and oral hygiene and lifestyle habits, including smoking and alcohol intake.

The most important section of the anamnesis is the medical history. This section will give us an overview of the patient's general condition.

Firstly, we will have information about any operations they may have undergone.

Secondly, the patient will be able to tell us what illnesses or disorders they may be suffering from.

Additionally, they can tell us what medication they are taking and if their conditions are well or poorly controlled.

The patient's medical history might be the first clue to arrive at a correct diagnosis, which is why it must be as complete and accurate as possible.

Following the anamnesis, a number of illnesses might be identified, depending on the patient. Indeed, a number of these diseases may represent co-morbidities, particularly in the case of dentoalveolar extractions. These include cardiovascular, respiratory, gastrointestinal, renal, hepatic, metabolic, infectious, haematologic, dermatological and neurological disorders. The following sections will give more detail on each.

2. Medical Comorbidities and their relevance in Dentoalveolar Surgery

Medical comorbidities particularly play a significant role in the context of dentoalveolar surgery. Common comorbid conditions such as cardiovascular, respiratory, gastrointestinal, renal, hepatic, metabolic, infectious, hematologic, dermatological, and neurological disorders can influence both the approach to and the success of surgical interventions. These conditions are rigorously reviewed to anticipate and mitigate possible postoperative complications.

2.1. Metabolic disorders

Diseases like diabetes and thyroid disorders directly impact surgical risk and management strategies.

2.1.1. Diabetes

Diabetes is a disorder in the assimilation, use and storage of sugars in the diet. It is a chronic disease that occurs when the pancreas does not produce a sufficient quantity of insulin or when the body cannot effectively use the insulin it does produce. Insulin is a hormone that plays an essential role in regulating blood sugar levels. This condition is characterised by high levels of glucose in the blood, generally known as hyperglycaemia. There are two main types of diabetes, caused by different malfunctions: type 1 diabetes and type 2 diabetes (Zaccardi et al., 2015).

2.1.1.1. Type 1 (insulin-dependent)

In this type of diabetes, the pancreas no longer produces enough insulin. In its absence, the cells can no longer properly use the sugar circulating in the blood. Hyperglycaemia

occurs rapidly, as soon as insulin levels become insufficient. It is frequently found in children, adolescents and young adults.

2.1.1.2. Type 2 (non-insulin-dependent)

This is the most common type of diabetes. It is mainly found in adults. It develops very gradually, insidiously over many years.

In type 2 diabetes, the cells become less sensitive to insulin. At the start of the disease, the pancreas produces insulin normally, but the cells in the body responsible for capturing and using glucose become insensitive to insulin, resulting in a rise in glucose levels.

Firstly, the body's cells become resistant to insulin. This resistance is normal with age, but is exacerbated if you are overweight or obese. Glucose accumulates in the blood and hyperglycaemia gradually sets in. This is the insulin resistance stage.

The body then tries to adapt by increasing insulin production by the pancreas. This is the hyperinsulinism stage.

Finally, after several years (10 to 20 years), the pancreas becomes exhausted and can no longer secrete enough insulin to regulate blood sugar levels. This is the stage of insulin deficiency (Zheng et al., 2017).

2.1.2. Hypothyroidism

Hypothyroidism is an endocrine disorder in which the thyroid gland produces less or no thyroid hormone. It is more common in older people.

This disorder may be of primary or secondary origin. Examples of primary causes include iodine deficiency, autoimmune thyroiditis (the most common being Hashimoto's), caused by treatment for hyperthyroidism, cancer radiotherapy to the neck or chest, congenital hypothyroidism (formation problems during pregnancy or the mother taking hyperthyroidism treatment during pregnancy). There are also secondary causes, such as thyroid stimulating hormone (TSH) deficiency or insufficient production of thyrotropin-releasing hormone (TRH) in the hypothalamus.

Hypothyroidism cannot be cured, so we compensate for it by ingesting replacement thyroid hormones. The most commonly used drug is Levothyroxine. It must be taken for the rest of the patient's life and normalises TSH levels (Gaitonde et al., 2012).

2.1.3. Hyperthyroidism

Hyperthyroidism is a disorder of the thyroid gland in which it produces an excess of thyroid hormones. Blood levels of the hormones triiodothyronine (T3) and thyroxine (T4) are permanently abnormally high. It generally leads to an acceleration in most of the body's vital functions: faster heart rate, weight loss, anxiety or chronic fatigue, for example.

There are many causes, the most common of which are:

- Graves-Basedow disease (which is an autoimmune disease).
- The appearance of an adenoma (benign tumour) or a toxic multi-nodular thyroid goitre.
- Thyroiditis (inflammation of the thyroid gland).
- Iodine-rich medicines.
- Treatments with too high a dosage of thyroid hormones.

Treatment of hyperthyroidism will depend on its cause. Indeed, the above-mentioned factors will have to be addressed before the condition can be stabilised.

In the case of Graves-Basedow disease, the patient should be treated with a prolonged prescription (12 to 18 months) of synthetic antithyroid drugs. However, if the disease becomes chronic, removal of the thyroid should be considered. If nodules are present, a course of medication will be prescribed to balance thyroid hormone levels in the blood, followed by surgery to remove part or all of the thyroid depending on the number and size of the nodules. Concerning thyroiditis, it is self-regulating and treatment consists of relieving the inflammation with medication, while carefully monitoring the progress of the disease. For causes due to an excess of iodine or thyroid hormones, the prescription will simply have to be reduced or stopped (Kravets, 2016).

2.2. Immunodeficiency

Immunodeficiency or **immunodepression**, which may be primary or secondary, is the more or less severe reduction in an organism's immune response to an antigen. Immunocompromised patients have an increased risk of serious infections, with greater morbidity and mortality.

2.2.1. Primary (congenital)

These are immune deficiencies generally present at birth and are genetic disorders that are commonly hereditary. They are usually seen in infancy or early childhood.

Congenital immune deficiencies can affect different parts of the immune system: humoral immunity (B lymphocytes, and consequently antibody deficiency), cellular immunity (T lymphocytes), humoral and cellular immunity (combined B and T lymphocyte deficiency), phagocyte deficiency, complement protein deficiency (proteins that help immune cells kill bacteria and identify foreign cells to be destroyed).

2.2.2. Secondary

These are non-hereditary immune deficiencies caused by various immunosuppressive agents such as anti-cancer treatments (radiotherapy, chemotherapy), undernutrition (the main cause of acquired immunodeficiency, which encourages infections), corticosteroid therapy, immunosuppressants or viruses (the most common being HIV or HPV).
In the case of HIV, it is the body's white blood cells that are affected, more specifically the CD4+ cells, thus weakening the effectiveness of the patient's immune system against infections (McCusker & Warrington, 2011).

2.3. Blood disorders

Haematopoietic disorders are numerous and can affect the quantity and function of blood cells and blood proteins.
There may be a reduction in the number of white blood cells (leucopenia) (Prankerd, 2014), in the number of red blood cells (anaemia) (Chaparro & Suchdev, 2019) or in the number of platelets (thrombocytopenia) (Gauer et al., 2012).
Similarly, there may be an increase in the number of white blood cells (leukocytosis) (Chabot-Richards & George, 2014), red blood cells (erythrocytosis) (McMullin, 2008) or platelets (thrombocytosis) (Skoda, 2009).
We can notice that many patients have coagulation disorders. Some patients have predisposing factors that lead to the formation of blood clots (thrombosis) (Ashorobi et al., 2019), and these patients will need to take anticoagulants. Others have coagulopathies, leading to abnormal bleeding (haemophilia, for example) (Fijnvandraat et al., 2012).

2.4. Respiratory / pulmonary disorders

These disturbances affect the respiratory system, causing breathing problems. They can be acute (e.g. bronchitis, sinusitis, nasopharyngitis, flu) or chronic (e.g. asthma, tuberculosis, chronic obstructive pulmonary disease (COPD), cystic fibrosis, lung cancer). The main risk factors for these diseases are tobacco smoke (active or passive

smoking), air pollution, work-related disorders and socio-economic factors (Bellisario et al., 2019). As part of our research, we focused on chronic disorders.

Chronic disorders like asthma and COPD require adjusted treatment plans to ensure patient safety during and after surgery.

2.4.1. Asthma

Asthma is a disease that is often present from an early age, but can also develop later in life. It is a condition in which the airways become smaller in diameter (reversibly). Symptoms include wheezing, shortness of breath, chest tightness and coughing. There is no cure for this disease, but it is possible to live with it, in particular through treatment with inhalers. There is treatment with bronchodilators (such as Salmeterol or Formeterol, which have a long action) that open up the airways and alleviate symptoms, or treatment with steroids that reduce inflammation of the airways, thereby reducing the risk of serious asthma attacks that can even lead to death (Papi et al., 2017).

2.4.2. Tuberculosis

Tuberculosis is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*, which more commonly affects the lungs, but can also reach the pleura, lymph nodes, eyes, skin, urinary system or bones. It is transmitted via the airways by the spread of the bacteria in the ambient air by an infected person coughing or sneezing. It is a curable disease, notably through antibiotic treatment, and can be prevented (thus avoiding contamination by *M. tuberculosis*) by the BCG vaccine (Yombi & Olinga, 2015).

2.5. Liver disorders

The liver is one of the largest organs in the abdomen. It produces bile, which helps to digest fats; stores glucose, vitamins and minerals produced by digestion, then releases them into the bloodstream when the body needs them. It also eliminates harmful elements such as drug residues and body waste. It regulates the amount of certain substances naturally present in the body, such as cholesterol.

Impairments in liver functions can significantly alter medication metabolism and excretion, affecting both anesthetic and pharmacological management.

The main disorders affecting the liver are cancer, hepatitis, cirrhosis, fatty liver and liver failure.

2.5.1. Hepatitis

Hepatitis A is a viral liver disease caused by the Hepatitis A virus (HAV). It is transmitted via the faeco-oral route, between people or through contact with contaminated objects and food. A person who has contracted hepatitis A is immune for the rest of his life. This disease is never chronic, and is easily and rapidly cured (generally in less than 6 months). A preventive vaccine is available (Matheny et al., 2012).

Hepatitis B is a viral liver disease caused by the Hepatitis B virus (HBV). The disease is easily transmitted by sexual intercourse or contact with blood from an infected person, but can also be transmitted from mother to child. It can be prevented by vaccination. The virus causes the liver to swell and prevents it from functioning properly. Patients with acute infection are generally cured within 6 months. For those chronically affected, the disease can progress to cirrhosis and subsequently to cancer (Liaw & Chu, 2009).

Hepatitis C is a viral liver disease caused by the Hepatitis C virus (HCV). There is currently no vaccine to prevent it. It is transmitted mainly via the blood, such as during blood transfusions or through the repeated use of non-sterile syringes (ex: drug addicts' syringes). The disease can manifest itself acutely, with patients generally recovering within 6 months, or chronically, progressing to cirrhosis and then liver cancer (Alberti & Benvegnù, 2003).

2.5.2. Metabolic Dysfunction Associated Steatotic Liver Disease

The **Metabolic Dysfunction Associated Steatotic Liver Disease (MASLD)** previously known as Non-Alcoholic Fatty Liver Disease (NAFLD) is a disease associated with metabolic syndrome (abdominal obesity, high cholesterol, diabetes, high blood pressure, etc.). It is characterised by an accumulation of fat in the liver, irrespective of excessive alcohol consumption. Fats in the liver generally develop when a person consumes more fats and sugars than their body can handle. A person has hepatic steatosis when this accumulation of fat represents more than 5.0% of the liver (Lanthier, 2020).

2.5.3. Alcoholic Liver Disease

Heavy alcohol consumption can also be responsible for steatosis, the **Alcoholic Liver Disease (ALD)**, which can lead to fibrosis of the liver and can progress to cirrhosis.

A fairly common liver disease caused by alcohol is **cirrhosis**. This is a serious chronic disease characterised by inflammation of the liver. It leads to the destruction of liver cells and their regeneration in the form of nodules. The disease leads to loss of function of the

organ and is accompanied by multiple complications. Once in place, it is irreversible. It may be stable or progressive.

To date, there is no treatment for cirrhosis, so it will be necessary to treat the cause, which is generally: stopping drinking alcohol, treating hepatitis B or C, treating diabetes or excess weight (Schuppan & Afdhal, 2008).

2.6. Renal disorders

The kidneys are essential organs of the urinary system, filtering blood and excreting urine through the nephrons.

Disruptions in kidney function can have a notable impact on the metabolism and elimination of medications, thereby influencing both anesthetic and pharmacological treatment approaches.

2.6.1. Urolithiasis

Urolithiasis is a disorder caused by the formation of renal calculus. In excessive concentrations in the urine, certain eliminated substances form crystals in the kidneys or bladder that can aggregate to form small solid particles, known as "stones", which block the channels through which the urine is evacuated. They generally lead to pain, bleeding, urinary tract infection or obstruction of urine flow. If left untreated, kidney stones can lead to kidney infection, kidney failure or sepsis.

In the case of small-calibre kidney or urinary calculus, these may evacuate spontaneously. If not, surgery will be required (Skolarikos et al., 2023).

2.6.2. Solitary kidney

The **presence of only one kidney** has also been encountered in a number of patients.

It may be caused by agenesis of one of the kidneys at birth. This condition is viable if it is isolated and the solitary kidney has a normal development. However, over the long term, the solitary kidney can become overloaded, particularly in cases of obesity or smoking. Regular monitoring and early detection are therefore important.

The presence of a solitary kidney may also be due to the donation of one of the kidneys for renal transplantation (Gluhovschi et al., 2013).

2.6.3. Kidney failure

Kidney failure is a serious illness that leads to a more or less irreversible deterioration in the kidneys ability to filter blood. It can be acute or chronic.

Acute kidney injury (AKI) leads to a rapid deterioration in renal function (a few hours to a few days) but with a high potential for recovery, depending on the origin of the disease. It can be triggered by any disease that reduces the blood supply to the kidneys, by any pathology or toxic substance affecting the kidneys themselves, or by any disease leading to obstruction of urine flow at any point in the urinary tract. Treatment involves correcting the cause of the acute kidney injury and, in some cases, dialysis. Acute renal failure can lead to chronic renal disease if renal function is not restored after treatment (Bellomo, 2011).

Chronic kidney disease (CKD) is a slow, progressive deterioration (over a period of months to years) of the kidneys ability to filter metabolic waste products from the blood. The most common causes of this chronic condition are diabetes and high blood pressure. The blood becomes acidified, anaemia develops, nerves are damaged, bone tissue deteriorates and the risk of atherosclerosis increases. The first step is to treat the dysfunctions that aggravate the state of kidney function, modify the diet and prescribe medication. The aim is to slow the decline in renal function and delay dialysis. As a last resort, a kidney replacement method such as dialysis or transplantation should be considered (Kalantar-Zadeh et al., 2021).

2.7. Gastrointestinal disorders

These disorders affect the patient's digestive system.

2.7.1. Gastritis

Gastritis is one of the gastric disorders encountered in the history of our patients. It is an inflammation of the stomach lining, and can sometimes lead to abdominal pain associated with nausea or vomiting. There are a number of triggers for this condition, including bacterial infection with *Helicobacter pylori*, stress, excessive alcohol consumption, excessive use of non-steroidal anti-inflammatory drugs (NSAID) and immune system disorders. It is generally diagnosed by endoscopy.

As far as treatment is concerned, the ingestion of antacid medication such as proton pump inhibitors or histamine H2 receptor antagonists will normally be sufficient. However, it

is essential to stop taking NSAID or alcohol. In addition, in the case of *Helicobacter pylori* infections, a course of antibiotics should be started (Sipponen & Maaroos, 2015).

2.7.2. Ulcers

Ulcers are characterised by a significant loss of substance from the inner lining of the gastric or duodenal mucosa, deepening the lining down to the muscular layer and forming a wound. There are two main factors causing this condition: the *Helicobacter pylori* bacterium and non-steroidal anti-inflammatory drugs (NSAID). These alter the mucosa's usual defence and repair mechanisms, making it more sensitive to acidity.

The aim of treatment is to heal the ulcer. It is quite similar to that for gastritis. It will therefore be necessary to stop taking non-steroidal anti-inflammatory drugs and to start antibiotic therapy for 10 to 14 days to eliminate the *Helicobacter pylori* bacteria. In addition, acid secretion from the stomach must be reduced by means of antisecretory drugs (Graham, 2014).

2.8. Cardiovascular disorders

Cardiovascular disorders constitute a vast field of disorders affecting the circulatory system and the heart, playing a significant role in human health. They are one of the main causes of morbidity and mortality worldwide. These alterations can vary in severity, from minor disorders of cardiac function to life-threatening conditions.

Conditions such as hypertension and arrhythmias necessitate specific surgical precautions and postoperative care to prevent exacerbations.

2.8.1. Hypertension

High blood pressure (hypertension) is characterised by abnormally high and persistent pressure within the blood vessels. It is the most common chronic disease in the world and is one of the main risk factors for heart disease.

It has no symptoms and can therefore be detected by checking blood pressure fairly regularly with a blood pressure monitor. There are a number of factors that make its onset more likely, such as age, ethnic origin, a family history of hypertension, a diet too high in salt, excessive alcohol consumption, smoking, obesity and lack of physical activity.

If left untreated, hypertension can lead to other health problems such as kidney disease, heart disease and stroke. According to the World Health Organisation (WHO, 2023), 1.28 billion people in the world aged between 30 and 79 are affected by this condition. It is

one of the leading causes of premature death worldwide. The treatment of high blood pressure is based on a change in lifestyle, and can also be supported by a course of medication. This means starting to exercise, reducing or stopping alcohol and tobacco consumption, and eating more vegetables, fruit and low-fat foods, for example. If all these measures are not sufficiently effective in reducing the patient's high blood pressure, a course of antihypertensive medication will be required (Elliott, 2007).

2.8.2. Hypotension

Low blood pressure (hypotension) is characterised by abnormally low pressure in the bloodstream. There are two main types of hypotension: orthostatic hypotension (when moving from a lying or sitting position to a standing position) and postprandial hypotension (around 2 hours after each meal). In the case of this pathology, the blood circulates poorly and the brain is therefore not adequately irrigated and functions poorly. As a result, the patient is prone to fainting. Fatigue, dizziness, blurred hearing and vision also occur. It is diagnosed in the same way as arterial hypertension, in other words by measuring blood pressure using a blood pressure monitor. If the hypotension is not stabilised, the general organs will not have the sufficient quantity of blood they need to function, which could lead to circulatory shock.

Low blood pressure can be caused by a number of factors, including:

- Heart or blood vessel disorders (heart failure, infarction, heart valve disease).
- Severe dehydration.
- Significant previous haemorrhage.
- Certain medications (antihypertensives, diuretics, antidepressants).
- Parkinson's disease.

Treatment of hypotension depends on the cause. For example, if you are taking medication that causes hypotension, you will need to reduce or stop this treatment, while remaining under medical supervision. In some cases, compression stockings may be recommended to improve blood circulation (Luciano et al., 2010 ; Bradley & Davis, 2003).

2.8.3. Congenital heart disease

Congenital heart disease is a heart disease characterised by a malformation of the heart during its formation in the womb. These malformations can be found in the chambers, walls, valves or blood vessels close to the heart. Symptoms include excessive sweating,

extreme fatigue, rapid heart rate, shortness of breath, chest pain, cyanosis and pimpled fingernails. They are diagnosed using electrocardiograms, x-rays and pulse oximetry.

In the case of non-viable malformations, the parents of the foetus may be offered a therapeutic abortion.

The most common cardiac malformations are ventricular septal defects, atrial septal defects, stenosis and patent ductus arteriosus.

Their severity can vary, from a very minor condition that causes no problems to a more serious one that requires treatment. Treatment consists of catheterisation or can go as far as open-heart surgery (Sun et al., 2015).

2.8.4. Heart failure

Heart failure is characterized by a condition in any cardiac ailment where, despite sufficient ventricular filling, the heart's ability to pump blood is diminished, or it is incapable of maintaining a sufficient rate to meet the tissue demands, all while keeping functional parameters within normal limits (Denolin et al., 1982). There are 2 types of heart failure, systolic (the heart contracts less vigorously and ejects less blood than it receives) and diastolic (the heart does not fill to its maximum capacity and the total amount of blood ejected during each contraction may therefore be insufficient). This syndrome is distinguished by fatigue, dyspnoea, signs of volume overload, abdominal swelling, peripheral oedema, paroxysmal nocturnal dyspnea and pulmonary rales. Diagnosis is based on an assessment of the patient's history, a physical examination, a chest radiograph, an electrocardiogram and laboratory tests. A third heart sound, displacement of the apex of the heart and interstitial oedema are signs that confirm heart failure. There are many causes of heart failure, including coronary artery disease, hypertension, idiopathic cardiomyopathy, valvular heart disease, endocrine/metabolic disorders and arrhythmia (King et al., 2012). With regards to the treatment of this pathology, it will be based on alleviating symptoms, improving exercise tolerance, reducing the rate of hospitalisation, halting the progression of the disease and improving the prognosis. The first step is to change lifestyle and diet. In addition, a course of medication may be prescribed, including digoxin, diuretics and angiotensin-converting-enzyme inhibitors (ACE inhibitors), which have been used for decades but are now being supplemented by beta-blockers and aldosterone antagonists. On the other hand, surgical treatment may also be proposed, but this is fairly rare, as medication is the most common (Rickenbacher, 2001).

2.8.5. Cardiac murmurs

Heart murmurs is characterised by an abnormal noise when a turbulent blood flow causes a prolonged and audible vibration of a cardiac structure. Its intensity varies according to several factors such as the viscosity of the blood, its speed, and the extent of the turbulence produced. There are 3 types of murmur, which can be systolic, diastolic or continuous (starts in systole and continues for part or all of diastole) (Bouchardy, Schlueter, 2005). Heart murmurs are diagnosed firstly by auscultation of the patient using a stethoscope and secondly by echography analysis. Clinically insignificant heart murmurs are referred to as "innocent" heart murmurs. Diastolic and continuous murmurs are always pathological, whereas systolic murmurs can be innocent. Abnormal murmurs are caused by abnormal communication between the heart chambers, blood vessels or both, and by diseased heart valves. These disorders may be:

- Congenital:
  - Cyanotic: tetralogy of Fallot and single ventricle.
  - Non-cyanotic: primum atrial septal defect, ventricular septal defect and patent ductus arteriosus.
- Acquired: rheumatic heart disease, senile calcific aortic stenosis and mitral valve prolapse.

The treatment of heart murmurs depends on the type of murmur, its intensity and the presence or absence of cardiac symptoms. Certain medications will be prescribed and the patient will be asked to limit his or her activity (Lessard et al., 2005).

2.8.6. Myocardial infarction

Myocardial infarction (or acute myocardial infarction (AMI)) is a disorder more commonly known as heart attack. This pathology results in the formation of plaque inside the arteries, reducing blood flow and preventing it from circulating normally to the heart. This degrades the heart muscle, leading to its necrosis due to a lack of oxygen. This disturbance leads to symptoms such as chest pain, shortness of breath, sweating, nausea, vomiting, abnormal heart rhythm, anxiety, fatigue, weakness, stress or depression. Myocardial infarction is diagnosed with the help of an electrocardiogram, as well as blood tests to measure proteins and fats levels in the blood. In addition, a coronary angiography and an X-ray of the heart and blood vessels are performed using a contrast agent. This syndrome is caused by the accumulation of deposits of fat, cholesterol and plaque around the blood vessels (also known as atherosclerosis). This is promoted by certain risk factors

such as smoking, drugs, high blood pressure, high cholesterol, excessively fatty diet, diabetes, obesity, lack of exercise or family history of heart disease. In the event of heart attack, the patient must be rushed to emergency immediately. Certain medicines can be taken in the event of symptoms of myocardial infarction, such as:

- Aspirin, which will break up the clot formed by the plaques.
- Thrombolytics, which dissolve the clot.
- Analgesics to control or reduce pain.
- Antihypertensives to reduce blood pressure and oxygen demand.
- Anticoagulants to reduce the formation of blood clots.
- Dopamine, to increase blood flow to the heart.

In addition, it will also be possible to carry out surgical procedures to prevent this pathology, such as angioplasty, coronary bypass surgery, the fitting of a pacemaker and even a heart transplant (Lu et al., 2015).

2.8.7. Angina pectoris

Angina is pain and/or a feeling of heaviness or pressure in the chest due to myocardial ischaemia. They are mainly caused by an accumulation of atheromatous plaque leading to a reduction in the lumen of the arteries. There are two types of angina pectoris:

- Stable angina: when the characteristics of presentation, severity and precipitating factors remain unchanged for several weeks without worsening over time.
- Unstable angina (belonging to the acute coronary syndromes): episodes appear at any time with a greater duration and intensity and a different location.

This illness is treated by changing lifestyle and reducing cardiovascular risk factors as far as possible (smoking, excessive salt consumption, high cholesterol, etc), as well as by pharmacological treatment (aspirin, beta-blockers, anti-calcium drugs, etc.) (Rutishauser et al., 2001).

2.8.8. Cardiac arrhythmias

Arrhythmias are a pathology that can affect patients of any age. They are characterised by an irregular heartbeat. This disturbance in myocardial pulsation may be too fast, known as tachycardia (>100 beats/min), or too slow, known as bradycardia (<60 beats/min). Symptoms of this disorder include dizziness, palpitations, shortness of breath, weakness, chest pain and rapid heartbeat. Diagnosis is made by means of an

electrocardiogram and blood pressure analysis to identify irregular heart rhythms (Fu, 2015). There are various disorders that cause this pathology, including:

- Anxiety.
- Thyroid disorders.
- Infectious pathologies.
- Cardiac pathologies such as heart failure, atherosclerosis and heart valve disease.
- Respiratory disorders.
- Overconsumption of coffee, tea, alcohol or tobacco.
- Consumption of certain medications (Dominguez et al., 2005).

Treatment consists of ventricular defibrillation and implanting a pacemaker. In addition, antiarrhythmic drugs may be prescribed to keep the heart rhythm within normal limits and prevent further arrhythmia (Fu, 2015).

2.8.9. Stroke

According to the World Health Organization, **cerebrovascular accident (CVA)** is defined as the "rapid development of localized or global clinical signs of cerebral dysfunction, with symptoms lasting more than 24 hours and leading to death, with no apparent cause other than a vascular origin". There are a number of causes of stroke, including:

- Atherosclerosis.
- Drugs (cannabis, cocaine).
- Arterial hypertension.
- Coagulation and haemostasis abnormalities.
- Brain tumours.
- Cranial trauma.

There are a number of risk factors which favour the appearance of these disorders:

- Non-modifiable: advanced age, gender, ethnicity, socio-economic background and family antecedents.
- Modifiable: arterial hypertension, tobacco and alcohol consumption, hormonal treatment and contraception (Béjot et al., 2009).

In the event of a stroke, certain symptoms may alert us to its onset, such as hemiparesis with numbness or weakness of the face, arm or leg; confusion or difficulty speaking or understanding; difficulty seeing out of one or both eyes; dizziness, difficulty walking, loss of balance or coordination; severe headaches (Beal, 2010). In the treatment of

cerebrovascular accidents, thrombolytic drugs are administered to dissolve blood clots. Antihypertensive drugs are also prescribed to lower blood pressure. Surgery may also be required (Marsh, 2010).

2.8.10. Wolff–Parkinson–White syndrome

Wolff–Parkinson–White syndrome (WPWS) is a heart rhythm disorder caused by ventricular electrical pre-excitation syndrome. This is a congenital condition in which there is an abnormal extra electrical pathway in your heart. When triggered, the extra pathway causes a rapid heart rate (tachycardia). However, some patients are asymptomatic. This pathology is caused by the existence of an accessory conduction pathway formed during early incorrect folding of the atrium and ventricle during cardiac embryogenesis. Electrically conductive myocardial bundles penetrate the normal electrical insulation of the atrium and ventricle, forming this additional atrio-ventricular conduction pathway. The most important test for detecting this syndrome is the electrocardiogram. Asymptomatic patients will not need to be treated immediately, but they will still need to be monitored regularly by a cardiologist. Patients at high risk will need to be prescribed preventive anti-arrhythmic drugs and may be subject to surgery to remove the accessory pathway (Chhabra et al., 2023).

2.9. Dermatological disorders

Dermatological disorders can be limited to superficial cutaneous problems, but they can also serve as external signs revealing more complex internal problems. Some of these conditions are benign, while others may be recurrent or more serious. In our study, the most common skin condition was psoriasis.

Psoriasis is a chronic inflammatory skin disease with autoimmune pathogenic features and a genetic tendency. Treatment for this pathology will depend on its severity, the patient's co-morbidities and access to health services. Depending on the clinical severity of the lesions, the body surface area affected and quality of life, patients will be categorised as either mild or moderate, or as severe. Patients with mild to moderate psoriasis are treated topically with glucocorticoids, vitamin D analogues and phototherapy. Patients with moderate to severe psoriasis are generally treated with systemic therapy (Rendon et al., 2019).

2.10. Cancer

Cancer includes a wide range of diseases that can form in almost any organ or tissue of the body, where abnormal cells multiply in an uncontrolled way.

Cancer can lead to the formation of malignant tumours, where cancer cells spread beyond their normal boundaries to invade neighbouring tissues or spread to other organs. This is known as metastasis and is a leading cause of cancer-related deaths (Brown et al., 2023).

In men, the most common cancers are lung, prostate, colorectal, stomach and liver. In women, the most common cancers are breast, colorectal, lung, cervical and thyroid. Some risk factors increase the likelihood of developing cancer, such as advanced age, genetic mutations, family history of malignancy, lifestyle and environmental factors or dietary habits (Sung et al., 2021).

Most of the time, cancer treatment is based on radiotherapy or chemotherapy, but it can also be supplemented by the surgical removal of the cancerous tumour (Torre et al., 2012).

2.11. Neurological disorders

These can complicate the healing process and the overall patient response to surgery.

2.11.1. Alzheimer's disease

Alzheimer's disease is characterised by a degeneration of the brain leading to major changes in memory, cognitive functions and/or behaviour, with a significant impact on the daily lives of those affected. It is the most common neurodegenerative disease.

The risk factors for this disease are multifactorial, involving age, environmental and genetic factors. At present, the etiology of this disease is still unknown. (Association France Alzheimer, 2006). The most common symptoms of this disease are memory loss, temporal and physical disorientation, and a deteriorating sense of language and comprehension (Soria Lopez et al., 2019).

In terms of treatment, Alzheimer's disease remains incurable today. However, there are both drug and non-drug treatments available to support patients. There are four main drugs used for this disease: donepezil, memantine, galantamine and rivastigmine. There are also non-pharmacological therapies, which involve increasing physical activity, cognitive training, improving nutrition and slowing cognitive and functional decline (Passeri et al., 2022).

2.11.2. Parkinson's disease

Parkinson's disease is a progressive idiopathic neurological disorder with motor and non-motor symptoms. It is a chronic neurodegenerative disease that affects patients of all ages. It is the second most common neurodegenerative disease.

There are three main risk factors for this disease: age, family history and exposure to pesticides. Symptoms include resting tremor, bradykinesia, postural instability and rigidity, to this will be added cognitive, behavioural and neuropsychiatric problems. With regard to diagnosis, in addition to the symptoms, a detailed history and physical assessment of the patient must be carried out.

Treatment for this neurological disorder involves a number of procedures, both medicinal and non-medicinal. These days, non-drug treatments are used extensively and are constantly being developed. They include psychomotor exercises, educating the patient and his or her family about the disease, speech therapy sessions, a suitable diet and attendance at support groups. This could be supported by a medical prescription for dopamine, anticholinergics, injectable dopamine agonists or monoamine oxidase-B inhibitors, for example (Beitz, 2014).

2.11.3. Epilepsy

Epilepsy is a chronic brain condition manifested by a persistent tendency to suffer seizures, without necessarily being caused by immediate damage to the central nervous system. The neurobiological, cognitive, psychological and social repercussions of these seizures are also significant. It is nevertheless important to note that not all people with epilepsy have seizures, and not all people who have seizures are necessarily epileptics (Beghi, 2019). There are four main etiological families causing this disease: idiopathic/genetic (benign familial neonatal convulsions, benign adult familial myoclonic epilepsy, benign partial epilepsies of childhood); symptomatic (Lennox-Gastaut syndrome, tuberous sclerosis, neurofibromatosis, Down syndrome, hemimegaloencephaly); provoked (drug-induced seizures, fever, metabolic and endocrine-induced seizures, photosensitive epilepsies, auditory-induced epilepsy); cryptogenic (unknown origin) (Shorvon, 2011).

Epilepsy can be treated in a variety of ways, using both drugs and surgical procedures. The choice of medication is determined by individual factors such as age, sex, the possibility of having children, concomitant medical conditions, tolerance problems and the type of crisis (example: benzodiazepines, phenobarbital, carbamazepine).

The sectioning or disconnection of a specific area of the brain is envisaged to achieve total seizure control, or even simply to stop disabling seizures (Thijs et al., 2019).

2.12. Autoimmune disease

Autoimmune disease is characterized by a dysfunction of the body's immune system, causing the body to attack its own tissues (Bellone, 2005). The onset of this type of pathology depends on genetic and environmental factors. The majority of autoimmune diseases involve a multigenic genetic component, characterized by the presence of several susceptibility genes. It is the genetic polymorphisms linked to other susceptibility genes that are involved in the autoimmune response. Environmental factors contributing to this disorder include viruses and bacteria, certain metals such as mercury, gold and silver, and synthetic chemicals such as pesticides, hormone blockers and fungicides.

These pathologies can also hinder the healing process and affect the patient's overall reaction to surgery.

Today, there is still no cure for autoimmune diseases. At best, it will only be possible to treat or alleviate the symptoms of certain diseases and reduce the activity of the immune system, while preserving its ability to fight foreign pathogens Singh et al., 2016).

2.13. Syphilis

Syphilis is a disease caused by the bacterium *Treponema pallidum subsp pallidum*, and is generally transmitted sexually or during pregnancy. It is known for its invasive nature and ability to evade the immune system. Clinically, this disease is characterized by local inflammatory recurrences and the appearance of spirochetes. Most of the time, this disease is diagnosed by serological analysis.

This pathology is treated with a course of antibiotics. Drugs such as benzathine penicillin G and procaine penicillin are used intramuscularly for early and late syphilis, or aqueous benzyl penicillin intravenously for congenital syphilis.

2.14. Sinusitis

Sinusitis is an inflammation affecting the nose and paranasal sinuses. It may occur in acute (<4 weeks), subaiguë (between 4 and 12 weeks) or chronic (>12 weeks) forms. A wide range of causes can lead to this syndrome, including viral infections, anatomical variations, smoking, dental infections, scuba diving, high-altitude climbing and diabetes.

Hyposmia, rhinorrhoea, fever, dental pain, nasal obstruction, pressure, pain or sensitivity in the face are symptoms of this disorder.

For the treatment of acute sinusitis, it is advisable to prescribe analgesics. In most cases, acute sinusitis disappears spontaneously. The treatment of chronic sinusitis begins with topical steroids. He can then be helped by antibiotics and saline sprays. If these prescriptions fail, surgical treatment may be considered (Ah-See & Evans, 2007).

3. Prevalence of the most common diseases in Europe

3.1. Cardiac diseases

3.1.1. Hypertension

Hypertension is the leading preventable cause of cardiovascular disease worldwide. Compared with all regions of the world, Europe has the highest prevalence. It stands at 55.0% in 2019 (Reuter & Jordan, 2019). In 2003, this same prevalence was 44.2%, with a fairly wide disparity within Europe itself, with, for example, 55.0% in Germany, 47.0% in Spain and 38.0% in Italy. The prevalence of hypertension increases with age. In Germany, it was 40.0% in the 35-44 age group, 75.0% in the 55-64 age group and 85.0% in the 65-74 age group. Similarly in Sweden, it was 20.0% in the 35-44 age group, 55.0% in the 55-64 age group and 70.0% in the 65-74 age group (Wolf-Maier et al., 2003).

3.1.2. Heart attack (myocardial infarction)

It is the most common coronary heart disease and accounts for 15.0% of mortality each year. In all age groups, the prevalence of myocardial infarction is higher in men than in women. In the UK, for example, 640 000 men and 275 000 women suffered heart attack in 2014. The prevalence of cardiac arrest increases with age:

- Among British people aged 45-54: the prevalence is 1.1% for men and 0.3% for women.
- Among British people aged 65-74: the prevalence is 7.0% for men and 2.1% for women.
- Among British people aged over 75: the prevalence is 12.1% for men and 5.5% for women (Jayaraj et al., 2018).

The difference between the sexes was the same from 2000 to 2010. In 2000, 40 million men in Finland had suffered a heart attack, compared with just 7.5 million women. In

2007, the pattern was again the same, with 37.5 million Finnish men affected compared with 8 million women. We can also take France as an example. In 2003, 20 million men were affected compared with 3.5 million women. The same scenario in 2010, with 17.5 million men affected and 2.5 million women.

We note, however, that over the years, prevalence has on average fallen sharply in a large number of European countries, in both the 35-64 and 65-74 age groups (Dégano et al., 2015).

3.1.3. Patient on antiplatelet or anticoagulant medication

There was a fairly wide disparity in the use of antithrombotic in Europe in the second decade of the 2000s.

Indeed, there has been a decrease in the use of antiplatelets in various European regions. In the United Kingdom, prevalence fell from 16.2% in 2010 to 11.6% in 2018. The same applies to Denmark, where it fell from 17.0% in 2010 to 13.3% in 2018. Spain and Italy experienced a smaller decline, with decreases of 2.3% and 2.0% respectively between 2010 and 2018.

However, we note that the opposite is true of anticoagulants. There has therefore been an increase in their use over the same period. In the United Kingdom, prevalence has risen from 3.1% in 2010 to 4.9% in 2018. The same is true of Denmark, where prevalence rose from 3.1% in 2010 to 5.6% in 2018. The increase remains gentler for Italy and Spain, with prevalence rising by 1.0% and 0.8% respectively between 2010 and 2018 (García Rodríguez et al., 2021).

3.2. Respiratory diseases

3.2.1. Chronic obstructive pulmonary disease (COPD)

The values for age-standardised prevalence rate (ASPR) per 100 000 were measured between 2001 and 2019, and show a gender disparity.

Over this period, 23 of the 28 countries showed a fall in the prevalence of this disease among men, while this was the case for only 11 countries among women.

The median variation for European men was -9.7% (in other words -372.9 per 100 000), for women it was 4.3% (in other words 97 per 100 000).

In 2019, for COPD, the median ASPR per 100 000 was 3 230 for men and 2 202 for women.

Among men in 2019, the highest prevalence rate was seen in Belgium with 4 345 cases per 100 000, Denmark with 4 214 cases per 100 000 and Hungary with 4 123 cases per 100 000. Among women, the highest rates were found in Denmark with 4 378 cases per 100 000, the Netherlands with 3 990 cases per 100 000 and the United Kingdom with 3 900 cases per 100 000.

Again in 2019, in the same way, the lowest prevalence rate among men was observed in Latvia with 1 844 cases per 100 000, Estonia with 1 936 cases per 100 000 and France with 2 351 cases per 100 000.

Among women, the rate was 970 cases per 100 000 in Latvia, 1 061 cases per 100 000 in Lithuania and 1 082 cases per 100 000 in Estonia.

For both men and women, the biggest fall in ASPR between 2001 and 2019 was seen in Lithuania, down 32.1% and 29.9% respectively (Marshall et al., 2022).

3.2.2. Asthma

In 2009, a study highlighted the prevalence in five European countries, including France, Germany, Italy, Spain and the United Kingdom. It showed that in these five countries combined, there were 14 million people affected by this disorder, or 5.8% of the adult population. Prevalence was significantly higher in the United Kingdom with 4.67 million cases (10.0%), in contrast to France with 2.28 million cases (4.8%), Germany with 3.27 million cases (4.8%), Italy with 2.26 million cases (4.6%), and Spain with 1.58 million cases (4.8%), which have a much lower proportion of sufferers (Demoly et al., 2009).

In 2013, the European Respiratory Society published information on the prevalence of asthma in Europe for adults aged between 18 and 44.

It was reported that:

- More than 9.0% of the population had asthma in France, United Kingdom, Ireland, Belgium, Netherlands, Finland and Scandinavia.
- Between 8.9% and 6.0% in Iceland, Spain, Portugal, Italy and Germany.
- Between 5.9% and 3.0% in Poland, Croatia, Czech Republic and Serbia.
- Less than 3.0% in most Eastern European countries such as Russia, Ukraine, Romania and Estonia.

This shows a fairly wide disparity in the prevalence of this condition between Eastern and Western Europe (Lundbäck et al., 2015).

3.3. Gastric diseases

3.3.1. Gastroesophageal reflux disease

According to a study published in 2017, the prevalence of people with symptoms of gastro-oesophageal reflux disease is 17.1%. If we look in more detail, we can see in particular that it is:

- Less than 10.0% in France and Denmark.
- Between 10.0% and 14.9% in Italy, Belgium, Denmark, Norway and Finland.
- Between 15.0% and 19.9% in Spain, Germany, Sweden and Russia.
- Between 20.0% and 24.9% in the United Kingdom, Iceland and Turkey.
- Over 25.0% in Poland, Greece and Romania.

In addition, according to the same study, the prevalence rate in northern Europe is 15.5%, compared with 21.3% in southern Europe (Eusebi et al., 2017).

According to a Swedish study conducted in 2005, in which 1 000 candidates answered a questionnaire, 259 participants reported suffering from gastro-oesophageal reflux, giving a prevalence rate of 25.9% (Ronkainen et al., 2005).

According to another Swedish study by actant in 2011, which questioned 2 373 people aged between 40 and 59, no fewer than 1 483 of them reported suffering from heartburn and/or regurgitation at least once a week. This represents a proportion of 8.8% (Löfdahl et al., 2011).

These last two studies show that the trend towards gastro-oesophageal reflux is increasing year on year (El-Serag et al., 2014).

3.3.2. Chronic gastritis

There are relatively few studies on the prevalence of chronic gastritis in Europe.

A 2015 study of a Finnish population showed that the prevalence of this condition increased with age. In the 20-29 age group, 29.0% of cases were found. In the 40-49 age group it was 50.0%, while in the 60-69 age group it was 76.0%. Among the over-80s, the figure was even as high as 85.0% (Sipponen & Maaroos, 2015).

In a study dating from the year 2000, it was also noted that, at that time, prevalence was also increasing with age. In fact, 28.0% of the 35-44 years-old surveyed had gastritis. Similarly, in the 55-64 age group, 45.0% suffered from this disorder. In people over 75, it was noted that 81.0% of this age group had gastritis. In total, of the 496 people monitored, 50.0% were affected by gastritis (Borch et al., 2000).

3.3.3. Bariatric Surgery

Bariatric surgery is a fairly common method used to reduce an individual's weight by reducing the amount of food consumed.

There are three main techniques for this type of surgery: gastric bypass, sleeve gastrectomy and gastric banding.

According to an article published in 2015, gastric bypass is the preferred technique in the vast majority of European Union countries.

Indeed, it has been shown that every year there are 8 000 gastric bypass operations in Belgium (representing 80.0% of the operations carried out in this country), 4 000 in England, 7 500 in Sweden (representing 98.0% of the operations carried out in this country), 18 000 in France and 3 000 in Italy.

Gastric banding is used more frequently in France, England and Italy, with a percentage of 19.0%, 21.0% and 37.0% respectively (Borisenko et al., 2015).

There is also a wide gender disparity in the prevalence of these surgical procedures. In fact, for a number of years now, women have been more likely to undergo these operations.

For example, a French study in 2019 showed this gender disparity. In 1997, out of a cohort of 2 793 people, 2 328 women underwent an operation, while only 465 men did, so 83.4% of the operations were performed on women.

The same was true in 2007, when a total of 22 382 surgical procedures were carried out, of which 3 054 were for men and 19 328 for women, the latter accounting for 86.4% of all operations.

More recently, in 2016, for a total of 55 655 surgical operations, 80.3% were performed on women, in other words 47 609 procedures against 11 674 for men.

It's easy to see that between the 1990s and the 2010s, there has been a marked increase in the number of cases requiring these interventions (Halimi, 2019).

3.4. Renal diseases

3.4.1. Chronic kidney disease

Chronic renal disease is a disorder that is relatively poorly recorded and studied in Europe. The most comprehensive study we have been able to find on the prevalence of this disease dates back to 2009.

In particular, it reports that in the case of young people under the age of 20, the prevalence is 74.7 cases per million age related population (pmarp) in Italy and 21 pmarp cases in Sweden, for example.

In adult men, the prevalence of stage 3-5 CKD ranges from 3.6% in Norway to 7.2% in Germany. In adult women, it varies from 6.2% in Italy to 10.2% in Iceland.

The prevalence of this disease is fairly uniform across the countries of the European Union, with a higher incidence in women than in men.

However, the prevalence of stage 3-5 CKD in all European countries shows that it increases with age (Zoccali et al., 2009).

3.4.2. Renal replacement therapy (RRT)

Renal replacement therapy (RRT) is a treatment method designed to replace the natural blood-filtering function of the kidneys. This therapy encompasses several modalities, such as dialysis, hemofiltration, hemodiafiltration and kidney transplantation.

In 2015, the total prevalence of renal replacement therapy was 801 pmp (per million population). This prevalence varies widely across Europe, with 1 824 pmp in Portugal and 1 355 pmp in Catalonia, and only 303 pmp in Russia and 178 pmp in Ukraine. Men are more likely to be affected (60.0%) than women (40.0%).

The average age of the disease is 60.8, ranging from 48.6 in Ukraine to 66.8 in Portugal. Of all the patients affected, 58.0% were receiving hemodialysis, 36.0% had undergone a kidney transplant and 5.0% were on peritoneal dialysis. The percentage of patients undergoing a kidney transplant decreased with age. Among patients aged between 20 and 44, 66% were living with a kidney transplant, whereas among those aged between 65 and 74, the figure was 42.0% (Kramer et al., 2017).

3.5. Diabetes mellitus

Diabetes is a significant chronic disease in Europe. Indeed, in 2019, no fewer than 32.3 million adults were diagnosed with this disease on our continent. There has been a marked increase in the number of people affected by this disease: in 2000, for example, 16.8 million people were diagnosed. It is estimated that 20.4 million people have diabetes but are unaware of it.

Due to biological factors, men are more likely to have this condition than women, and this figure has risen considerably in recent years, from 7.3 million in 2000 to 16.7 million diagnosed in 2019. Similarly for women, 9.5 million were diagnosed in 2000, compared

with 15.6 million in 2019 (IDF, 2019). Women are more likely to be affected after the age of 70 because they have a longer life expectancy than men.

In Europe, this chronic problem is progressive and changes with age:

- In the 60-79 years old, 19.3 million are affected.
- In the 40-59 years old, 11.3 million people are affected.
- In the 20-39 years old, 1.7 million are affected.

In 2019, the prevalence of adult diabetes in EU countries averaged 6.2% and is tending to stabilise. Ageing, physical inactivity and obesity are causing a slight increase in prevalence in the countries of Southern Europe and Central and Eastern Europe. The level of education must also be taken into account in the prevalence of this disease. It has been observed that people with a lower level of education are more likely to be affected (NCD Risk Factor Collaboration, 2016).

4. Post-operative complications

4.1. Immediates

4.1.1. Swelling

Oedema is a localised disturbance in the balance of water and electrolyte exchange between blood plasma and interstitial fluids, occurring through the walls of the capillaries. It is characterised by inflammation, low predictability and random intensity. It lasts no longer than one week and is variable, lasting from two to four days. This is a normal part of the healing process (Dudala, 2003).

There are various techniques for reducing and treating post-operative tooth edema, which may be pharmacological or non-pharmacological.

In the case of pharmacological techniques, antibiotics (which can also be prescribed before the operation), corticosteroids and steroids are generally used. Non-pharmacological techniques include surgical techniques, cryotherapy and the use of lasers (Pandey et al., 2020).

4.1.2. Pain

According to the European Federation of Pain (EFIC), pain is defined as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.

Pain is therefore perceived differently by each person, depending on their sex, age, the practitioner's experience, the location of the extracted tooth and also their lifestyle and smoking habits. Post-extraction dental pain is mainly described as constant pain, shooting pain, dull pain, and pain when chewing or biting. In some cases, however, there may be no pain.

In the event of post-extraction pain, analgesics and anti-inflammatory drugs will usually be prescribed, but these will only be taken if the patient is in real pain (Al-Khateeb & Alnahar, 2008).

4.1.3. Nerve damage

The two nerves most often affected are the inferior alveolar and the lingual, which innerve the mandible. Damage to an oral nerve may subsequently lead to paraesthesia and alteration of taste. During surgery, nerves may experience severance, stretching, or crushing. These injuries can impact the quality of life of patients, leading to emotional, social, and functional impairments. In the event of nerve damage, in some cases it is preferable not to act and to see if the situation returns to normal. In other cases, microsurgery may be required to repair the damaged nerve. However, some authors recommend that if it is discovered during the operation that the nerve has been damaged, it is advisable to repair it directly (Coulthard et al., 2014 ; Kushnerev & Yates, 2015).

4.1.4. Bleeding

Bleeding after a tooth extraction is a normal part of the healing process. When a tooth is removed, it creates a wound in the gum and exposes the extraction site to blood vessels. Bleeding occurs when these blood vessels are damaged during surgery and the blood clotting process is activated to form a blood clot.

This blood clot plays a crucial role in healing by protecting the wound, helping to stop bleeding and promoting the formation of new tissue. Bleeding can vary in intensity depending on the complexity of the dental extraction and the individual's predisposition to bleeding. Because of the increase in the use of anticoagulants such as aspirin, warfarin or clopidogrel, this type of post-operative complication is only becoming more common. This is why, in some cases, patients will be asked to stop their anticoagulant treatment a few days before the intervention (Kumbargere Nagraj et al., 2018).

4.1.5. Allergic reaction

Allergic reactions following dental extraction are rare but possible. They can occur in response to various agents, such as local anaesthetic drugs, antibiotics prescribed after surgery, materials used for sutures or disinfectants.

The symptoms of an allergic reaction can vary in severity and may include skin rash, itching, skin eruptions, swelling of the face, lips or tongue, breathing difficulties, nausea, vomiting and anaphylactic shock in the most serious cases. In the most serious cases of allergy, such as anaphylactic shock in the dental surgery, it will be necessary to administer epinephrine to the patient and to call emergency services so that he can be taken to hospital (Syed et al., 2015 ; Goto, 2023).

4.2. Mediates

4.2.1. Alveolitis

Post-extraction alveolitis is one of the most frequent complications of dental extractions. It involves infection and inflammation of the dental alveolus that has been extracted. There are two types of alveolitis, dry and suppurative.

Alveolitis is a complication that occurs during the healing phase after dental extraction. It manifests itself as intense, pulsating pain due to the exposure of bone in the extraction site. Normally, a clot forms in the socket after extraction to protect the bone. However, when this clot detaches or dissolves prematurely, the nerves and bone are exposed, resulting in intense pain requiring the intervention of a dental professional. Generally, heals spontaneously within a week (Mahiout et al., 2018).

4.2.2. Osteomyelitis

Osteomyelitis is a serious infection of the jawbone. It is characterised by inflammation and destruction of the bone, usually accompanied by pain, paresthesia, fever, trismus or exudation of pus. It can be classified as acute, sub-acute or chronic.

To treat this post-operative problem, it may be necessary to undergo treatment with antibiotics or surgery to remove the infected site and parts of the bone (Lorè et al., 2013 ; Moratin et al., 2020).

5. Objectives and motivation of this study

The aim of this study is to define the impact that certain comorbidities can have post-operatively following dento-alveolar surgery. In other words, to present the medical problems encountered by patients requiring dental extraction, and to highlight the impact of comorbidities on the risk of post-operative complications.

As a final objective, we wanted to characterise the profile of patients attending oral surgery consultations, while at the same time verifying certain associations between some of the variables under study.

II. MATERIALS AND METHODS

1. Type of study

This was a retrospective observational study.

2. Ethical approval

Ethical approval was obtained from Fernando Pessoa Ethical Committee, with reference number FCS/MMED 463/23-3. This included the Research Project Authorisation Request, the Research Project Submission Form to the Fernando Pessoa University Ethics Committee and the Research Project Proposal. These documents detailed each stage of the study, from the methodology to the analysis and interpretation of the data. We emphasised the importance and potential impact of the research on the scientific community and society in general, demonstrating our commitment to strict compliance with all ethical rules and regulations. This ensured the confidentiality of the participants and the validity of the results achieved.

After receiving a positive opinion, data collection for the research began.

3. Sample

The sample for this study comprised 2 011 patients who had undergone at least one dentoalveolar surgery at the Pedagogical Dental Clinic of the of Health Sciences of the Fernando Pessoa University, over a 5-year period (2018-2022).

4. Inclusion and exclusion criteria

The established inclusion criteria included adult patients who have undergone at least one dentoalveolar surgical procedure at the Pedagogical Dental Medicine Clinics of the Faculty of Health Sciences at Fernando Pessoa University (PDMC-FPU) during the study period (2018-2022).

Data to be collected in this research include: demographic data (age and gender), medical comorbidities, smoking habits, oral hygiene habits, type of dentoalveolar surgery performed and postoperative complications.

The established exclusion criteria included child patients.

All inclusion and exclusion criteria defined and employed in this study were based on international literature.

5. Data collection instruments

The data collection involved reviewing the clinical files of patients at the Pedagogical Dental Medicine Clinics of the Faculty of Health Sciences at Fernando Pessoa University (UFP), containing at least one record of dentoalveolar surgery between 2018 and 2022.
The data were gathered and organized into an Excel spreadsheet. Throughout the research process, there was ongoing discussion between the researchers collecting the data and the faculty members for analysis and interpretation of the information from the clinical records.

A numerical code was assigned to each selected case to prevent the identification of participants, thereby ensuring that access to or disclosure of any personal data was avoided.
The data collected included: gender, age, number of times teeth brushed per day, type of toothbrush (soft, medium or hard bristles), whether or not dental floss was used, smoking habits, number of cigarettes smoked per day, number of years of smoking habit, potential pathologies/comorbidities, and whether or not the patient had been subject to at least one post-operative complication.

For each patient, we recorded a maximum of three comorbidities. Therefore, for some patients who had more than three co-morbidities, we retained only the three main ones which seemed to us to be the most prevalent. Let's take a few examples.
For a patient presenting with asthma, diabetes, renal impairment and cardiovascular impairment, we have chosen to retain diabetes, renal impairment and cardiovascular impairment.
For a patient with a gastric problem, epilepsy, asthma, a cardiovascular problem and a liver problem, we recorded the cardiovascular, liver and gastric problems.
For a patient with thyroid problems, kidney disturbance, asthma, Alzheimer’s disease, skin disease and epilepsy, we keep Alzheimer’s disease, thyroid and kidney disturbances.
For a patient with skin disease, kidney disorders, diabetes, syphilis, thyroid disorders, asthma, blood disorders, we have chosen diabetes, kidney disorders and blood disorders.

6. Statistical analysis

The data was exported to the IBM SPSS Statistics programme, where all the statistical analysis for this study was carried out. Descriptive statistics were used (mean and standard deviation) to summarize the data set.

The Chi-Square (Chi^2) statistical test was used to analyse the association between two variables. In all cases, a significance level of 5.0% was considered. Thus, if the test value (p) is greater than 5.0%, then we assume no statistically significant association between the variables, otherwise the association between the variables is statistically significant.

III. RESULTS

In this study, data was retrieved for 2 011 patients, of whom 891 (44.3%) were females and 1 120 (55.7%) males.

The age interval ranged from 18 to 94, with a mean age of 54.9 and a standard deviation of 16.9, with no significant differences between the two sexes.

The ages are evenly distributed according to the histogram and boxplots shown in Figure 1a and 1b, respectively. Comparing men and women, the age distributions are similar, with the average age for men being 54.5 and for women 55.2.

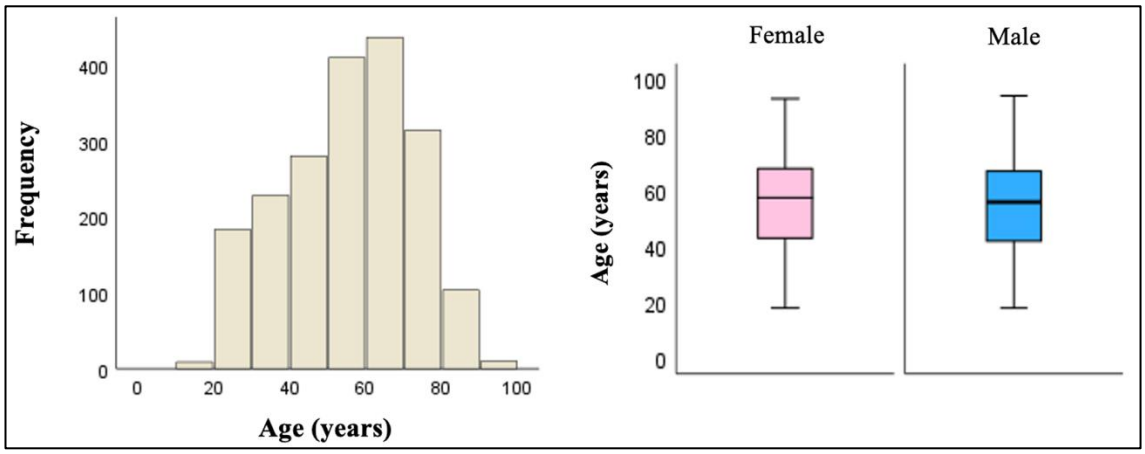


Figure 1a - Age histogram

Figure 1b - Age boxplots by gender

With regard to patients' oral hygiene habits, the majority (52.9%) brush their teeth twice a day. The most commonly used type of toothbrush is one with medium hard bristles (71.5% of the total), regardless of the number of daily brushings.

Figure 2 illustrates the distribution of patients in relation to the type of toothbrush used and the number of daily brushings. 79.0% of these patients are not in the habit of using dental floss in their oral hygiene.

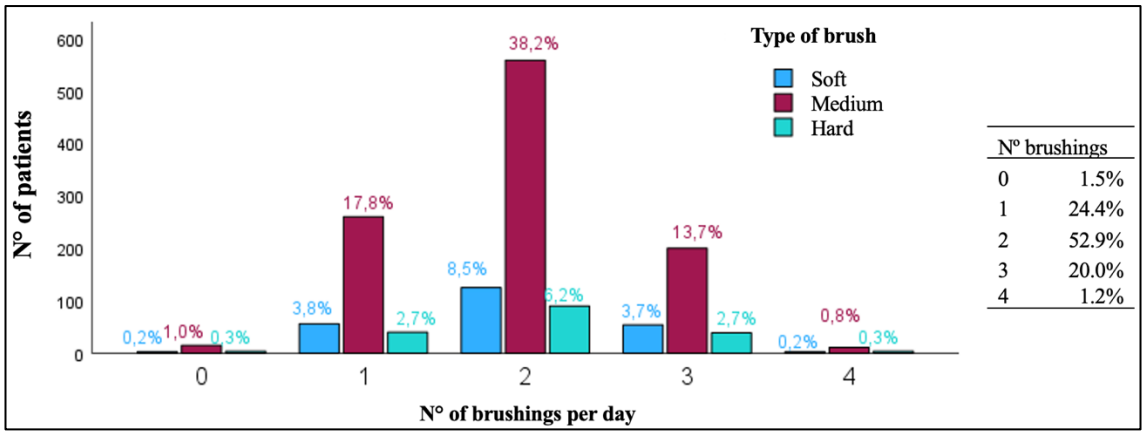
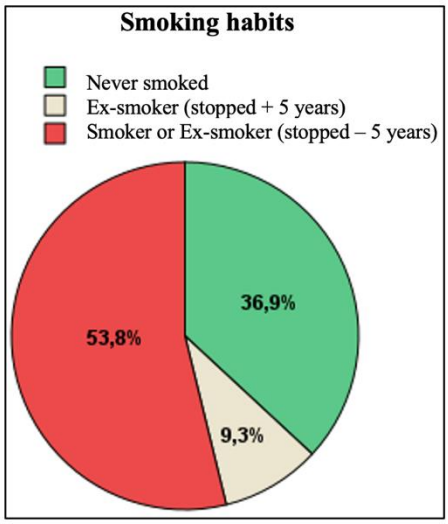


Figure 2 - Distribution of the type of toothbrush used by the number of daily brushings

With regard to the smoking habits of the patients under study, only 561 individuals were reported. Of these, 36.9% have never smoked, which means that the majority currently smoke or have been smokers.

Figure 3 shows the distribution of patients who answered this question with regard to tobacco consumption. Of the 354 (63.1%) smokers, only 248 answered about the number of cigarettes they smoke/smoked daily. On average, these patients smoke 16 cigarettes a day, the minimum number being 1 and the maximum 60. There was also information that these patients had smoked an average of 41.0% of their lives.



Smoking habits	N	%
Never smoked	207	36,9
Ex-smoker (stopped + 5 years)	**52**	9,3
Smoker or Ex-smoker (stopped - 5 years)	**302**	53,8
Total	561	

	Nº cigarettes/day	Nº years smoking	Nº years smoking/age
N	248	47	47
Average	16,2	23,4	0,41
Minimum	1	1	0,03
Maximum	60	67	0,86

Figure 3 - Smoking habits of 561 patients

Of the patients studied, 1 046 (52.0%) had at least one comorbidity.

Table 1 shows the distribution of these patients by number of comorbidities. The comorbidities identified in the study patients are distributed according to the information in Figure 4, with cardiovascular disease being the most prevalent (49.0%), followed by type 2 diabetes (20.0%).

Table 1 - Distribution of patients by number of comorbidities

Number of Comorbidities	N	%
1	692	66,2
2	245	23,4
3	109	10,4
Total	1046	
With Comorbidities?	**N**	**%**
No	965	48,0
Yes	**1046**	52,0
Total	2011	

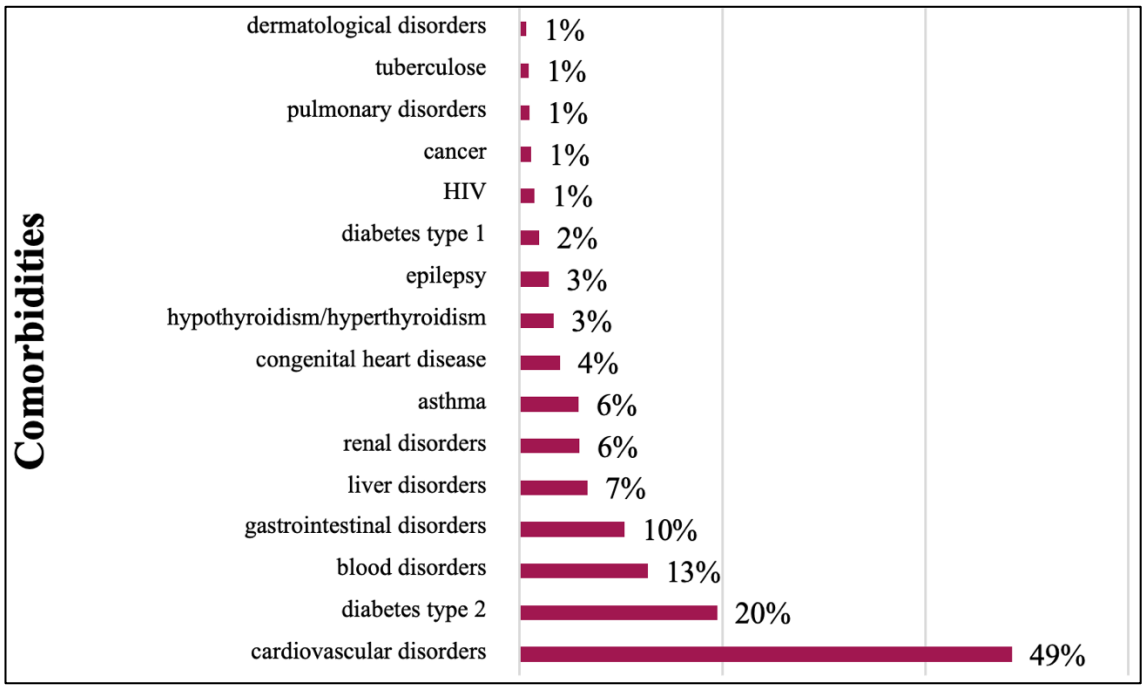


Figure 4 - Patient comorbidities

In relation to post-operative complications, only 182 (9.1%) of the 2 011 patients who attended the first consultation had symptoms.

Table 2 - Distribution of patients by presence or absence of post-operative complications

Post-operative Complications	N	%
No	1829	90,9
Yes	182	9,1
Total	2011	100,0

Analysing the association between the age of patients and the number of comorbidities (Figure 5), we can see, as we would expect, that the individuals with the most comorbidities are older. It should be noted that the minimum age of patients with at least three comorbidities is around 40 years old, while in the group of people with one comorbidity, the youngest patient is around 20 years old. Statistically, this association is significant (Chi^2= 223; p-value <0.001<<5%).

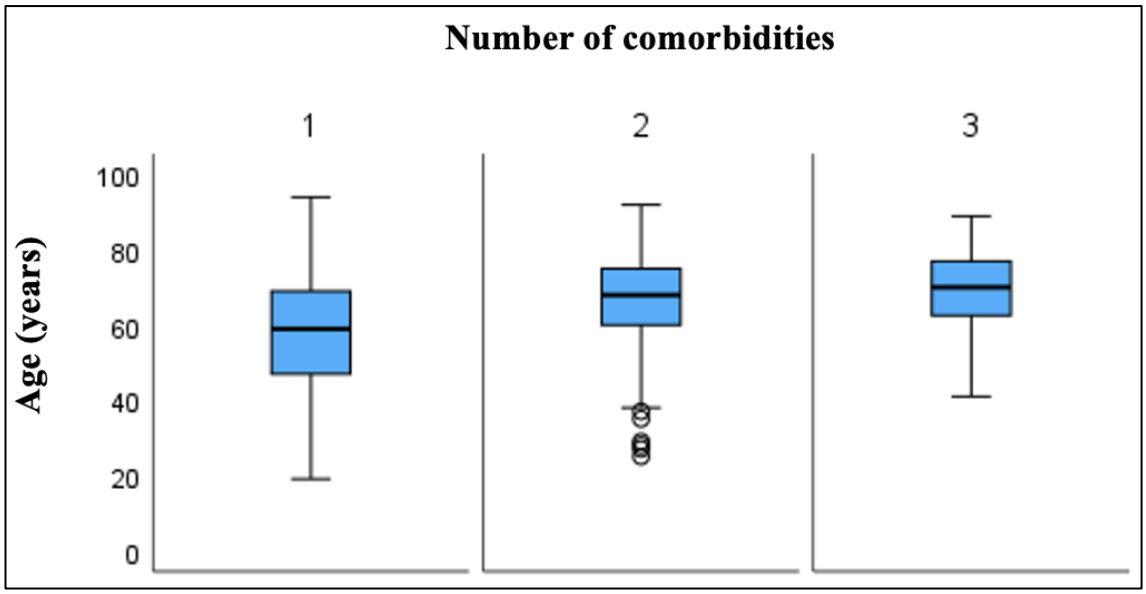


Figure 5 - Distribution of patient ages by number of comorbidities

The aim of this study was to assess the association between smoking habits and post-operative complications (Figure 6). To this end, the Chi^2 statistical test was applied, from which it was concluded that there were no statistical arguments to affirm that this association exists (Chi^2=0.9; p-value=0.6 >5.0%). This conclusion is easy to understand when we see that 29 patients who smoked had complications, while 21 of the non-smokers also had symptoms. As smokers make up 53.8% of patients (302) and non-smokers 36.9% (207), the fact that there are more complications in smokers is to be expected.

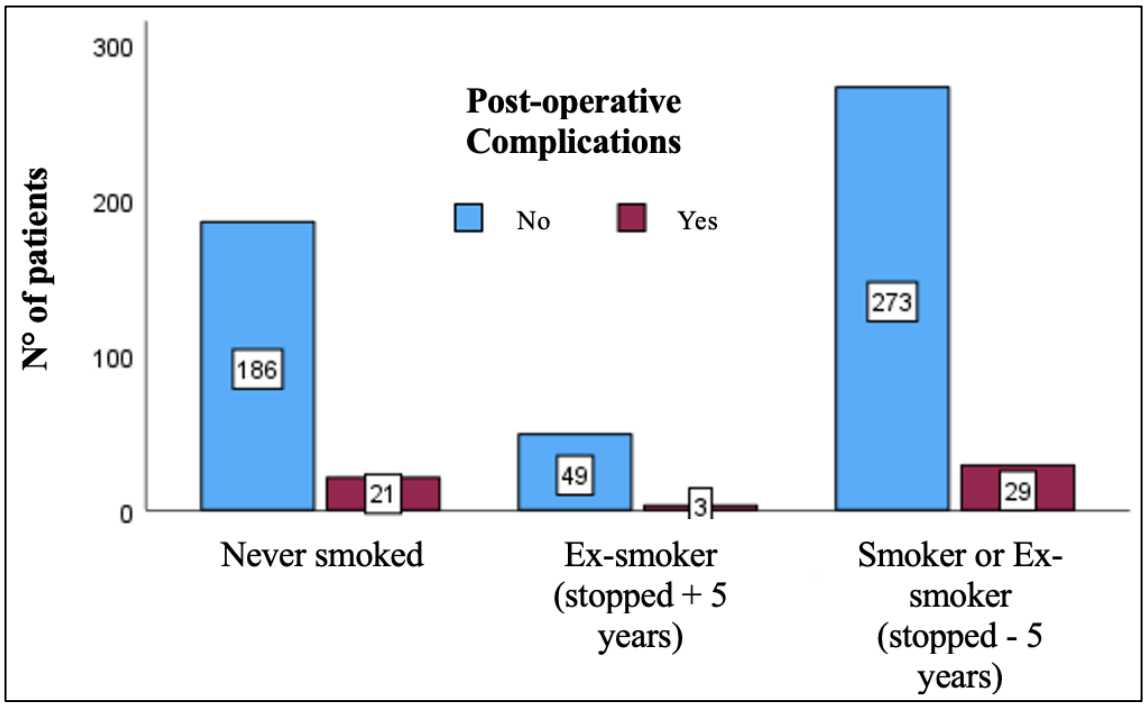


Figure 6a - Distribution of patients in relation to the number of post-operative complications and smoking habits

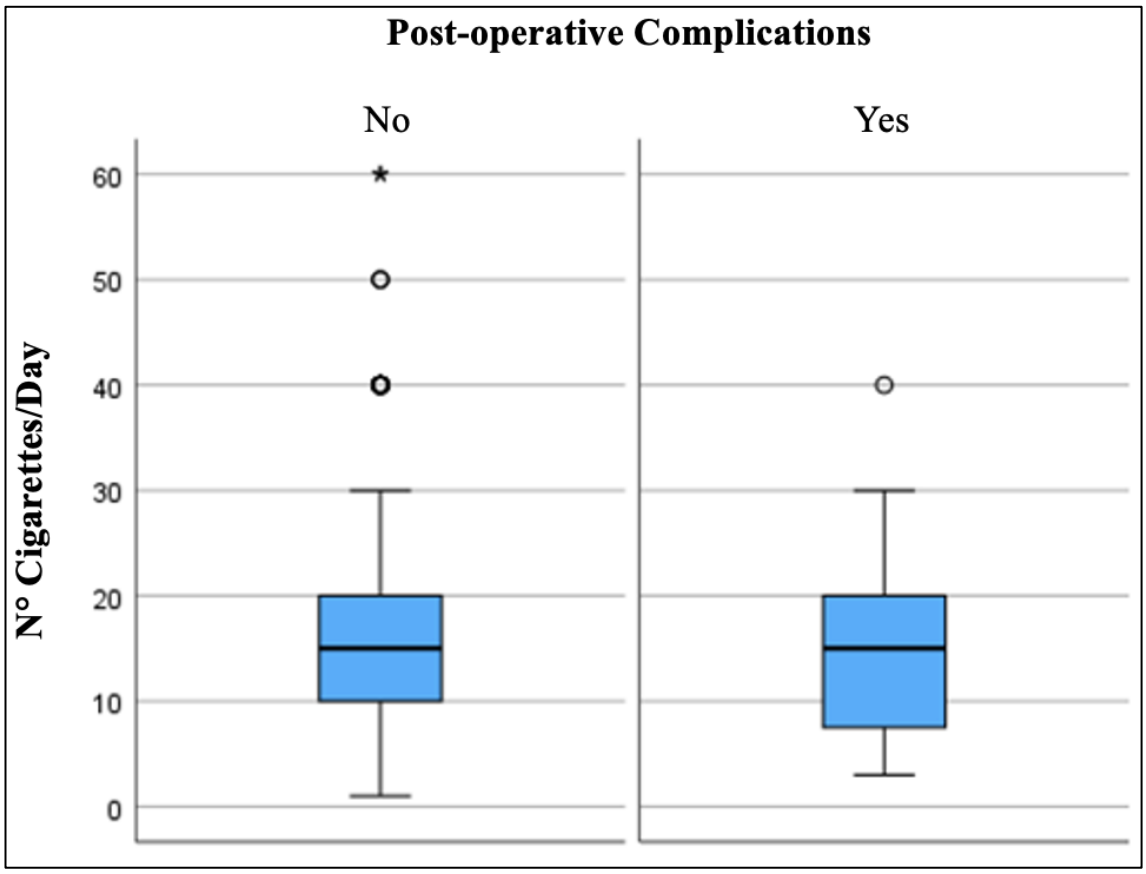


Figure 6b - Distribution of patients in relation to the presence of post-operative complications and smoking habits

Analysing the association between the existence of diagnosed comorbidities and the presentation of post-operative complications (Figure 7a), there are no statistical arguments to affirm that this association exists (Chi^2=0.8; p-value=0.4 >5.0%). The same conclusion can be drawn (see Figure 7b) when analysing the association between the number of comorbidities diagnosed and the presence of post-operative symptoms (Chi^2=0.8; p-value=0.7 >5.0%).

Looking at our results, we can see that whether or not the patients had comorbidities, the vast majority did not have any post-operative complications. It should be noted that 872 of the patients with comorbidities had no complications, compared with 93 who did. Similarly, 957 patients with comorbidities had no post-operative complications compared with 89 who did.

The same observation was made whatever the number of comorbidities affecting the patients. Among patients with one comorbidity, 632 patients had no complications compared with 60 who did. Among patients with two comorbidities, 227 had no complications compared with 18 who did. Finally, among patients with three or more comorbidities, 98 were not affected by post-operative complications, compared with 11 who were.

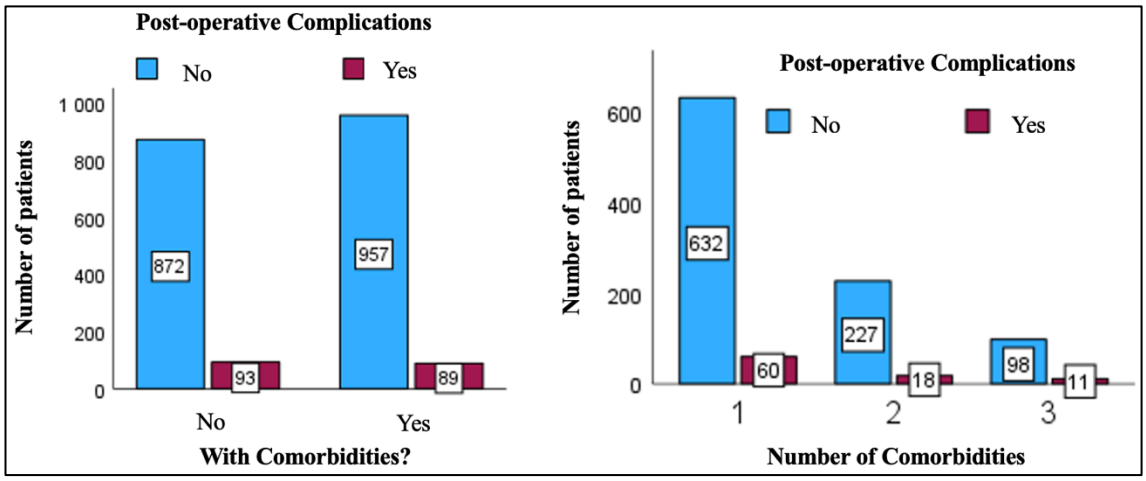


Figure 7 - Distribution of patients relating the presence of post-operative complications and (a) the existence of comorbidities; (b) the number of comorbidities

Analysing the association between the existence of diagnosed comorbidities and the smoking habits of the patients in this study, it can be concluded that this association exists and is statistically significant (Chi^2=16.8; p-value<0.001 <<5.0%). Table 3 shows the distribution of patients in relation to the existence of comorbidities and smoking habits. A similar conclusion can be drawn (Figure 8) when analysing the association between the number of diagnosed comorbidities and smoking habits (Chi^2=10.7; p-value=0.03 <5.0%).

Table 3 - Relationship between the existence of comorbidities and patients' smoking habits

		Never smoked	Ex-smoker (stopped + de 5 years)	Smoker or Ex-smoker (stopped - 5 years)	Total
With Comorbidities?	No	97	16	177	290
	Yes	110	36	125	271
Total		207	52	302	561

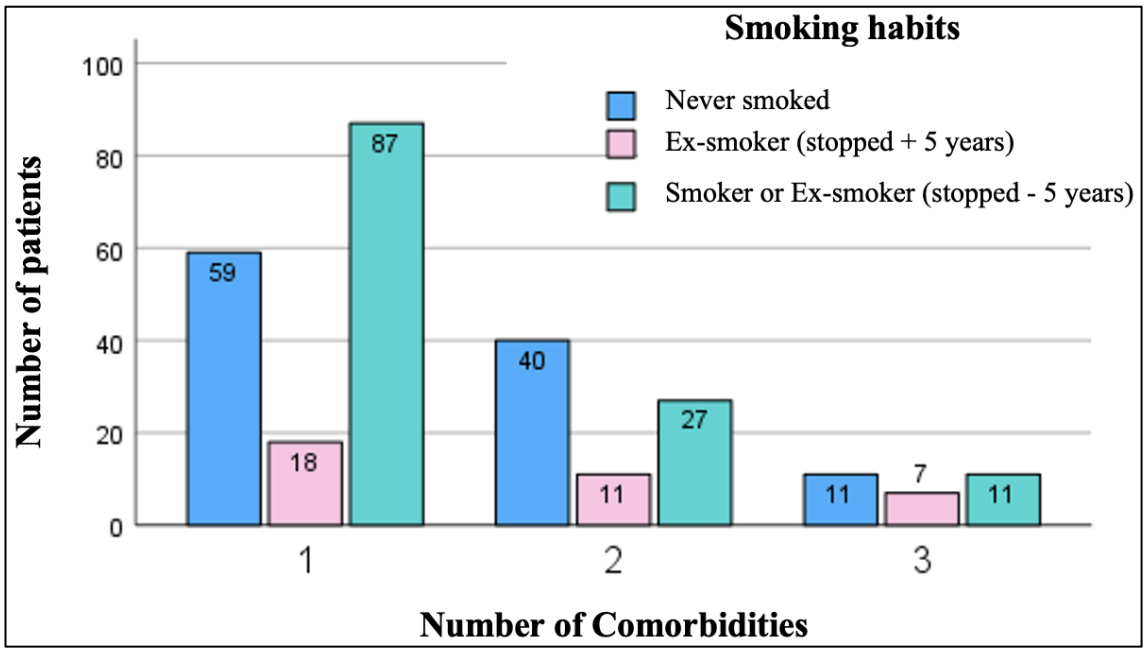


Figure 8 - Distribution of patients in relation to smoking habits and number of diagnosed comorbidities

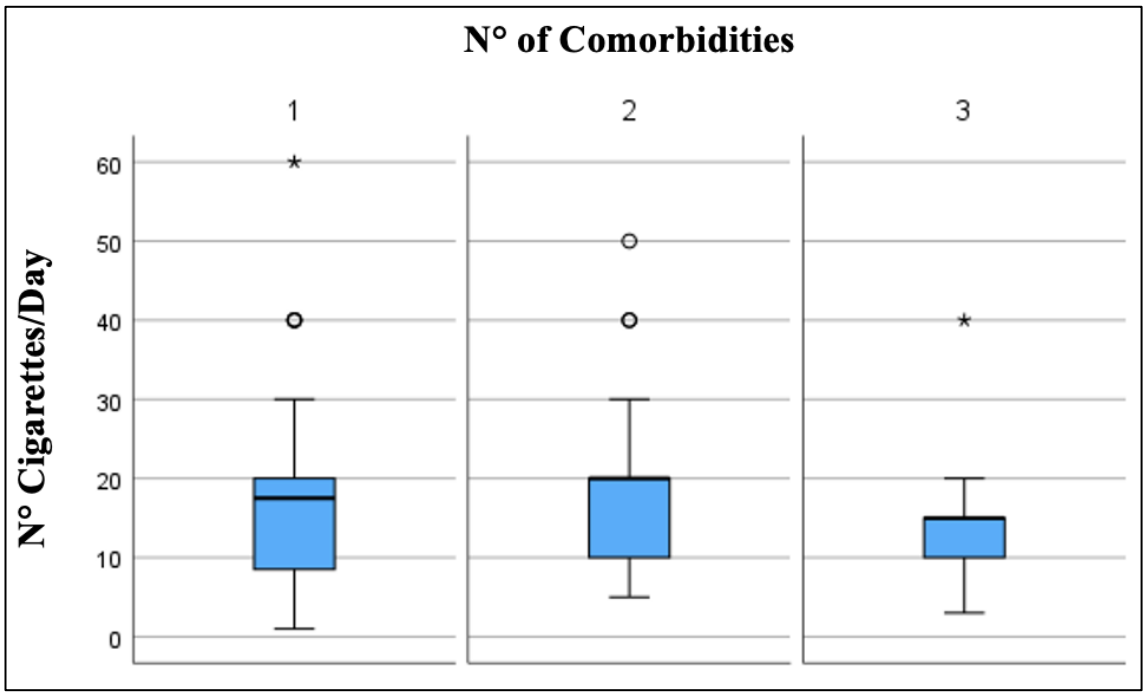


Figure 9 - Boxplots of the number of cigarettes consumed daily and the number of comorbidities diagnosed

The prevalence of the different comorbidities diagnosed in the patients is shown in Figure 4, which shows that cardiovascular disease (49.0%) and type 2 diabetes (20.0%) are the two most prevalent, followed by blood disorders (13.0%) and gastrointestinal disorders (10.0%). In order to assess whether any of these comorbidities were related to the onset of post-operative complications, a detailed analysis was carried out, the results of which are shown in Table 4 and illustrated in Figure 11.

This analysis once again confirms that the appearance or not of post-operative complications is not related to the diagnosed comorbidities. There was no association between any of these four comorbidities and post-operative complications (Chi^2 tests with p-values greater than 5.0%).

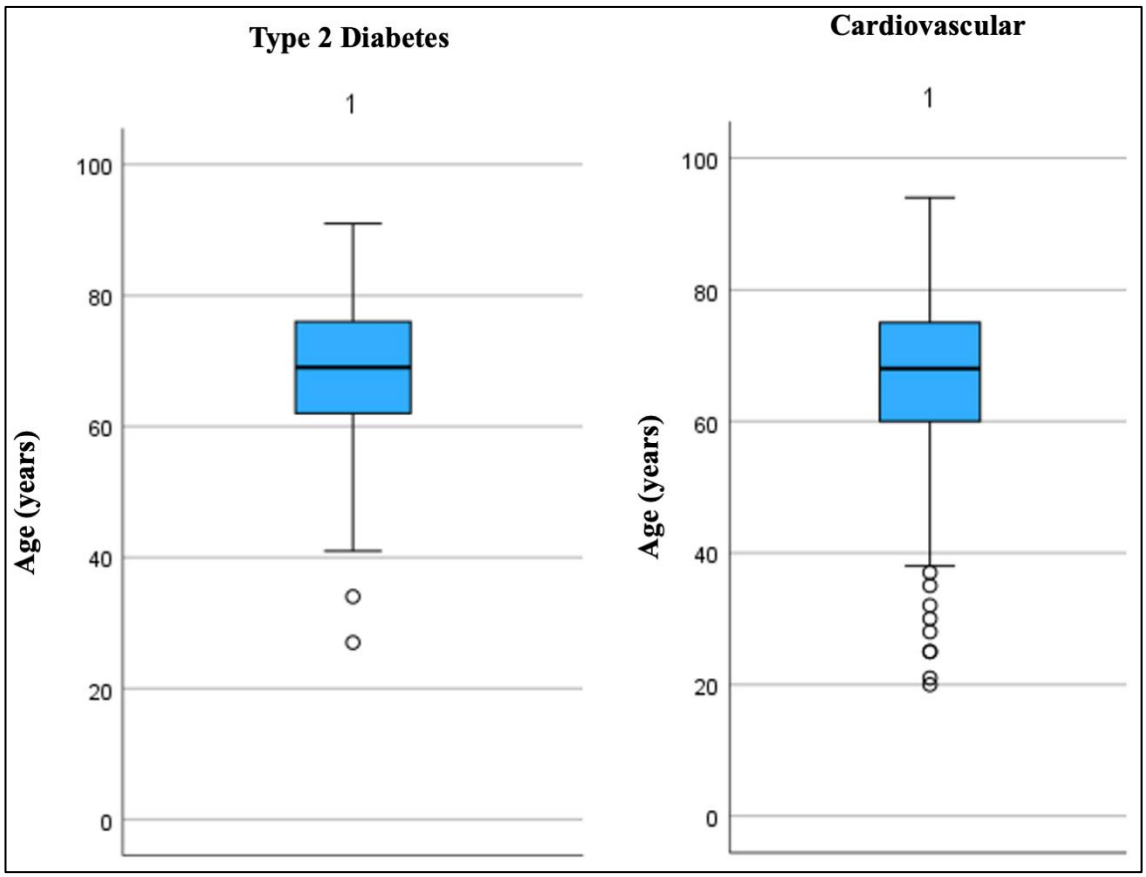


Figure 10 - Boxplots of patient age in the two most prevalent comorbidity groups

Table 4 - Association between the most prevalent comorbidities and post-operative complications

		Cardiovascular		Type 2 Diabetes		Blood Disorders		Gastrointestinal Disorders	
		NO	YES	NO	YES	NO	YES	NO	YES
POST OPERATIVE COMPLICATIONS	NO	489	468	767	190	837	120	862	95
	YES	**49**	**40**	**75**	**14**	**78**	**11**	**76**	**13**
	TOTAL	538	508	842	204	915	131	938	108
	%	**9%**	**8%**	**9%**	**7%**	**9%**	**8%**	**8%**	**12%**
	Chi^2	0.511		0.882		0.002		1.926	
	p Value	0.507		0.403		1.000		0.199	

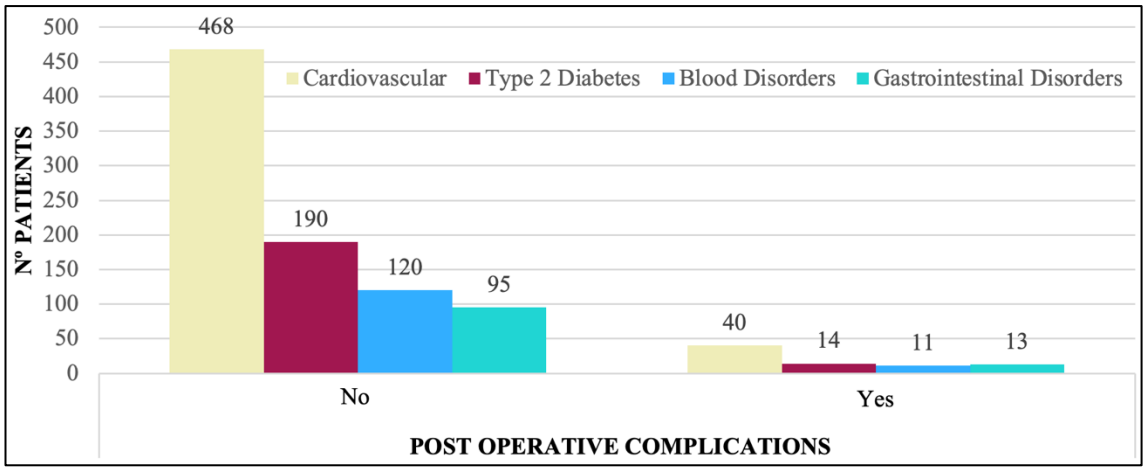


Figure 11 - Distribution of patients with the four most prevalent comorbidities and existence of post-operative complications

IV. DISCUSSION

This was a retrospective observational study looking at the data of 2 011 patients.
Based on the results obtained, we were able to highlight certain associations between some of the variables under study. However, this was not true for others variables and this was surprising given the high number of patients and the amount of data collected.

At the time of completion of our study, we observed that approximately half of the patients (52.0%) were suffering from comorbidities.
The age of the patient has a certain influence on the association with comorbidities.
In our study, as we expected, we found that older patients, had a greater the chance of suffering from multiple comorbidities. In fact, for people with one comorbidity, the minimum age recorded is 20 years, whereas for those with at least three comorbidities it is around 40 years. This seems fairly consistent with the fact that the body and immune system become more fatigued over time.
These observations are similar to a study carried out in the United Kingdom, where, for example, in white men aged between 1 and 9 years, 25.0% were not affected by any comorbidities and around 2.0% were affected by at least eight comorbidities. Among white men aged 70 to 79, 80.0% were affected by at least eight comorbidities, whereas less than 1.0% have no comorbidities. Once again, this shows that age is associated with the onset of comorbidity (Kuan et al., 2023).

It has been known for many years that the effects of smoking cigarettes are harmful to health. It is therefore not surprising to note that patients with smoking habits are more likely to be affected by comorbidities. Within our study, we found that of the 271 people affected by comorbidities, 161 were currently smoking or had used tobacco in the past. Therefore, more than half of patients with comorbidities are smokers or ex-smokers. The results are consistent with our hypothesis.
Similar results were found in an American study conducted in 2021. Looking at the two main comorbidities in our study, cardiovascular problems and diabetes, we can see from the American study that among non-smoking patients, 37.7% had hypertension and 6.7% diabetes. In former smokers, this percentage rises to 47.9% for hypertension and 10.0% for diabetes (Zhu et al., 2021). In view of the many studies reporting this association, this

condition is likely to remain the same. It should be noted that even if you are a former smoker, you still have a greater risk of developing systemic complications compared to someone who has never smoked.

In view of the comments made previously, we expected there to be a link between smoking and the development of post-operative complications. However, after analysing our results we found that there was no association between these two parameters. Among the 302 patients in our study who smoked, only 29 developed post-operative complications after their surgery. In comparison, only 21 of the 207 non-smoking patients suffered post-operative complications. Thus, in view of the small, non-significant difference between these two types of population, our data does not support a strong association between smoking and the development of post-operative complications.

In a 2019 study from Saudi Arabia, researchers found a slightly increased risk of developing a post-operative complication in patients who smoke.

In the case of swelling, after 7 days, 92.3% of smokers are not subject to swelling. This figure rises to 93.2% for non-smokers. In the context of infection, again after one week, 92.3% of smokers are free from infection, compared with 96.6% of non-smokers. However, in the case of bleeding 7 days after surgery, the results showed that smokers were less prone to this problem than non-smokers. At 7 days, 100.0% of smokers showed no bleeding, compared with 98.3% of non-smokers (Sanari et al., 2019).

In the three previous examples, as in our study, we can observe that this also supports the view that the association between these two parameters is not as strong as we originally hypothesised.

In an American study this time, comparing surgical to simple extractions with post-operative complications in smokers and non-smokers, a more significant association was noted. In the case of surgical extractions, 33.3% of smokers were affected by complications, compared with 15.8% of non-smokers. The same was true for simple extractions, with 20.2% of smokers affected by complications, compared with 10.9% of non-smokers (Heng et al., 2007).

It is important to note, however, that out of the 2 011 patients, only 561 gave information about their smoking or non-smoking habits. As a result, there was a significant lack of information, leading to bias. If we had more data on this parameter, we might have had different results concluding an association between smoking and post-operative complications. Furthermore, we can also hypothesise that certain patients who had post-

operative complications following dento-alveolar surgery at the PCFH did not go to the clinic but rather to the emergency department of a hospital or have even been subject to self-medication, thus leading to a lack of data in our study.

Similar to our previous observations, we also hypothesised if there was a link between the presence of comorbidities and the occurrence of post-operative complications following dental extraction. After analysing our data, we realized that there was no statistical evidence to support this association. Indeed, it makes no difference whether or not the patient is suffering from comorbidities, as in both cases there are more patients without post-operative complications (Figure 7a). For patients without comorbidities, 872 were unaffected by complications, compared with 93 who were. The same was true for patients with comorbidities, with 957 free of complications versus 89 affected. As shown in Figure 7b, whether the patient suffers from one, two or at least three comorbidities, the fact of having no complication following dentoalveolar surgery remains dominant. In fact, among those reporting one comorbidity, 632 had no complications, compared with 60 who did. Among those with two comorbidities, 227 had no complications versus 18 who had. Among patients with three or more comorbidities, 98 had no post-operative problems, compared with 11 who returned to the clinic.

In terms of comparison in relation to this association, we found relatively few articles reporting the link between the presence of comorbidities and the occurrence of post-operative complications.

However, in a German study tracking the link between diabetes and post-operative complications, it was shown, as in our study, that this association was not significant.

When we look at people with diabetes, 15.0% are affected by infections and 28.3% by swelling. These percentages are fairly similar in non-diabetics, reaching 12.1% for infections and 32.0% for swelling.

The only complication showing a slight difference is osteomyelitis, with 14.2% in diabetics compared with 6.5% in non-diabetics.

Nevertheless, this study also explains that among the 1 347 patients followed, those with a glycemia problem had a higher average length of hospitalisation than those not affected by this pathology with one day longer on average (Rahimi-Nedjat et al., 2017).

The reason for the absence of post-operative complications in certain patients may be due to various factors, such as adequate surgical technique (skill and experience of the surgeon, use of precise and high-quality equipment), appropriate pre-operative

instructions (adjustment of medication, smoking cessation), good post-operative instructions which the patient followed correctly, satisfactory pain management by prescribing analgesics and anti-inflammatories, failure to follow up the patient after extraction (the patient went to another clinic to resolve the complication).

Throughout the period of this study, we were faced with a number of limitations. Having taken a step back from this study, which aimed to show the link between comorbidities and post-operative complications in patients who had undergone dentoalveolar surgery, there are certain aspects that could have been dealt with differently, particularly with regard to the history.

A large number of anamneses did not contain information on smoking habits, which probably created a bias in our results and would have made our data more complete. It would therefore be advisable for the PCFH history page to be reworked, if not completely redone, in order to restructure and group together certain diseases, as well as to add smoking and alcohol habits.

In preparing this study, we listed a maximum of 3 comorbidities per patient in our data spreadsheet. In the end, it would have been more judicious to list all the comorbidities present in each patient in order to obtain more complete results.

V. CONCLUSION

The present study was important as it has allowed for collection of important data from a large sample. Based on our results, we were able to highlight some of the findings we had been looking for, in particular the link between smoking habits and the presence of comorbidities, and the link between the number of comorbidities and age. However, we were surprised by the results showing that there was no association between smoking habits and postoperative complications, or between comorbidities and postoperative complications.

According to the results of our study, we were able to show that the two most frequent comorbidities in our cohort were cardiovascular problems and type 2 diabetes. Clinical protocols should be well-defined in oral medicine and surgery consultations for the management of these patients.

The author's contribution to the clinical protocols:

In patients with cardiovascular problems, particular attention needs to be paid to checking their medical history and whether their cardiovascular problems are controlled and stable. It is also essential to know what medicines the patient is taking, particularly anticoagulants. It is advisable to carry out the operation in an environment that is as stress-free as possible, and for as short a time as possible. If the patient has cardiovascular problems, local anesthetics with vasoconstrictors should be avoided. In the post-operative period, if the patient is in pain, we can prescribe analgesics, but anti-inflammatory should be avoided as they can increase blood pressure and interact with cardiac drugs. Antibiotics may also be prescribed to prevent the risk of infection, particularly in patients with valve disease or a high risk of bacterial endocarditis. Clear and thorough instructions for oral hygiene should be provided. Close follow-up should therefore be planned to monitor healing and intervene rapidly in the event of complications.

In the case of diabetic patients, make sure that their diabetes is under control to avoid any unexpected events. Morning consultations should also be organised, for as short a time as possible. During the consultation, great care should be taken to watch out for signs of hypoglycaemia, which the patient may be prone to and which could complicate the operation. If the patient is taking insulin, it may be necessary to adjust the dose, and the patient should therefore see his general practitioner beforehand. In the event of pain, the

patient should be given analgesics and anti-inflammatories should be avoided as they can affect the glycemia. If the patient's diabetes is poorly controlled, antibiotic prophylaxis may be considered. Clear and careful oral hygiene instructions should be given. Regular follow-up should also be organised to monitor healing and intervene promptly in the event of complications.

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VII. ANNEXES

Annexe A – Positive opinion from the Ethics Committee

UNIVERSIDADE FERNANDO PESSOA

Exma. Senhora
Prof. Doutora Sandra Gavinha
Diretora da FCS

Nº	Data
FCS/MMED – 463/23-3	30 de Janeiro de 2024

Exma. Senhora Professora Doutora,

A Comissão de Ética analisou o pedido de inclusão do aluno Anthony Charles Joseph Delhoume (39530) num projeto de investigação anteriormente aprovado pela Comissão de Ética.

Trata-se de um estudo observacional retrospetivo previamente aprovado pela Comissão de Ética da Universidade Fernando Pessoa (N° FCS/MED - 319/22-2, datado de 15 de dezembro de 2022, intitulado "Caracterização do perfil de prescrição de antibióticos em cirurgia dentoalveolar - estudo em população de UFP").

Face ao esclarecimento enviado a 26 de Janeiro 2024, pela Professora Doutora Otília Lopes, a Comissão de Ética não tem nada a opor quanto à inclusão do aluno Anthony Delhoume no projeto de investigação citado acima.

Não há necessidade de parecer desta comissão relativamente ao trabalho deste aluno, uma vez que o projeto onde este está incluído já teve parecer positivo desta comissão.

Com os melhores cumprimentos,

A Presidente da
Comissão de Ética da UFP
Inês Lopes Cardoso

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