MEDICAL UNIVERSITY - PLEVEN

FACULTY OF MEDICINE
DEPARTMENT OF EYE DISEASES, EAR NOSE THROAT DISEASES, MAXILLOFACIAL SURGERY

AUTOREFERAT

of the dissertation for the award of an educational and scientific degree "DOCTOR"

TOPIC: STUDY ON THE SURVIVAL OF FLAPS USED IN THE CLOSURE OF ORAL CAVITY DEFECTS

Professional field 7.1. Medicine

Doctoral program: Otorhinolaryngology

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Pleven

2024

The dissertation is 150 pages long and consists of an introduction, three chapters, complications of the cases, deductions, conclusion, abbreviations, scientific contributions, application in practice, scientific publications and bibliography. It contains a total of 379 cited sources, 7 of which are in Bulgarian and 389 are in foreign languages.

The dissertation contains 37 figures, 1 graph and 5 tables. The figures and tables included in the abstract coincide with those in the dissertation.

Author: Tsvetomir Stoyanov

Title: " Study on the survival of flaps used in the closure of oral cavity defects "

CONTENTS

GENERAL CHARACTERISTICS OF THE DISSERTATION

1. Relevance of the problem

Maxillofacial defects, arising due to developmental abnormalities, trauma, or ablative surgery in cancer, present a challenge to the individual due to a change in shape, function, and aesthetics. The face of a person is considered a reflection of their personality and existence. Any change in facial structure or symmetry changes the aesthetics of the individual. This can have a profound psychological impact on the patient, affecting self-confidence, self-esteem and the ability to interact with others (Prakash et al. 2021).

Oral and maxillofacial surgery was originally developed in the mid-20th century, when dental surgeons began applying their knowledge of the oral cavity and surrounding tissues to treat military personnel who had suffered potentially devastating facial injuries during various conflicts, including World War I and World War II (Isaac et al. 2022: 15).

Since then, the scope of the specialty and the range of different pathologies in it have become increasingly diverse. As cases become more complex, it is evident that in addition to a detailed knowledge of the oral cavity and facial skeleton, it is also necessary to know the principles of both medicine and surgery. In the past, injuries were the main cause of maxillofacial defects, including those in the oral cavity. An interesting fact is that maxillofacial and plastic surgery were created as specialties after the First World War, when there were many injuries to the face. Then the first flaps, obturators, etc. were made.

Oral cancer is a common formation involving one third of all head and neck malignancies. Treatment options for oral cancer have not changed significantly in the last three decades; however, the work, the approach to monitoring, and reconstruction options have continued to evolve. Due to the deep functional and cosmetic importance of the oral cavity, oral cancer treatment requires a thorough understanding of disease progression, management approaches, and alternative ways of reconstruction. This review aims to discuss the most current treatment options for oral cancer (Genden et al. 2010: 100-1017).

Cancers located in the tongue, throat, or vocal cords can damage speech. After surgery or after radiation and chemotherapy, speech becomes unclear or the voice sometimes becomes hoarse. This has a demoralising effect on trust and social interactions.

Mouth cancers make it difficult to chew, swallow food, or drink fluids. The ability to eat is fundamental to quality of life, health and nutrition. However, oral cancer interferes with this important function, causing weight loss, pain, and challenges in balanced meals. Taste receptors can also be affected, reducing the pleasure of food.

Visible oral cancers or disfiguring surgical procedures have a profound impact on facial aesthetics and appearance. Surgery often means removing parts of the mouth, tongue, or lips. Radiation leaves burn marks that permanently alter the tissues. This change in appearance affects self-image and emotional well-being. Such patients may develop social worries due to an altered physical form.

405,000 new cases of oral cancer are expected worldwide each year, and the countries with the highest rates are Sri Lanka, India, Pakistan, Bangladesh, Hungary and France (Ferlay et al. 2010: 2893-2917). There are approximately 66,650 new cases in the European Union each year. The American Cancer Society estimates that there will be 42,440 new cases of oral and pharyngeal cancer in the United States, causing 8,390 deaths in 2014. (Siegel 2014: 9-29). Smoking and alcohol are the main etiological factors in oral SCC. (Blot et al. 1988: 3282-3287; Blot 1992: 2119s-2123s).

Tobacco contains many carcinogenic molecules, especially polycyclic hydrocarbons and nitrosamines. There is a direct proportional effect between the number of cigarettes smoked and the risk of SCCOC (Spitz et al. 1988: 203-208). This risk can be reduced after quitting smoking, but it does not completely decrease (30% in the first 9 years and 50% for those over 9 years) (Macfarlane et al. 181-187; Samet 1992: 399-414). Over the past 15 years, a reduced incidence of oral cancer has been reported, which is widely attributed to a decrease in tobacco use (Howlader et al. 2011).

Alcohol and tobacco have a synergistic effect in the etiology of oral and oropharyngeal SCC (Blot et al. 1988:3282-3287; McCoy 1979: 2844-2850). However, alcohol is associated with an increased risk of cancer even in non-smokers (Kato et al. 1994: 75-81). Other factors such as poor oral hygiene (Maier et al. 1993: 655-661), exposure to wood dust (Schildt et al. 1999: 317-320), dietary deficiencies (La Vecchia et al. 1997: 302-312), consumption of red and salted meat (Tavani et al. 2001: 191-195; De Stefani et al. 2012: 1584-1588) have been reported as etiological factors. HSV is suspected but not implicated in SCCOC etiology (Larsson et al. 14-18.

Despite emerging evidence supporting the role of HPV in the etiology of oropharyngeal cancer, it is not conclusively associated with SCCOC (Sturgis et al. 2007: 1429-1435). Host factors such as changes in the immune system in transplant patients (Shah et al. 2013: 176-179) and HIV-infected AIDS patients (Ficarra et al. 1994: 159-185), as well as genetic diseases such as pigment xeroderma, Fanconi's anemia and A-T are associated with an increased incidence of head and neck cancer (Berkower et al. 1988: 746-748; Kutler et al. 2003: 106-112).

2. Aim and objectives of the dissertation

This paper aims to explore the possibilities of applying regional, mucocutaneous, fasciocutaneous, or myogenic flaps for oral defects, the advantages and disadvantages of each flap, and the conditions for the survival of these flaps, considering the errors and complications in the implementation.

Given the aim of the dissertation, the following theoretical-scientific and empirical-applied tasks are outlined:

1. When planning surgeries, finding a sufficient number of patients with advanced cancer, which are expected to have a defect that is difficult to close with local tissues.

2. Detailed clinical and anatomical examination of each one of the flaps selected by the team, taking into account the specifics of each flap, its advantages and disadvantages.

3. Pre-planning the operation, selecting a suitable flap for each patient after clinical discussion, based on clinical examination data, CAT (NMR) and histological examination data.

4. To account for errors and complications that has led to difficult healing or flap necrosis. and indicate ways to avoid them.

3. Scientific thesis and scientific hypothesis

The scientific thesis is based on the claim that a thorough investigation of the survival of the types of flaps for closing acquired defects in the oral cavity will achieve a new level of scientific knowledge about the advantages and disadvantages of their use.

The scientific hypothesis is based on the assumption that by deriving the categorical advantages and disadvantages of the types of flaps in various surgical interventions, a standard in the surgery of acquired defects in the oral cavity can be reached.

4. Test methods

Data about patients in the Clinic of ENT Diseases of the University Hospital "Dr. Georgi Stranski", Str. Pleven, in the period 2019-2023, is analysed for the preparation of this dissertation. A systematic data collection method of patients operated on in the clinic is applied according to leading indicators.

Standard methods for diagnosis, treatment and follow-up of the disease are used.They are grouped by type: diagnostic, therapeutic, experimental and statistical in order to authenticate the results of the study.

5. Scientific contributions

The dissertation is distinguished by the following theoretical-analytical and empirical-applied scientific contributions:

1. It tracks, analyzes and summarizes a sample of 35 regional flaps used to close oral defects, taking into account the specifics of each individual flap, anatomical variations, errors, complications and recommendations.

2. It approves ENT clinic at "University Hospital-Dr. Georgi Stranski" – Pleven, as one of the leading clinics in the country, and the author – as one of the leading surgeons engaged in major oncological operations on the head and neck.

3. It serves as a step in the direction of the future development of restorative surgery – 3D virtual scanner reconstruction and the use of bioprinted tissues to close defects of the oral cavity and face.

4. The empirical study establishes leading criteria for surgical manipulations, such as the most commonly used anesthesia, the most common reconstructive technique, the most positive trend related to the team experience, the most common soft tissue defects, bone structure defects, combined defects, and according to the data presented, standards for surgical treatment can be derived.

6. Publications

The doctoral candidate's scientific publications are four in total and have been published and approved in representative scientific forums and publications:

CONTENT OF THE DISSERTATION

CHAPTER ONE

LITERARY REVIEW

The first chapter of the dissertation provides a literature review in which a definition of an oral cavity defect is given, and the types of defects, congenital and acquired, are provided, as well as theoretical analysis of oroanthral fistula and oral cancer is emphasized. Operative-surgical activities are monitored, tumors are classified and prognostic indicators and diagnostics are derived. Operative-surgical activities are monitored, tumors are classified and prognostic indicators and diagnostics are derived.

The oral cavity is a complex neuromuscular organ that is integral to maintaining nutrition and is key to social interaction and daily communication. It affects an individual's social performance, communication, self-image and QOL (Shin et al. 2012; Chepeha et al. 2023: 106431).

Oral diseases are some of the most common ones worldwide (Peres et al. 2020: 186-187). Among these, oral mucosal defects are a series of diseases caused by the shedding of inflammatory necrotic tissue (An 2022: 126-138), thus affecting the oral mucosa and soft tissues, including ulcerative lesions of the oral mucosa, represented by recurrent aphthous ulcers (Lin 2021: 1247-1258), which severely affect patients' quality of life. The causes of mouth ulcers are varied and complex, such as an imbalance in the oral microbiota (Ibid.), fatigue, stress and complications of diabetes (D'Aiuto et al. 2017: 944-948) and as there are many types of oral ulcers, it leads to difficulties in making an accurate diagnosis. However, due to the dynamic environment of the oral cavity, there are few effective treatments (Qi et al. 2022: 206-215).

Oral cancer accounts for nearly 30% of all head and neck malignancies. Approximately 90% of cases are squamous cell carcinoma (Cooper et al. 2009: 748-

758),while the remaining 10% represent rare malignancies (unusual forms of squamous cell carcinoma, small tumors of the salivary glands, melanomas, lymphomas, sarcomas) and various malignant tumors of odontogenic origin. In North America, common risk factors for oral cancer include tobacco and alcohol use. Outside North America, dietary habits, such as chewing betel and areca nuts, pose an additional risk for the development of oral cancer. Apart from these risks, there is little evidence linking dietary factors or nutritional deficiencies to the development of oral cancer. The highest rates of oral cancer occur in Pakistan, Brazil, India and France (de Camargo et al. 2010).

Oral maxillofacial defects may be congenital or acquired due to trauma or pathology (Kao et al. 2017: 835-841). Rehabilitation of these defects is difficult because it requires a multidisciplinary approach that includes surgical, prosthetic, psychological counseling and speech therapy rehabilitation for the overall well-being of the patient (Kao et al. 2017: 835-841). Maxillofacial defects caused by neoplasm require surgical resection of the nasal, maxillary and oral cavities (Kao et al. 2017: 835-841). This leads to communication between theoral-nasalcavity and the antrum. Rehabilitation consists of precise separation, which prevents regurgitation in the nasal cavity, prenasal speech and defective function of the maxillary space, surgically resected (Kao et al. 2017: 835-841). The aim is to restore speech, chewing and occlusion, prevent enophthalmos and diplopia, focus on providing soft tissue support to restore the middle contour of the face and achieve an adequate aesthetic result that improves both the patient's physical and psychological condition (Singh 2013: 117-120).

Multiple options for reconstruction of oral defects are available. Among them, FAMMIF is a flap composed of a mucous membrane of the cheek, submucosa and part of the buccinator muscle. FAMMIF is ideal for reconstruction of small to moderate defects of the oral cavity and oropharynx. This is due to the fast operating time, lack of complications and good functional and aesthetic results. Special attention is paid to the design of the flap, the identification of the vessels, taking the myomucosal island, preparing the tunnel for its passage through the neck and back to the oral cavity and closing the donor area of the cheek with the buccal fat pad (Copelli et al. 2022: 745-751).

Oral resection and reconstruction can be challenging for maxillofacial surgeons (Squaquara et al. 2010: 198-211; Chimet al. 148-154. While large oral cavity defects require a muscular or fasciocutaneous flap, which is either free or pedicle-based, in the more limited tissue loss, a direct closure or local flaps can be made (Fang et al. 2013: 26).

OAF is a pathological abnormal communication between the oral cavity and the maxillary sinus that can occur as a result of unsuccessful primary healing of OAF, dental infections, osteomyelitis, radiation therapy, trauma or iatrogenic complications. In the presence of a fistula, the maxillary sinus is permanently open (Yilmaz et al. 2003: 221-223). Microbial flora passes from the oral cavity to the maxillary sinus, and sinus inflammation occurs with all possible consequences (Parvini et al. 2018).

At a later stage, the formation of an antral polyp is possible, which is visible through the defect intraorally. The verification of oro-antral communication can be confirmed by the *Valsalva* method. The patient is instructed to expel air against closed nostrils while the clinician checks whether the air hisses from the fistula into the mouth. A hissing noise of air leaking through the maxillary sinus and nose shows a positive test. In some cases, a test with blowing through the nose or mouth does not give a positive response, especially when the fistula canal is filled with inflammatory changed nasal mucosa. In addition, a blunt probe test will confirm the presence of an oroanthral fistula canal. However, to confirm clinical findings, the clinician must radiologically inspect the site by panoramic radiography or CT scan.

In CT or CBCT, the oroanthral fistula may show as an interruption at the bottom of the sinus, sinus opacity, or communication between the oral cavity and sinus. In addition, focal alveolar atrophy and associated periodontal disease can be observed (Abraham et al. 1995: 1273-1276).

In chronic OAF, there is a generalized thickening of the mucosa. Recent studies indicate that the oroanthral fistula should be closed within 24 hours. After this period, inflammation of the sinuses by contamination of the oral cavity makes it impossible to conduct the treatment effectively (Yalçın et al. 2011: 333-339; Anavi et al. 2003: 527-534).

Oral cancer is the sixth leading cause of cancer in the world. In the United States alone, there are over 21,500 oral cancers diagnosed each year and 6,000 Americans die from oral cancer each year (Landis et al. 1999: 8-31). The incidence of oral cancer varies between countries in the world, with estimates above 40 per 100,000 in parts of France, Southeast Asia, Hungary and Singapore. Therefore, oral cancer is a major cause of morbidity worldwide. 20% of oral malignancies are squamous cell carcinomas. However, the treatment of some other oral malignancies, such as sarcoma and small salivary carcinoma, is also predominantly a surgical excision and surgical principles are also applicable to the treatment of these tumours (Boyle et al. online).

The etiology of oral cancer is exposure to carcinogens in tobacco and the tumor-stimulating effects of alcohol. 20% of the risk of oral cancer in the United States is directly due to smoking (Shopland et al. 1991: 1142-1148). Tobacco smoke and alcohol are synergistic in their carcinogenic effects in the oral cavity. The relative risk of oral cancer in heavy smokers is 7 times higher than in non-smokers. The risk for heavy drinkers is 6 times greater than for non-alcoholics. The risk for patients abusing both alcohol and tobacco is 38 times higher than those who abstain from both (Blot et al. 1988: 3282-3287).

Chewing tobacco and betel also increase the risk of oral cancer (Mahale et al. 2000: 199-206). Chronic exposure to a carcinogen factors creates a field effect, and the entire upper aerodigestive mucosa is at risk of malignancy in smokers and alcoholics (Slaughter et al. 1953: 963-968). After successful treatment of oral cancer, the risk of a second primary cancer is 3.7% per year and increases to 24% after ten years (Day et al. 1992: 14-19). Cessation of alcohol and tobacco use reduces the risk of second aerosol cancers.

SCC is the most common histology and the main etiological factors are the use of tobacco and alcohol (Blot et al. 1988: 3282-3287). Although early diagnosis is relatively easy, advanced disease diagnosing is not uncommon. The standard of treatment is primary surgical resection with or without post-operative adjuvant therapy. Improvements in surgical techniques, combined with routine use of post-operative radiation or chemotherapy, have led to improved survival statistics over the past decade (Pulte et al. 2010: 994-1001).

The undertaken operative-surgical activities have an important effect on the patient's appearance, which is defined as the perceived discrepancy between the actual status and the ideal standards of the patient (Morton 1995: 1029-1035). Aesthetically and functionally, the consequences due to surgical incision and resection of cancer, often associated with pre- or post-operative radiotherapy, always change the patient's self-perception and ability to interact with others in everyday social life. While scars and body changes are usually hidden during social activities and dramatic situations such as permanent colostomy or the vascular shunt for dialysis can be easily hidden in public places, patients with head and neck cancer cannot hide functional changes after treatment and have to cope with the subsequent negative impact on self-esteem and confidence in all areas (Villaret et al. 2008: 120-125). The remarkable advances in reconstructive techniques for the head and neck have significantly improved aesthetic and functional outcomes. The primary goal in the management of such cases is to treat the patient while maintaining a good appearance that is compatible with satisfactory self-acceptance and interpersonal social relationships. (Urken et al. 1991: 935-950).

Various surgical approaches are available for the resection of the primary tumor in the oral cavity. The choice of a specific approach depends on the above mentioned factors, such as the location and size of the primary tumor, as well as its depth of infiltration and proximity to the lower jaw or maxilla. The surgical approaches commonly used are perora, mandibulotomy, flap access on the lower cheek and flap access on the upper cheek (Jatin et al. 2007: S15-S18).

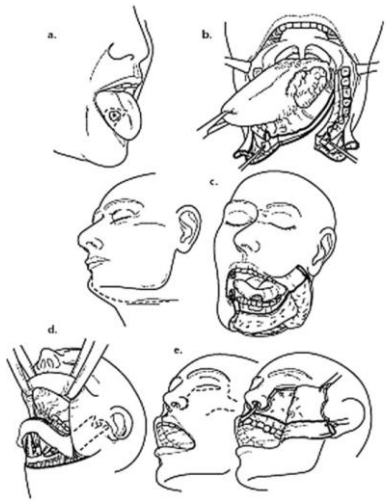


Figure 1.
Surgical approaches for excision of oral cancer: (a) peroral, (b) mandibulotomy, (c) lower cheek flap, (d) visor flap and (e) upper cheek flap
Source: Jatin et al. 2007:S15-S18

The reconstruction of the free flap is sometimes necessary, but it is always worse from a cosmetic and functional point of view due to the lack of the function of *orbicularis oris* and the difficulties with the reconstruction of the commissary (Cordeiro et al. 1999: 1850-1856).

Tongue cancer can spread along the mucous surface to encompass the floor of the oral cavity and the lower jaw, or the oropharynx, or it can spread by deep invasion between muscle bundles that offer little resistance to tumor spread.

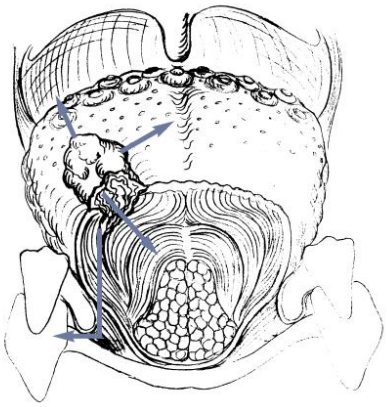


Figure 2.
The anatomical routes of spread of oral cancer to the tongue
Source: http://www.patologiabucal.com/index_htm_files/cancerdecavidadoral.pdf

Oral resection is the most common approach for T1 and T2 lesions of the oral tongue. Partial glosectomy is easily performed using an electrocauter to maximize hemostasis. A limit of 1 to 1.5 cm of normal tissue of the tongue in all dimensions is maintained, and both visual assessment and palpation of the tongue guide resection. The intraoperative margin samples are taken with a scalpel to minimize the burn-in artifact. The resection can be performed with a carbon dioxide laser. Whenever possible, the resection is planned in a transverse wedge-shaped manner. The partial glosectomy defect is closed in a horizontal direction, resulting in shortening of the tongue. Its appearance and function after a horizontal closure are excellent. This is preferable to a longitudinal closure, resulting in a thin pointed tongue. The size and extent of the tumor will determine the orientation of the resection. For many T2 and

T3 oral tumors of the tongue and for any size tumor at the back of the tongue or bottom of the mouth, the mandibulotomy approach provides the exposure necessary to perform an oncologically stable resection. The low morbidity of paramedic mandibulotomy is always preferred to poor visualization and inadequate assessment (Loree et al. 1990: 410-414; Wolf et al. 1999: 689-693).

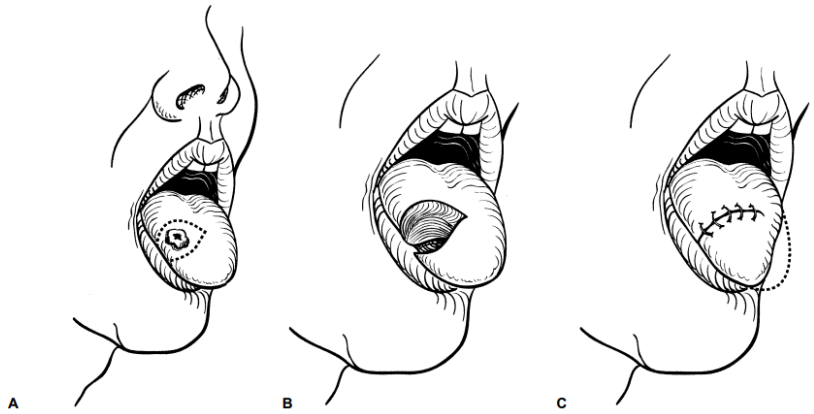


Figure 3.
Oral wedge-shaped excision and primary closure of T1 tongue cancer with horizontal closure.
Source: http://www.patologiabucal.com/index_htm_files/cancerdecavidadoral.pdf

This procedure begins with an elective supra-mohyoid or modified radical dissection of the neck, in which the skin and muscle valves of the neck are raised, revealing the lower border of the lower jaw. The access to the floor of the mouth is exposed through the submandibular triangle. A separating incision is then made on the lower lip. The cinnabar border is marked to ensure accurate rearrangement, and the lip is sharply split along the midline and connected to the front of the neck incision. The periosteum of the lower jaw remains unaffected, and the soft tissues of the lip and cheek are also unaffected. The gingival mucosa and periosteum are incised at the mandibulotomy site anterior to the mental foramen and lateral to the insertion of the digastric muscle.

An excision of small lesions on the floor of the mouth may require local resection with marginal resection *en bloc* of the lower jaw (Shaha 1992: 116-119). This can be achieved through oral access. The excision of the mucous membrane and soft tissues is left attached to the lower jaw, tooth extraction is performed at the

sites of the alveolar incisions, and bone incisions are performed with a sagittal saw and ultra-thin blades.

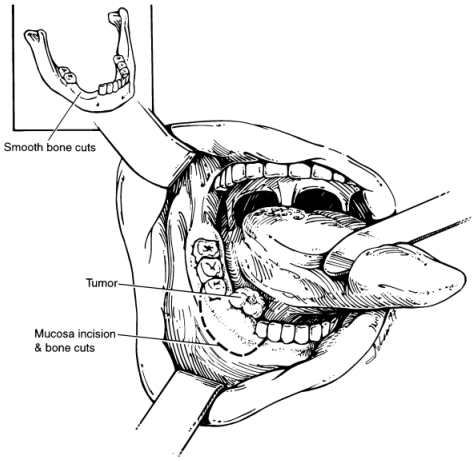


Figure 4.
Resection of cancer at the bottom of the mouth with marginal mandibullectomy.
Source: http://www.patologiabucal.com/index_htm_files/cancerdecavidadoral.pdf

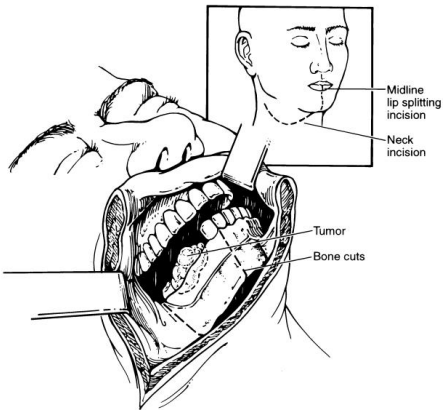


Figure 5.
Segmental resection of the lower jaw by flap access of the lower cheek for a large carcinoma of the floor of the mouth with the mandibular bone roughly affected
Source: http://www.patologiabucal.com/index_htm_files/cancerdecavidadoral.pdf

Smooth cuts are preferred rather than cuts at right angles to evenly distribute chewing forces and prevent subsequent fractures. When the lower jaw is affected by a tumor only in the lingual plate, vertical partial mandibular resection can be performed using the tooth roots as the vertical plane of resection. The nearby teeth are extracted, and a right-angled blade is used to resect only the lingual plate, taking care to preserve the alveolar artery. Elective or therapeutic neck dissection improves lower jaw exposure. The resulting defects at the bottom of the mouth and the lower

jaw can be left to granulate, the local flaps from the mucous membrane or a split skin graft can often close these defects well (Schramm et al. 1980: 528-532; Schramm et al. 1983: 175-177).

There are a number of prognostic factors that determine patient survival and influence treatment decisions. The main prognostic factors are tumor size (T-stage), regional node involvement (N-stage) and the presence or absence of distant metastases (M-stage). This TNM classification is still used today with different modifications. Several other biological, molecular and histopathological parameters have also been identified in recent decades.

The diagnostic evaluation of a patient with oral carcinoma consists of a medical history and physical examination, histopathological tissue diagnosis and imaging diagnostics. The clinical history begins with the current disease and includes the duration and location of symptoms such as non-healing ulcer, oral or neck formation, pain, bleeding and any cranial nerve deficiency symptoms. An in-depth study of the patient's previous medical and surgical history and review of the systems provides evidence of operational risk.

CHAPTER TWO

METHODOLOGY FOR CONDUCTING THE CLINICAL TRIAL

The second chapter of the dissertation sets out the aim, objectives, object and subject of the research, the scientific thesis and scientific hypothesis, and methods.

The location and time period of the study were revealed – all patients were operated at the ENT Clinic of the University Hospital "Dr. Georgi Stranski", Pleven, in the period 2019-2023. The clinical characteristics of the studied patients are presented, as well as the criteria for inclusion in the study.

The defects in the oral cavity are brought out, focusing on the acquired defects – the main subject of the dissertation.

The types of flaps and their clinical and anatomical characteristics are presented.

The submental flap (flap based on the submental vessels) is a cutaneous-muscular pedicle-based flap that includes skin, subcutaneous adipose, platysma, adipose tissue, and lymph nodes from the submental area and may include parts of the anterior abdomen of the digastric muscle, the mylohyoid muscle, and part of the lower jaw. The submental artery is a branch of the facial artery. It separates from the latter at the upper posterior end of the submandibular gland, goes under the lower edge of the lower jaw and ends behind the symphysis of the lower jaw, where it releases a variable number of perforants that puncture the platasm and feed the subdermal plexus in the submental region (Parmar et al. 2009)

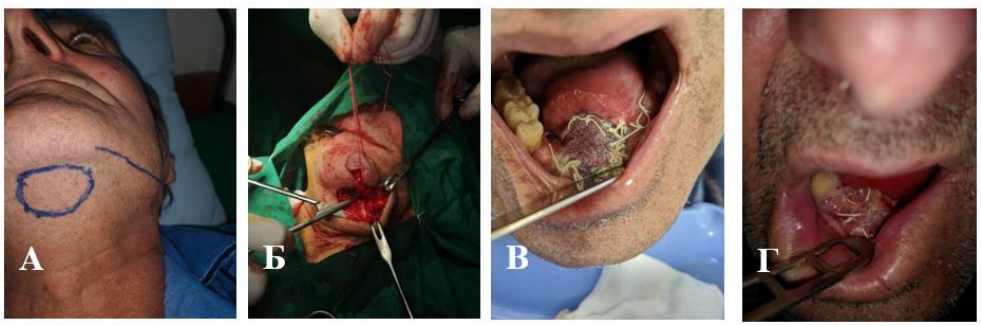


Figure 6.
Preoperative (A), intraoperative (B) and postoperative (C, D) images of submental flap

The nasolabial flap can be used as an insular cutaneous-subcutaneous, myocutaneous or pedicle-based flap. It is very suitable for one-stage reconstruction of oral defects or for staged reconstruction of facial defects. It is based on the facial artery, which makes nutrition very reliable and is suitable for use in unfavorable for other flaps conditions (Kallappa et al. 577–581).

Figure 7.
Intraoperative (A, B) and postoperative (C, D) photos on the first day of nasolabial flap

The *m. platysma flap* is an island myocutaneous flap that can be used to close defects on the lower face, cheek, and floor of the oral cavity. In certain cases, the flap may reach the oropharynx; however, depending on the patient's bodily habit, the closure of defects in the oropharynx may require excessive strain and impaired blood supply.

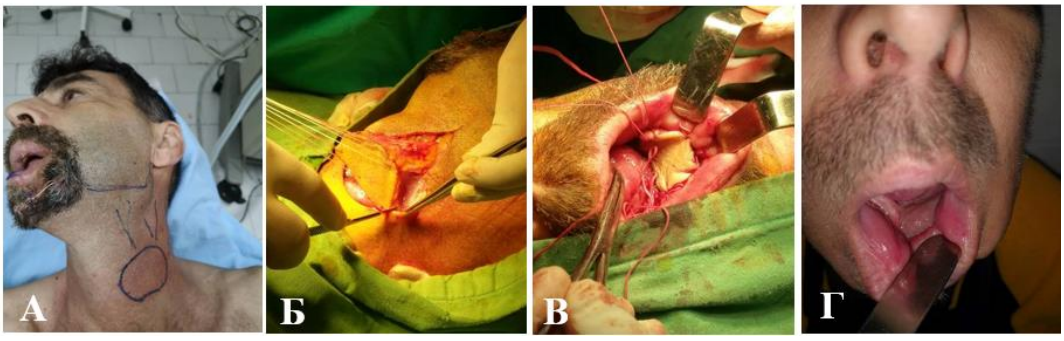


Figure 8.

Preoperative (A), intraoperative (B, C) and postoperative (D) images of flap from *m.platysma*

The buccal flap may be composed of a mucous membrane, buccal muscle, fatty body, or a combination of these. Here, the flap is seen as a combination of mucous membrane and muscle, as the team most often uses it.

The buccinator myomucosal flap is an axial flap based on the facial and/or buccal artery. This is a flexible and multifunctional flap suitable for the reconstruction of soft tissue defects of the oral cavity, oropharynx and nasal septum. Unlike most free flaps, it provides mucosal coverage and is sensory. The donor site can usually be closed without causing deformation or scarring. The flap is about 5 mm thick and includes buccal mucosa, submucosa and buccinator muscle, with feeding vessels and vascular plexus (Rahpeyma et al. 2015: 58-62).

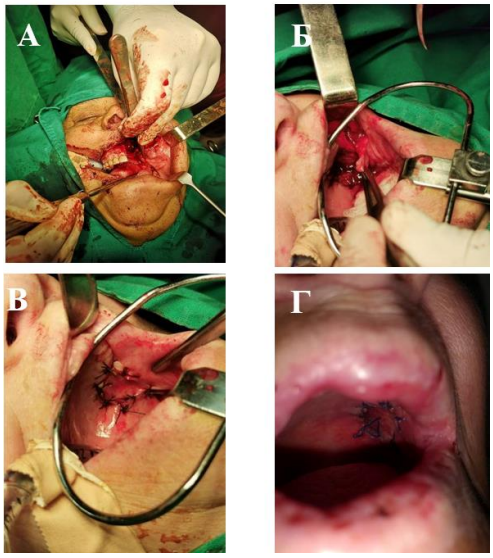


Figure 9.
Intraoperative (A, B, C, D) shots of buccal flap

The temporal flap is a pure muscle flap, and its aponeurosis may also be included. It is used to fill defects in orbital exantheration, cheek, upper jaw or palate defects. The floor of the oral cavity is not the most suitable flap due to the relative distance and passage of the pedicle through the soft tissues of the cheek. Bone transfer,which is suitable for closing defects of the palate, is also described. There is also a pure fascial flap from the temporoparietal fascia (Shanmugam et al. 2017: 321-325).

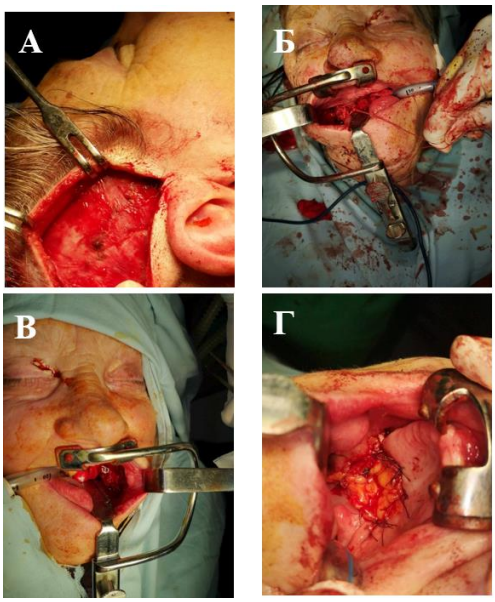


Figure 10.
Intraoperative photographs of temporal muscle flap (A,B,C,D)

The pectoral muscle flap is widely used in maxillofacial reconstructive surgery to cover the lower and middle floors of the face (cheek, lower lip, oral floor, chin). It is also used to cover neck defects and for pharyngoesophageal reconstruction. Beside the face, this flap is used to cover the axillary fossa and medial thoracic region. The pectoralis muscle flap has the following advantages: constant anatomy, easy implementation, one-stage, stable patient operating position, large rotation arc, large muscle and skin mass. The lymphatic dissections and irradiations are usually at a great distance from the area of the pedicle.

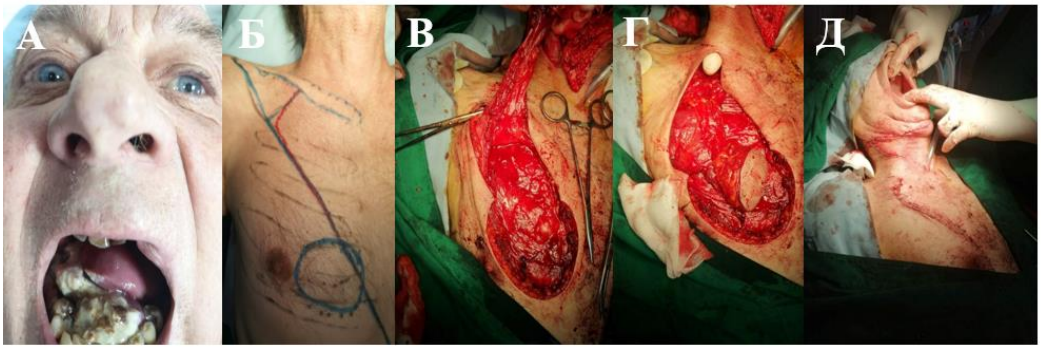


Figure 11.

Preoperative (A, B) intraoperative (C, D, E) status – pectoral flap

This chapter of the dissertation also presents methods for closing defects in the oral cavity through spontaneous epithelialization; release and suturing of surrounding

tissues; plastic surgery with local tissues; free skin transplantation; free mucosal transplantation; nasolabial flap; pedicle-based flap; island myocutaneous flap from platysma; cutaneous-subcutaneous flap from the submental area; cutaneous-muscular flap from m.sternocleidomastoideus; pectoral myocutaneous flap; island myocutaneous flap from m.trapezius; buccal flap and others.

CHAPTER THREE

DESCRIPTION OF SPECIFIC PATIENT CHARACTERISTICS. RESULTS

Chapter three presents an empirical-clinical study involving 35 inpatient patients admitted and examined at the ENT Clinic of the University Hospital "Dr. Georgi Stranski", Pleven, in the period 2019-2023. The main criteria for inclusion in the retrospective study are the voluntary principle and the data that are valid for the subject of the dissertation. The statistics have been processed using the Excel program.

The most common diagnosis in the studied group of patients is CA – 80% of those admitted for surgery are people with cancer. The next group of patients is that with BRONJ – 11.4%, followed by a group with an equal percentage ratio in ONJ (2.9%) and Trauma (2.9%) diseases.

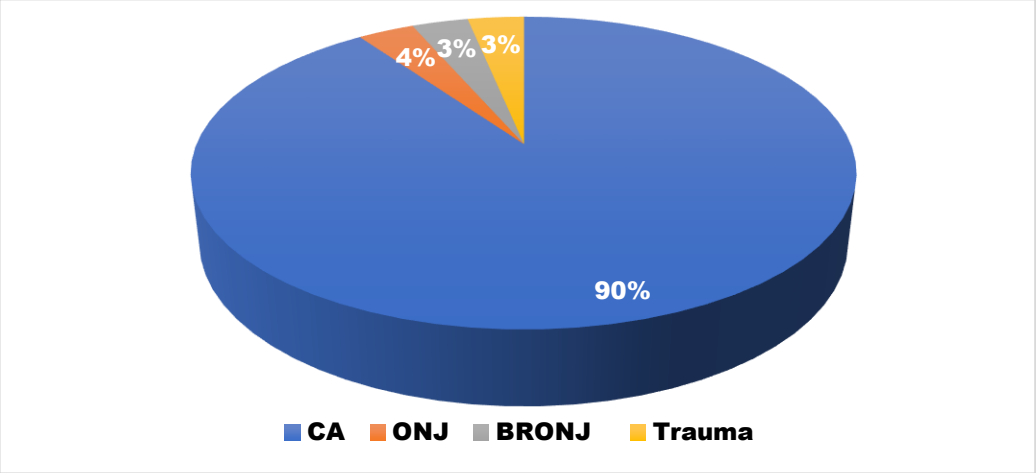


Figure 12.
Diagnosis of diseases in the studied group of patients

The surgical intervention that is applied depends on the severity of the tumor and the surrounding tissues affected. In the sample presented, most interventions

were applied using the Resectio partialis mand approach. Electroexcisio (17.1%), followed by Resectio partialis mand. Electroexcisio and Disectio colli (14.3%), with an equal number in percentage ratio have the surgical interventions in Resectio partialis mand. Electroexcisio. Disectio colli (11.4%) and Electroexcisio et disectio colli (11.4%).

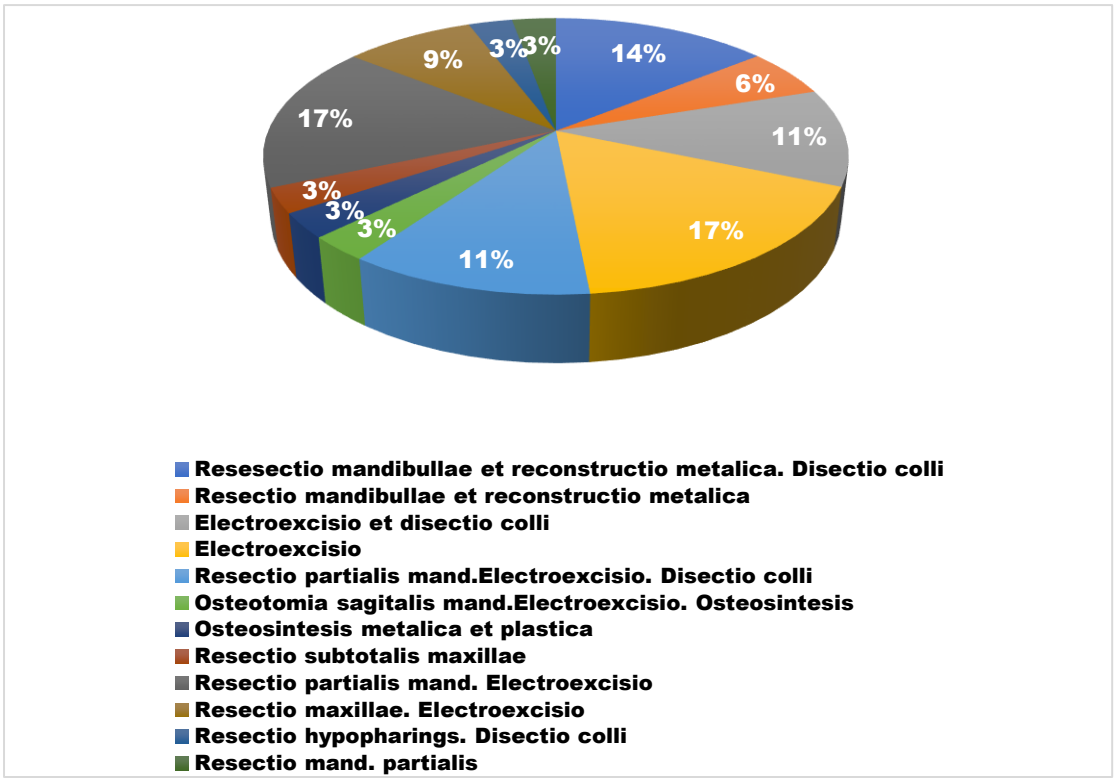


Figure 13.
Type of Operations

The anesthesia used in surgical intervention is three types according to the type of surgical technique and the individual case.

⇒ OA – orotracheal;

⇒ OA – nasotracheal;

⇒ OA-tracheostoma.

The chart below shows that the most commonly used anaesthesia is OA-nasotracheal (48.6%), followed by OA (45.7%) and OA-tracheostoma (5.7%). It turns out that the preferred anesthesia is OA.

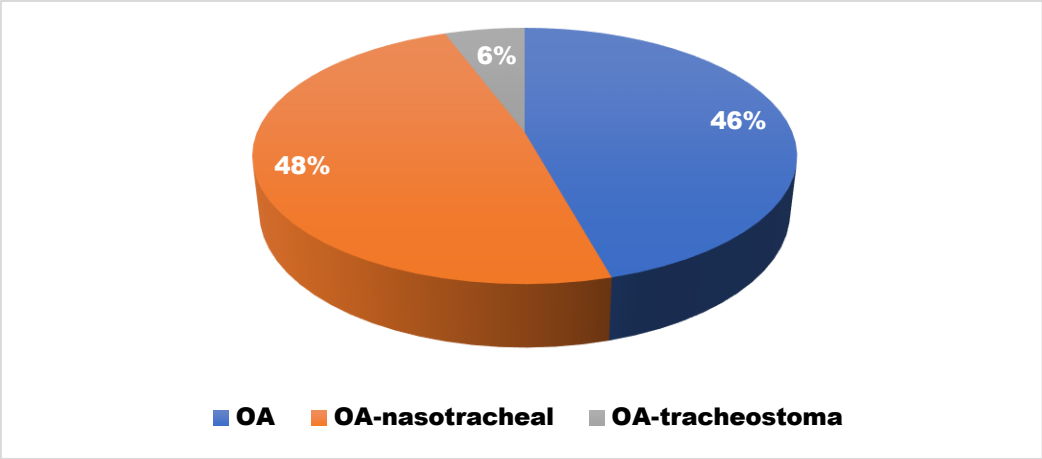


Figure 14.
Type of anesthesia administered

The reconstructive techniques used are: PMF; PMMF; BF; TF; SMF; NLF_X2; NLF+BF; NF_X2.

The diagram shows the most commonly used reconstructive techniques in the examined group of patients. The most common reconstructive technique of the six mentioned in the chart is BF (31%), followed by PMF (27%) and SMF (19%).

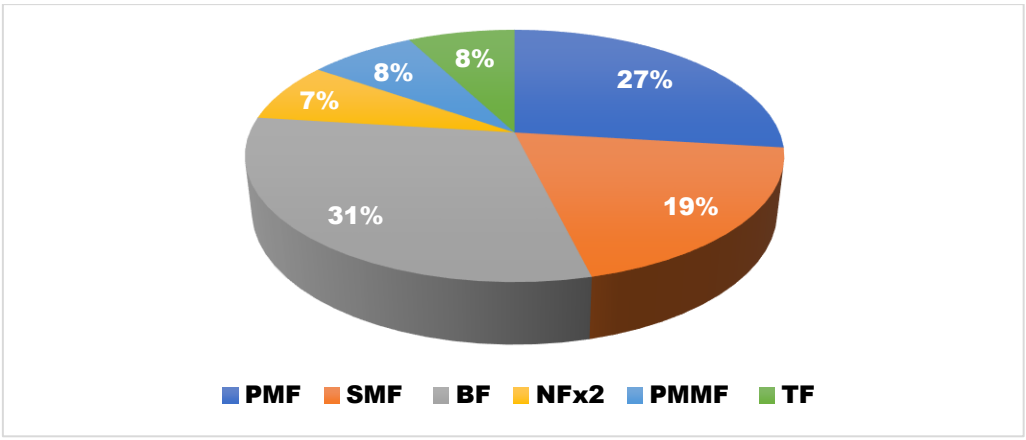


Figure 15.
Reconstruction techniques

The post-operative complications that occur are:

⇒ without complications;

⇒ fistulapharyngo-cutanea-reoperatio;

⇒ cianosis;

⇒ contractura;

⇒ dehiscence. Necrosis-reoperatio;

⇒ dehiscence flap;

⇒ necrosis flap;

⇒ fistulaoro-antralis;

⇒ dehiscence;

⇒ fistula pharingo-cutanea,necrosis-reoperatio;

⇒ haemorrhagia-revisio.Necrosis flap.

The diagram shows the complications that can be observed after surgical intervention. The most positive trend observed is that there are no complications from the conducted operational interventions (84%), which is due to the team experience, on the one hand, and on the other hand – to the type of operational intervention. Dehiscence (14.3%) and Fistula (8.6%) are complications that occur more often than those cited above.

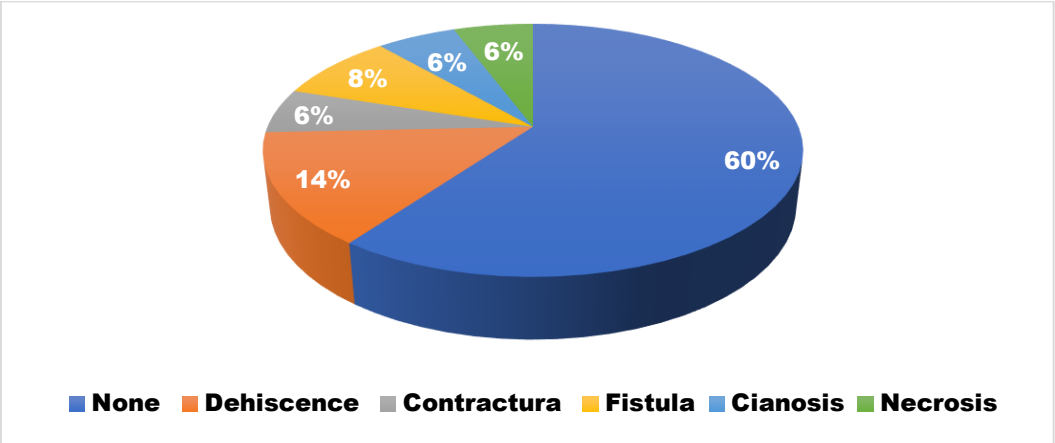


Figure 16.
Post-operative complications

Depending on the type of defect, they are divided into:

⇒ soft tissue defects – cover the anterior or lateral part of the floor, tongue, lower lip, soft palate, palatal arch, cheek, pterygomandibular area, the entire floor of the oral cavity and 2/3 of the tongue, posterior

lateral part of the palate, oral angle, nasolabial area, hypopharynx, tongue root;

⇒ defects of bone structures – cover the mental department of the lower jaw, lateral part of the lower jaw, alveolar comb, hard palate, maxilla, oro-antral communication;

⇒ combined or combined defects – front of the floor and mental department of the lower jaw; front of the floor of the UC and mental department of the lower jaw; lateral part of the floor, angle of the lower jaw; lower lip, alveolar crest; front of the floor, mental department of the lower jaw, lower lip; alveolar crest, lateral part of the floor, tongue; alveolar crest, lateral part of the floor; alveolar crest, soft tissues.

Undoubtedly, the most serious complication is persistence or recurrence of the tumor, as well as the appearance of metastases. Due to the referral of patients for radiotherapy to the various oncological dispensaries in the country and the loss of contact with a large number of them, it is difficult to make statistics at what percentage these complications occur.

Mistakes can be made before the operation, during the operation and in the post-operative period. The most common mistake that is made pre-operatively is the incorrect selection of patients. Patients with severe cardiovascular and pulmonary diseases, uncompensated diabetes, hemophilia, patients on systemic corticosteroid therapy, with inflammatory diseases, especially near the areas to be worked, and other manifestations, are not best suited for flap use.

Soft tissue defects are shown as a percentage of the diagram, and are divided among a total of 19 patients into: the front of the floor and the mental compartment of the lower jaw; the front of the floor of the UC; the front of the floor (11.4%); the lateral part of the floor and tongue; the lateral part of the lower jaw and floor; the lateral part of the floor (14.3%) and others (22.9%), which includes: the tongue and mandibulolingual area (2.9%); the entire floor of the oral cuniform and 2/3 of the tongue (5.7%); the cheek and pterygomandibular area (5.7%); the soft palate and anterior palatal arc (2.9%); the oral angle, nasolabial area (2.9%); the hypopharynx, the root of a tongue (2.9%).

- the front of the floor and the mental compartment of the lower jaw; the front of the floor of the OC; the front of the floor
- the lateral part of the floor and tongue; the lateral part of the lower jaw and floor; the lateral part of the floor
- others

Figure 17.
Soft tissue defects

Bone structure defects were observed in a total of 6 patients and included: lateral lower jaw (5.7%); lateral lower jaw and cheek (2.9%); hard palate, alveolar crest (5.7%) and oro-antral communication (2.9%).

- lateral lower jaw
- lateral lower jaw and cheek
- hard palate, alveolar crest
- oro-antral communication

Figure 18.
Bone structure defects

The combined defects were observed in 10 patients, with the most common defects being: anterior floor area of the UC and mental area of the lower jaw (11.4%); lateral floor area, lower jaw angle (2.9%); lower lip, alveolar crest (2.9%); alveolar crest, anterior and lateral floor area, tongue (8.6%) and alveolar crest, soft tissues (2.9%).

- anterior floor area of the OC and mental area of the lower jaw
- lateral floor area, lower jaw angle
- lower lip, alveolar crest
- alveolar crest, anterior and lateral floor area, tongue
- alveolar crest, soft tissues

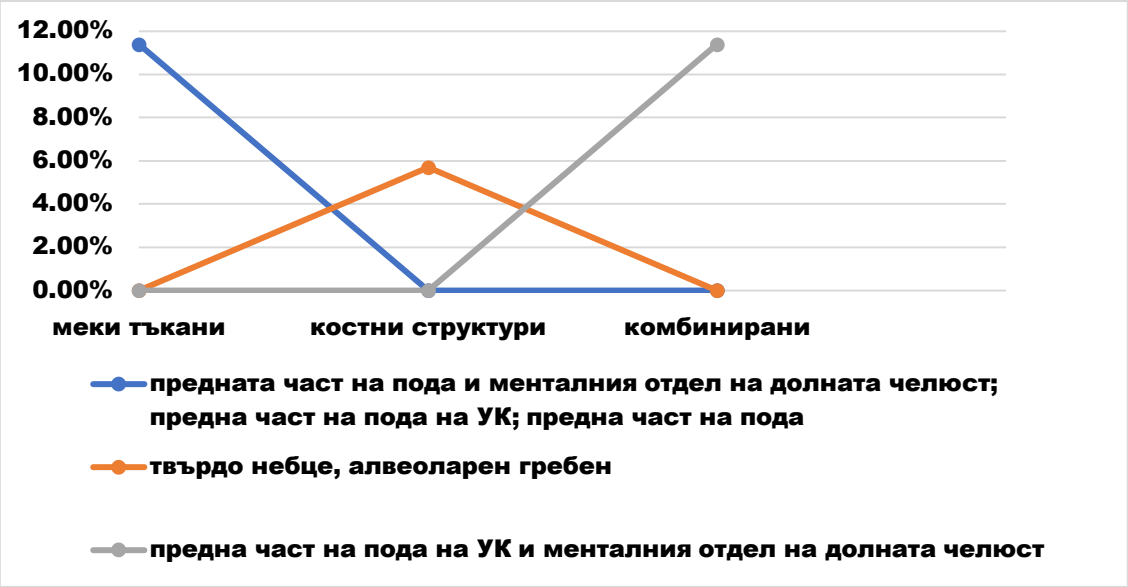
Figure 19.
Combined Defects

In a summary diagram, the three types of defects are presented. The illustration shows that the most common defects are in soft tissues - more than half of the patients studied have this type of problem (54.3%), followed by combined defects (28.6%) and defects of bone structure (17.1%)

- soft tissues
- bone structures
- combined

Figure 20.
Defect Types – Summary Chart

The line chart illustrates the types of oral defects by tracking the change in the condition of a patient. This displays continuous data over time along an evenly scaled axis and is therefore ideal for displaying trends in data at regular intervals.



- soft tissues
- bone structures
- combined

- anterior floor area and the mental area of the lower jaw; anterior floor area of OC; anterior floor area
- hard palate, alveolar crest
- anterior floor area and the mental area of the lower jaw

Figure 21.
OC Linear Defect Types Chart

A total of 35 patients were included in the study group, with 19 (54%) of them male and 16 (46%) female.

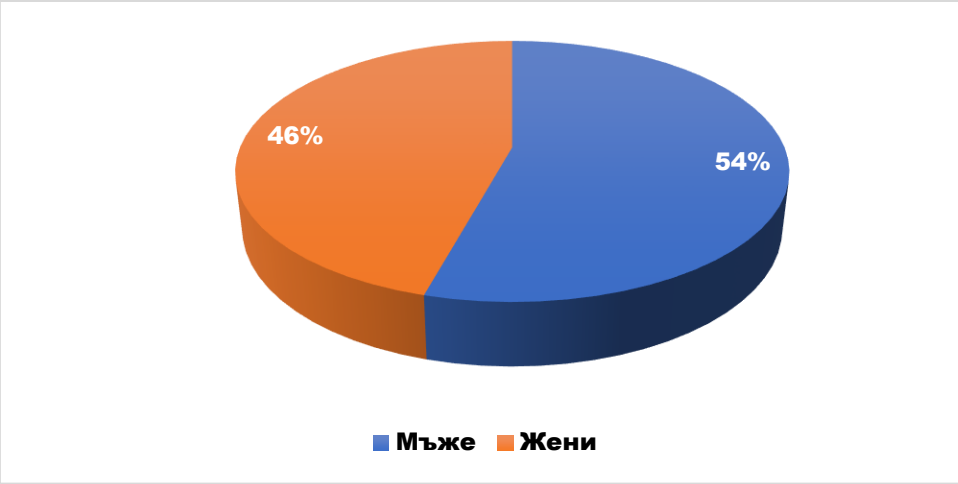


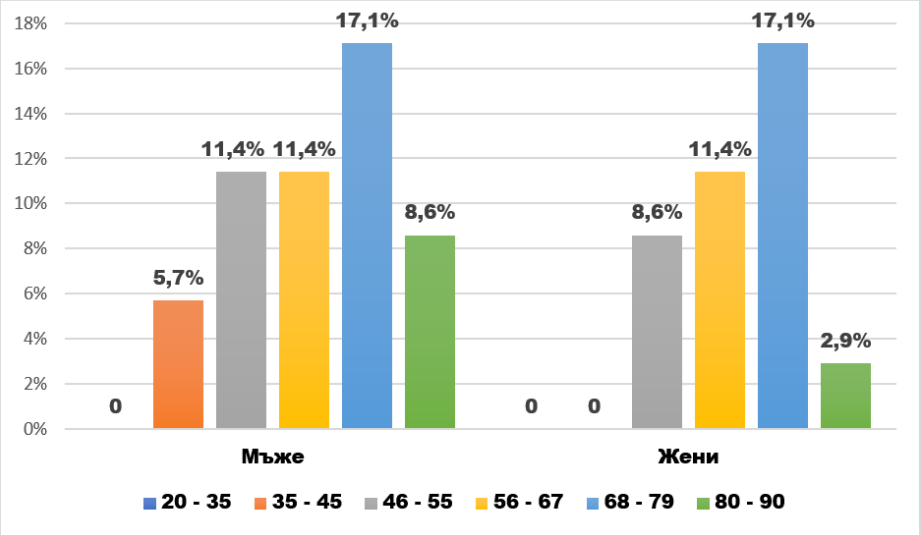
Figure 22.

Percentage distribution of the patients in the experimental group

The average age of the total patient sample was n=63.72 years for men, and n=66.93 years for women. The youngest operated patient is 40 years old and male, respectively the oldest is 88 years old and female. Patients are grouped according to age range:

Age in years	Men	Woman
20 / 35	none	none
35-45	2 (5.7%)	none
46-55	4 (11.4%)	3 (8.6%)
67	4 (11.4%)	4 (11.4%)
79	6 (17.1%)	6 (17.1%)
> 80-90	3 (8.6%)	1 (2.9%)

Table 1.
Male and Female Age Distribution Table



Graph 1
Age distribution of the patients in the study

Both the table and the graph show that the largest group of patients is between the age of 68 and 79. There are no patients who cover the age range of 20-35 years in men and women, and this group is supplemented by women in the age range of 35 – 45 years. This categorization can be attributed to two main signs – the first is that most patients are from the cities of Pleven and Lovech and their adjacent villages, where the population is demographically aging, and the other sign is that the specifics of their diseases cover a higher age range.

The following table shows the distribution of patients according to the flap used.

Flap type	Sample 35
nasolabial	6 (17.1%)
buccal	11 (31.4%)
temporal	3 (8.6%)
platism	7 (20%)
sub-mental	5 (14.3)
pectoral	3 (8.6%)

Table 2.
Distribution of the patients according to the type of flap used

nasolabial
buccal
temporal
platism
sub-mental
pectoral

Figure 23.
Distribution of patients according to the type of flap used

Both the table and the figure show that the most used flap is the buccal flap (31.4%), followed by platism (20%), and the lowest percentage is for the pectoral and temporal flaps (8.6%).

The following figure shows the percentage cases of more than one flap being used.

nasolabial	nasolabial and buccal
Temporal and buccal	buccal

Figure 24.
Distribution of the patients according to more than one flap being used

The figure shows that the most frequently applied re-use is the nasolabial flap (67%), considered as a percentage of the total sample, followed by the buccal flap (17%).

The figure shows the distribution of the patients according to the type of disease.

- malignant tumor
- osteomyelitis and osteonecrosis
- traumas

Figure 25.
The distribution of the patients according to the type of disease

83% of the total sample had malignant tumor formations, followed by a group of patients with osteomyelitis and osteonecrosis (14%) and, finally, those patients with traumas (3%).

Regarding the time of surgery, in 32 patients the duration of the intervention was the same, and in three of them - a two-stage approach was taken to the procedure.

INFERENCES

Based on the data provided, the following conclusions are drawn from the study among 35 patients of the ENT Clinic of the University Hospital "Dr. Georgi Stranski", Pleven in the period 2019-2023:

1. The most common diagnosis in the studied group of patients is CA – 80% of those admitted for surgery are people with cancer.

2. The surgical intervention that is applied depends on the severity of the tumor and the surrounding tissues affected. In the sample presented, the most interventions were applied using the Resectio partialis mand approach. Electroexcisio (17.1%).

3. The most commonly used anesthesia is OA-nasotracheal (48.6%).

4. The most common reconstructive technique of the six mentioned in the diagram is BF (31%).

5. The most positive trend observed is that there are no complications from the conducted operational interventions (84%), which is due to the team experience, on the one hand, and on the other hand – to the type of operational intervention.

6. Oral cavity defects are divided into soft tissue defects; defects of bone structures and combined defects.

7. The most common soft tissue defects are on the lateral area of the floor and tongue; the lateral area of the lower jaw and floor; the lateral area of the floor (14.3%), followed by the anterior of the floor and the mental area of the lower jaw; the anterior of the floor of the OC; the anterior of the floor (11.4%).

8. The most common defects of the bone structure are of the lateral section of the lower jaw (5.7%) and of the hard palate, alveolar crest (5.7%).

9. The most common combined defects are on the the anterior of the floor of the OC and the mental area of the lower jaw (11.4%), followed by defects of the alveolar crest, the anterior part and lateral part of the floor, tongue (8.6%).

10. More than half of the patients studied have a problem covering soft tissue and bone structures defects (54.3%).

DISCUSSION

The recovery of oral defects after oncological operations is not an easy task for surgeons. The main objective of their work is to evaluate the functionality, viability and safety of the submental flap for oral reconstruction. Cariati et al. (2018: 284-287) analyzed the records of patients diagnosed with oral and oropharyngeal SCC and reconstructed ones using a submental flap.

A study by Koch et al. (2012: 2111–2119) evaluated myocutaneous platysma flap (MPF) as an alternative to free flaps for defect closure after head and neck tumor resection in selected cases. MPFs were used to close small to medium-sized oral and pharyngeal defects after surgery for stage cT1-3 tumors (oral cavity 37.1%, oropharynx 24.3%, hypopharynx 38.6%) in 70 patients. Flap-related complications developed in 27% of cases (partial necrosis 7%, total necrosis 3%, salivary fistula 11.4%, bleeding/hematoma 5.7%) and donor site complications in 10%. The closure of the defect was adequate in 97%; 62.5% of the patients required intraoperative tracheotomies (closed again in 72.5%).

Alkan et al. (2003: 465–470) conducted a study to assess the success of buccal fat pad, used in the reconstruction of oral defects, to clarify the indications and limitations of the size, and to identify risk factors, if any. In this prospective clinical study, buccal fat pad was used in 26 patients with various indications, which included 5 defects, resulting from tumor excision, 3 maxillary cysts, 3 secondary maxillary cysts, and 15 oroantral communications. All defects are in the upper jaw with a maximum size of 5×3 cm. The patients were evaluated for signs of flap epithelization, infection, fistula recurrence, and facial contour deficiency. Results: the epithelialization process was completed after 3 to 4 weeks without any complications in 22 patients. However, partial flap dehiscence was observed in 2 patients with major maxillary defects. Serious bleeding was also observed during surgery in one of the cases. Due to the small fistula, 1 patient was reoperated. In conclusion, the results of this series support the view that the use of buccal fat pad is a simple, convenient and reliable method for the reconstruction of small to medium-sized oral defects.

The aim of a study by Almadori et al. (2015: 386-393) is to investigate oncological outcomes in patients affected by oral cancer treated with radical compartmental surgery followed by reconstruction of a microvascular flap. A retrospective analysis was conducted on a group of 130 patients. All patients underwent ablative tumor resection (compartmental surgery) followed by immediate reconstruction with free flaps and adjuvant chemoradiotherapy when necessary according to international guidelines. Disease-specific survival curves (DSS) were obtained using the Kaplan-Meier method. The log-rank test and the Wilcoxon signed-rank test were used to examine the most important prognostic factors of 5-year DSS. A Cox proportional hazards model is constructed to provide hazard ratios or relative risks for individual variables. 88.5% of the patients were affected by SCC. The sample consisted of 46 (35.4%) women and 84 (64.6%) men with an average age of 58.5 years. At the end of the follow-up period, 36 (27.7%) patients died, only 3 of whom from other causes. The 5-year DSS rate was 67.8% (SE 4.9%).

SMF was first described by Martin et al. in 1993 in their search for an ideal flap to repair facial defects in terms of color, shape, and tissue texture. (Martin et al. 1993: 867-873). Three years later, it was used in oral squamous cell carcinoma by Sterne et al. (1996: 85-89). Over the past two decades, this flap has gained recognition as a reliable and easily accessible alternative in the reconstruction of oral defects. Thomas et al. (2016: 420-424) conducted a study among 229 consecutive oral cancer patients operated by extensive excision and reconstruction of a flap of the submental artery at the Regional Cancer Center, Trivandrum, India, from October 2004 to September 2012. They were tested to assess the viability of the flap and the degree of local-regional control. Patients also include those with clinically tangible nodules of dubious oncological significance. The submental flap was collected after thorough dissection and isolation of its vascular pedicle during neck dissection in all cases. The results show that there are 122 men and 107 women with an average age of ± S.D. of 56.12 ± 11.7 years, ranging from 18 to 85 years. Tongue is the most common localization (79.9%) and the majority of patients (80.3%) have a T2 stage tumor or lower. Forty-six patients underwent neoadjuvant chemotherapy and forty-two of them subsequently migrated (downstaged) to T2 or less. 74 patients (32.3%) had clinically tangible neck nodules prior to surgery, of which twenty-eight (12.2%)

had level Ib involvement. A marginal mandibullectomy should be performed in fifty-one (22.3%) patients for clearance.

Conclusion

The dissertation presents a scientific justification of the types of defects in the oral cavity, the complications, advantages and disadvantages of a preferred operative method.

Acquired defects of the oral cavity and the face will continue to be a healing problem in the coming years. Despite the positive trend of reduction of malignant head and neck tumors, improvement of prevention and new knowledge about the treatment of drug-induced jaw necrosis, despite improved diagnosis and search for new methods of treatment, improved paraclinical and imaging tests to monitor the occurrence of relapse, a serious reduction in these diseases and the defects that they form is not expected.

When the causes of defects are detected in time, adequate and timely treatment can help patients lead a life close to normal. This therefore highlights the need for thorough diagnostic processing, including medical/dental history, clinical examinations, examination models, photographic and radiographic recordings on a case-by-case basis to prevent serious functional and aesthetic complications. Recently advanced diagnostic procedures such as stereophotogrammetry, 3D stereolithographic models, skeletal scintigraphy (radionuclide scans), 3D computed tomography scans, cone beam computed tomography, and magnetic resonance imaging have provided innovative diagnostic tools for multiple maxillofacial defects.

Trends in the development of surgery towards minimally invasive and robotic, as well as the use of bone substitutes and bio printed tissues are beginning to appear in our country, but their introduction for mass use is slow, difficult and expensive and is not expected to enter practice anytime soon. The time is not far off when an expected large defect will be prepared in advance using a 3D reconstructive scanner, a 3D printed implant consisting of bone, muscle, skin and mucosa, and biocompatible with the specific patient. But until then, regional flaps will be used en masse for the closure of defects of the oral cavity due to the quick and relatively easy preparation, without the need for serious surgical qualifications by an operating team in one

operation time and the absence of a high percentage of complications – both for the flap and the donor site.

The reconstruction of oral defects is a major challenge for any team, as improper treatment can lead to multiple complications and more severe defects. The main reason for the reconstruction of these defects is the separation of the oral cavity from the surrounding areas - nose, maxillary sinus and neck. The reconstruction method should not interfere with swallowing and speech if possible. The different ways range from spontaneous epithelialization to complex composite flap with microvascular anastomosis.

The dissertation presents a theoretical-analytical and empirical-applied overview of maxillofacial anomalies, with emphasis on the study of flap survival, which is used when closing oral defects.

The first chapter introduces the scientific work.

In the second chapter, a literary review is made and basic definitions of defects in the oral cavity are drawn up. Opportunities for reconstruction of defects are offered, according to the practice of the clinicians, offering positive and negative effects of different modes of administration. Bisphosphonate osteonecrosis is being considered for the treatment of various medical conditions, while also considering factors that increase the risk of developing ONJ.

The types of defects in the oral cavity are deduced, dividing them into congenital and acquired (such as OAF and Ca) - the subject of the scientific work. The surgical activities that are undertaken have an important effect on the patient's self-esteem and quality of life.

A classification of tumors according to the TNM system is made, after which the prognostic indicators that determine patient survival and treatment decisions are revealed. Diagnosis is an important point in the clinician's process – a medical history is taken, a physical examination, histopathological tissue diagnosis and imaging diagnostics are made.

The third chapter is entirely empirical, outlining the methodology for conducting the clinical study – the aims, objectives, subject and object. An analysis of

the types of flaps and their clinical and anatomical characteristics (SMF, NLF, PMF, BF, TF, PMF) is made by applying photographic material from the practice of the author. The ways of closing defects in the oral cavity are also revealed – spontaneous epithelization, release and suturing of surrounding tissues, plastic with local tissues, free skin transplantation, free mucosal transplantation, nasolabial flap, pedicle-based flap, insular myocutaneous flap from platism, skin-subcutaneous flap from the submental area, skin-muscle flap from m.sternocleidomastoideus, buccal flap, etc. A classification of the types of flaps is made according to the tissues they contain, the way of vascularization, the connection and position with the donor's area, the way the tissues move from the donor to the recipient area.

The place and time period of the study are mentioned – all patients were operated at the ENT Clinic of the University Hospital "Dr. Georgi Stranski", Pleven in the period 2019-2023. The clinical characteristics and criteria for inclusion of patients in the clinical study are presented. Test methods are applied. The specific characteristics of the patients are described and the results of the clinical study are applied.

A separate heading outlines the errors and complications that occur before, during and after an operative intervention.

Conclusions are drawn based on the presented empirical and applied data from practice and a conclusion is drawn.

Scientific contributions are only a small part of the overall contribution of the dissertation, since in the years of gaining experience in practical and theoretical-scientific work, the author shares his experience as a diagnostician, clinician and surgeon.

CONTRIBUTIONS OF THE DISSERTATION

The dissertation is distinguished by the following theoretical-analytical and empirical-applied scientific contributions:

1. It tracks, analyzes, and summarizes a sample of 35 regional flaps used to close oral cavity defects, considering the specifics of each individual flap, anatomical variations, errors, complications, and recommendations.

2. It confirms the ENT clinic at "University Hospital—Dr. Georgi Stranski"—Pleven as one of the leading clinics in the country and, as the author of the dissertation, as one of the leading surgeons engaged in major oncological surgeries of the head and neck.

3. It serves as a step towards the future development of reconstructive surgery, reconstruction using a 3D virtual scanner and bioprinted tissues for the oral cavity and face defects' closure.

4. The empirical study establishes leading criteria for performing surgical manipulations such as: the most commonly used anesthesia, most common reconstructive technique, most positive trend related to the team experience, most common soft tissue defects, bone structure defects, combined defects, thus, according to the data presented, standards for surgical treatment can be derived.

LIST OF SCIENTIFIC PUBLICATIONS IN CONNECTION WITH THE DISSERTATION

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ACKNOWLEDGEMENTS

I would like to express my personal gratitude and respect to my scientific supervisor Assoc. Prof. Dr. Alexander Valkov, MD for his professional and responsible attitude towards me, as well as to thank him for the constructive criticism during the process of compiling the scientific work.

I thank the Clinic of ENT Diseases of the University Hospital "Dr. Georgi Stranski", Pleven, for trusting me to be their doctoral student.

I also thank all my colleagues who supported me during this difficult and responsible path.

DECLARATION OF ORIGINALITY AND RELIABILITY OF THE DISSERTATION

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Dissertation on "Study on the survival of the flaps used in the closure of oral defects" for the acquisition of the educational and scientific degree 'DOCTOR'

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