OVIDIUS UNIVERSITY CONSTANȚA
FACULTY OF MEDICINE

ANATOMICAL PATHWAYS OF ODONTOGENIC INFECTIONS IN CERVICO-FACIAL REGIONS

- SUMMARY OF PHD THESIS -

SCIENTIFIC COORDINATOR:
PROF. DR. BORDEI PETRU

PHD CANDIDATE:
MOHAMMED AL MUTAWAKEL

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KEYWORDS:

1. **ODONTOGENIC INFECTIONS**
2. **PATHWAYS OF SPREAD**
3. **CERVICO-FACIAL SPACES**

INTRODUCTION

Head and neck infections represent a frequent problem in the current practice of dentists and specialists of oral and maxillo-facial surgery. Most of these infections are caused by a polimicrobian aerobic flora, anaerobic and non-specific facultative anaerobic and the most common etiology is dento-periodontal pathology, Cranio-facial trauma, accidentally penetrated foreign body the mucosa or skin, staphylococcus infection, salivary gland stones, tonsil or pharyngolaryngeal infections, malignant bone tumors which become infected, are also starting points for head and neck suppurations, but they are not covered in this study.

Odontogenic infections evolution is influenced by the number and virulence of microorganisms involved, the anatomical particularities of the region, the body's defense mechanism and not least, the timely implementation of appropriate treatment.

Odontogenic infections rarely extend beyond the anatomical boundaries of the mandible for deep space head and neck, but once produced such an extension, the correct evaluation of fascial spaces involved is difficult and relies on knowledge of methods and their pathways. The purpose of this paper is to analyze the anatomical features that determine the pathways of disseminating odontogenic infections into the head and neck spaces, without trying to deal with other aspects of these disorders such as clinical manifestations or treatment.

Cervico-facial infections of odontogenic origin has affected humanity through history, ancient human remains were discovered in ancient Egypt who had signs of dental abscesses and papyrus describing treatment.

Relationship between fascial planes and dissemination of head and neck infections was given attention in the 1930s, a period in which their anatomical aspects has already been fully clarified and the radiological explorations are common, contributing to a precise diagnosis and can forsee any possible complications. Infection's treatment had a spectacular evolution after the emergence of antibiotics to cure and improve the means of treatment in dentistry. Despite the great development of the means of diagnosis and treatment, number of head and neck infections with odontogenic starting point is further increased, particularly due to the late addressability of patients to doctor or inadequate treatment, most commonly used on own initiative, without a prescription. All this is also why I chose the thesis topic with selectable cases from Oral and Maxillo-Facial Surgery clinic in County Emergency Hospital of Constanța between period 01.01.2008 - 31.07.2011, clinic where I performed my residency and where I work in the present. With the help of the anatomical studies conducted in the department of anatomy, I was able to establish anatomical pathways distribution of odontogenic infections in head and neck spaces, which is absolutely necessary to treat complications, especially in these infections.

The general part starts with embryological developmental of the head and neck, absolutely necessary to establish morphological features of various head and neck regions, the channels of communication between them and especially the persistence of these variants and abnormalities.

Further are presented the anatomical characteristics related to the delimitation, the structure and content of the head and neck spaces, the anatomy of the cervical fascia being presented in detail.

In the next chapter, that of the cervico-facial infections, are presented in order: oral microbiology, the main microbial species in the mouth, antibacterial protection mechanisms in the mouth, oral microbial and periodontitis, apical periodontitis and immunity and anti-infective defense . Presentation of pathways of dissemination of infection from the outbreak inflammatory presentation is followed by the soft perimaxilary infections, which were described: pathogenesis, pathogenic mechanisms which lead to suppurative processes of the soft tissues and anatomical-clinical forms. Are presented: 1. Periosseous abscesses, 2. Superficial spaces abscesses, 3. Deep spaces abscesses, 4. Diffuse infections. Among nonspecific inflammatory lymphadenitis of the head and neck are presented acute adenitis (submandibular, parotid, jugulo-carotid, genian) and chronic adenitis, perimaxilary chronic fistulas, and finally the principles of diagnosis and treatment of odontogenic infections.

In the personal part, after the material and methods work, we presented 30 cases that we were able to follow from their diagnosis and development until discharge, describing symptoms, clinical and laboratory examinations performed, surgical and medical treatment, developments and complications, highlighting the pathways of transmission of infection from the odontogenic pathological process into the cervico-facial region that has been affected, everything being illustrated with extensive imaging. In the discussion chapter I compared the results of personal outcomes with the existing literature that I was able to consult. In the last chapter, we presented some conclusions which we have emerged from this study, conclusions that we consider to be worth remembering by both morphology and especially the practitioner.

In closing I want to thank the Ph.D. supervisor, Professor Dr. Petru Bordei who guided me for 4 years in making this work. Also thanks Associate Professor Adrian Creangă, under whose direct supervision I worked more in the Oral and Maxillo-Facial Surgery Clinic of the Emergency County Hospital of Constanța, Associate Professor Ion Niculae, from the same clinic and the staff of the clinic.

PERSONAL PART

MATERIALS AND METHODS

The study was conducted on a sample of 6842 patients who presented at the Oral and Maxillofacial Surgery Clinic of the Emergency County Hospital of Constanța during the period 01.01.2008 - 31.07.2011. Within this group were identified a total of 1280 patients who were diagnosed with infections, of which 1109 had infection of odontogenic etiology.

Necessary data were obtained by:

• history: personal data (name, sex, age, provenance), reasons of presentation, history and personal history pathological condition

• clinical examination of endo oral and loco-regional of the head and neck, emphasizing especially by inspection and palpation suggestive of a pathological discharge

• laboratory tests: a standard set of investigations was used that was later adapted according to each particular case:

• CBC: number of leukocytes, lymphocytes, monocytes, granulocytes, erythrocytes number, hemoglobin, hematocrit, mean corpuscular volume, hemoglobin eritocitar average, average concentration of hemoglobin / erythrocyte width distributions, platelet number, platelet mean volume, plachetocrit, platelet distribution width;

• urea, creatinine;

• Blood glucose, glycosylated hemoglobin;

• sideremia;

• Tests of coagulation: bleeding time, APTT, Quick time, prothrombin time, INR;

• Total cholesterol, HDL cholesterol, triglycerides;

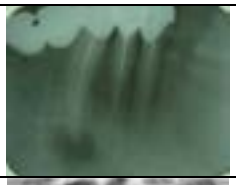
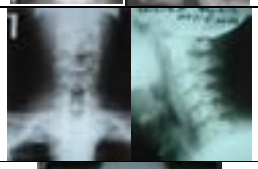
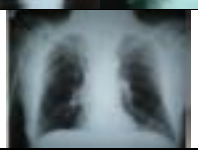
• Serum Calcium, Magnesium, Sodium, Potassium,

• ALT/SGOT, AST/SGPT;

• Uric acid, creatinine, urinary glucose, urinary urea;

Radiographic examination: varied incidence of X-rays were used to clarify the causal factors and explore possible dental complications:

TABLE NO. 1 - TYPES OF USED RADIOGRAPHIES

No.	Radiography type	Photo
1.	Periapical	
2.	Ortopantomography	
3.	Scrolled jaw radiographs incidence	
4.	Cranio-facial incidence (A-P and lateral)	
5.	Cervical incidence (A-P and lateral)	
6.	Chest X-ray	

Clinical and statistical analysis of data obtained was performed on the following criteria: pathology, age, sex, place of origin, dental causal factor, diagnosis, duration of hospitalization.

For each of these criteria we conducted one centralized data table to the total number of patients and showed a graphic from which the conclusions are presented below. Treatment of patients in this study followed three main steps: surgical, medication and treatment of dental causal factor.

Surgical treatment

Is made following general steps which apply regardless of the type or location of the suppuration: incision and evacuation of the collection followed by antiseptic lavage and drainage. Anesthesia used for incision of head and neck odontogenic infections may be local or loco-regional anesthesia with or without IV sedation depending on the location and severity of the infection. Thus, if the periosseous abscesses most commonly used intradermal or intramucosal anesthesia placed along the incision line, for the fascial spaces infections or those with extensive and rapid development iv sedation is associated or practiced under general anesthesia by oro-tracheal intubation. Most commonly used local anesthetics are lidocaine (Xilin), mepivacaina (Mepivastesin) and articaine (Ubistesin).

The incision is practiced in a low area of the collection to allow gravity

drainage, except where aesthetic needs are great. For the incision we use scalpel blades no.11 or no.10. Incisions must be wide to facilitate the access of the operator, the drainage of the pus collection and removal of necrotic tissue. Choosing where to place the incision is made according to the anatomical areas affected by any development in the fascial spaces and neighboring vital structures present at this level.

Evacuation of purulent secretions for superficial collections is done immediately after the incision, while for deep collections requires open space by blunt dissection performed using a Pean curved forceps.

Antiseptic lavage performed with hydrogen peroxide and chloramine B which acts mechanically by driving remaining debris to discharge and chemically by tissue oxygenation and the antiseptic action. Drainage of abscesses is practiced preferably by tubes fixed to the skin or mucosa. Drainage of purulent collection must permit evacuation and antiseptic lavaj. Drainage tubes remain 24 to 72 hours until a significant reduction or disappearance of purulent secretion from the wound. Wound healing will be done per secundam.

Medication

Follows fight infection (antibiotics), inflammation and pain (antiinflammatory and analgesics) and is administered orally or by injection. First-line antibiotics use common antibiotics, preferably in combination, effective on the aerobic and anaerobic flora.

The most frequently used regimen is: Penicillin G 2000000-5000000 U.I. every 12 hours, i.v. (dose increased with severity of infection), Metronidazole 500 mg every 8 hours, iv, Gentamicin 80 mg every 8 hours iv or im, Ketonal 100 mg every 12 hours, i.v. or im.

Targeted antibiotic sensitivity testing is indicated in the following conditions: initial antibiotic treatment inefficient, rapidly severe evolving after first-line antibiotics and surgical treatment, infections which interests multiple profound secondary fascial spaces, patients allergic to common empirically antibiotics, aged patients, immunocompromised or systemic disease, perimandibular infections (risk of osteomyelitis), repeated infections, with long evolution, with a history of repeated antibiotic treatments.

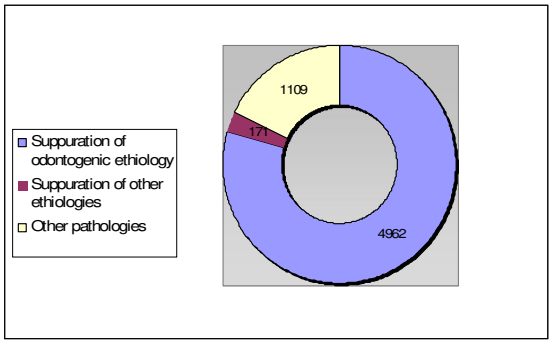
Causal dental factor treatment

May be conservative or radical, depending on the scale of the infection and causal tooth condition which is evaluated after clinical and radiological examination. Conservative treatment of teeth consists in periapical curettage and apicectomy and sealing of the surface section of the root and is applied only after resolution of acute inflammatory phenomena. This procedure is preceded by endodontic drainage therapy that is performed during the acute episode. Radical treatment is tooth extraction and removal by curettage of the periapical lesion.

PERSONAL RESULTS

TABLE NO. 1 – STUDY OF ODONTOGENIC INFECTIONS BY PATHOLOGY

Type of pathology	Number of cases	Percentage
Suppuration of odontogenic etiology	1109	16,20%
Suppuration of other etiologies	171	2,49%
Other pathologies	5562	81,29%
TOTAL	**6842**	**100%**

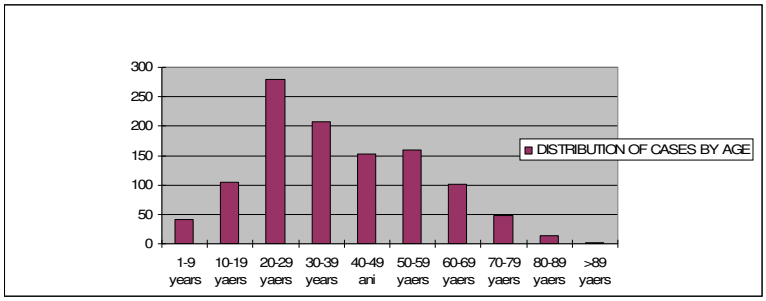


GRAPHIC NO. I - DISTRIBUTION OF CASES BY PATHOLOGY

This graphic shows a relatively high proportion of odontogenic infections (16.2%) registered in the Clinic of Oral and Maxillofacial Surgery in Constanța during the period the study was conducted.

TABLE NO. 2 – STUDY OF ODONTOGENIC INFECTIONS BY AGE

Age	Number of cases	Percentage
1-9 years	42	3,78%
10-19 years	104	9,37%
20-29 years	280	25,24%
30-39 years	207	18,66%
40-49 years	153	13,79%
50-59 years	160	14,42%
60-69 years	101	9,10%
70-79 years	48	4,32%
80-89 years	13	1,17%
≥ 90 years	1	0,09%
TOTAL	**1109**	**100%**



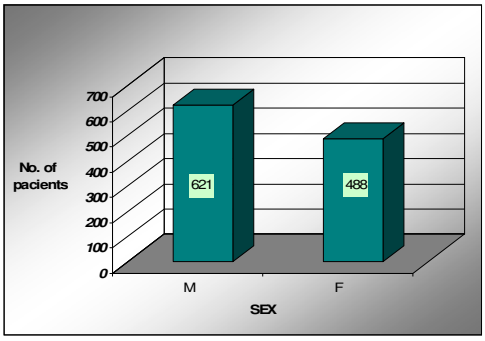
GRAPHIC NO. II - DISTRIBUTION OF CASES BY AGE

It appears from the chart that the highest frequency of odontogenic infections is found between 20-29 years and 30-39 years. Minimum age is 1 year and maximum is 90 years.

TABLE NO. 3 – ODONTOGENIC INFECTIONS STUDY BY SEX

Sex	Number of cases	Percentage
Male	621	55,99%
Female	488	44,01%
Total	**1109**	**100%**

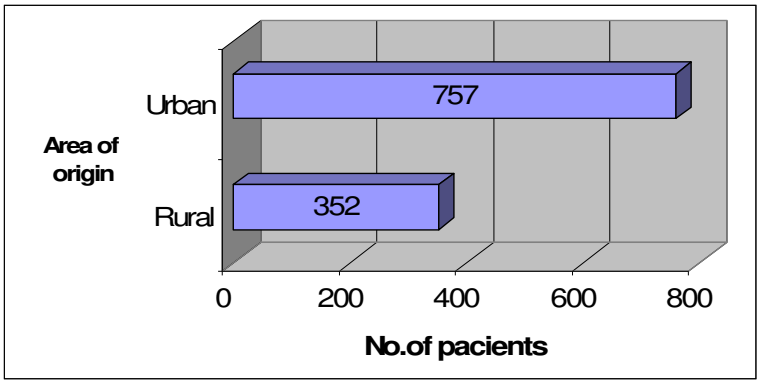
The difference between the sexes is not huge, male gender was the most commonly affected, with percentages of 56% for males and 44% for females.



GRAPHIC NO. III - DISTRIBUTION OF CASES BY SEX

TABLE NO. 4 – STUDY OF ODONTOGENIC INFECTIONS BY ENVIRONMENT ORIGIN

Area of origin	Number of cases	Percentage
Urban	757	68,26%
Rural	352	31,74%
Total	**1109**	**100%**



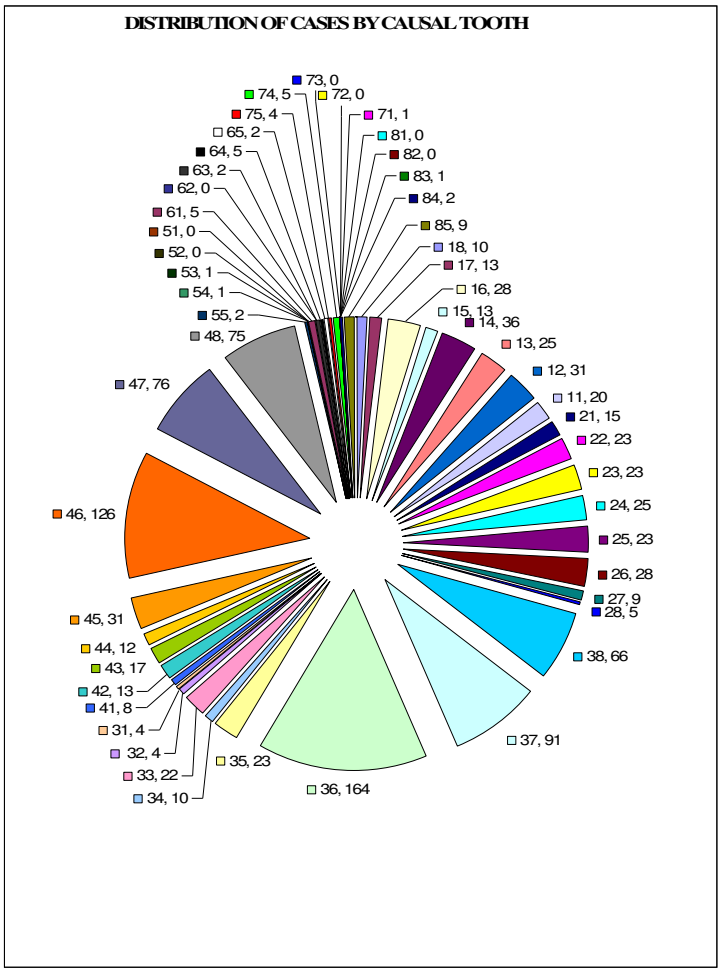
GRAPHIC NO. IV - DISTRIBUTION OF CASES BY PLACE OF ORIGIN

Environment has some significance in the etiology of odontogenic infections appearance. The most frequent cases are from urban areas. Percentage rural (31.74%) is probably due to reduced targeting of the health care provider due to symptoms that attention is paid only too late and limited financial possibilities to access to physicians in the city.

TABLE NO. 5 – STUDY OF ODONTOGENIC INFECTIONS BY DENTAL CAUSAL FACTORS

Causal permanent tooth	Number of cases	Percentage	Causal temporary tooth	Number of cases	Percentage
18	10	0,90%	55	2	0,18%
17	13	1,17%	54	1	0,09%
16	28	2,52%	53	1	0,09%
15	13	1,17%	52		0%
14	36	3,24%	51		0%
13	25	2,25%	61	5	0,45%
12	31	2,79%	62		0%
11	20	1,80%	63	2	0,18%
21	15	1,35%	64	5	0,45%
22	23	2,07%	65	2	0,18%
23	23	2,07%	75	4	0,36%
24	25	2,25%	74	5	0,45%
25	23	2,07%	73		0%
26	28	2,52%	72		0%
27	9	0,81%	71	1	0,09%
28	5	0,45%	81		0%
38	66	5,95%	82		0%
37	91	8,20%	83	1	0,09%
36	164	14,78%	84	2	0,18%
35	23	2,07%	85	9	0,81%
34	10	0,90%			
33	22	1,98%			
32	4	0,36%			
31	4	0,36%			
41	8	0,72%			
42	13	1,17%			
43	17	1,53%			
44	12	1,08%			
45	31	2,79%			
46	126	11,36%			
47	76	6,85%			
48	75	6,76%			
TOTAL	**1069**	**96,4%**		**40**	**3,6%**

The study highlights the most frequent involvement of the mandibular molars in the etiology of the odontogenic infections, representing 53.9% of dental etiological factors.

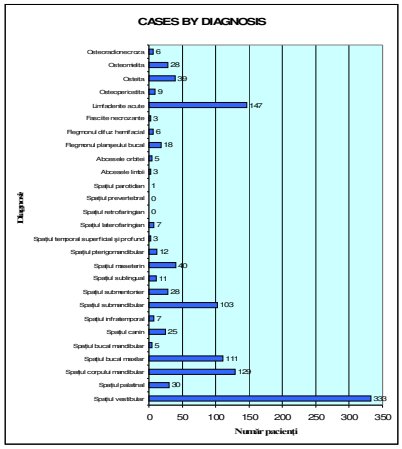


GRAPHIC NO. V - DISTRIBUTION OF CASES BY CAUSAL TOOTH

TABLE NO. 6 – STUDY OF ODONTOGENIC INFECTIONS ACCORDING TO DIAGNOSIS

Diagnosis	Number of cases	Percentage
Vestibular space	333	30,02%
Palatinal space	30	2,70%
Mandibular body space (peribasilar/ perimandibular)	129	11,63%
Bucal maxillary space (genian)	111	10,00%
Bucal mandibular space (paramandibular/buccinato-maxilary)	5	0,45%
Canine space	25	2,25%
Infratemporal space	7	0,63%
Submandibular space	103	9,28%
Submentonier space	28	2,52%
Sublingual space	11	0,99%
Maseteric space	40	3,60%
Pterigomandibular space	12	1,08%
Superficial and profound temporal space	3	0,27%
Lateropharyngeal space	7	0,63%
Retropharyngeal space	-	0%
Prevertebral space	-	0%
Parotid space	1	0,09%
Tongue abscess	3	0,27%
Orbital abscess	5	0,45%
Phlegmon of flour of the mouth	18	1,62%

Diffuse hemifacial phlegmon	6	0,54%
Necrotizing fascitis	3	0,27%
Acute lymphadenitis	147	13,25%
Osteoperiostis	9	0,81%
Osteitis	39	3,51%
Osteomyelitis	28	2,52%
Osteoradionecrosis	6	0,54%
Total	**1109**	**100%**

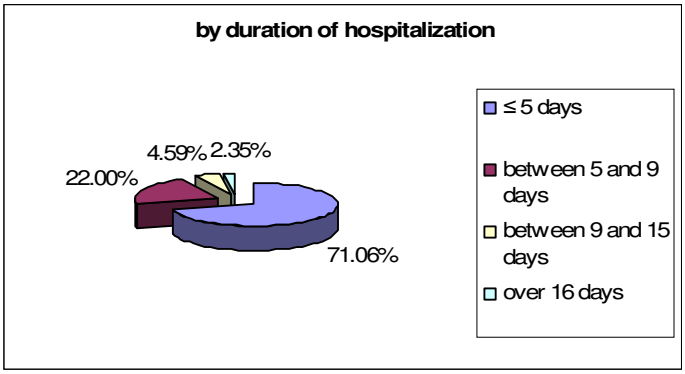


GRAPHIC NO. VI - CASES BY DIAGNOSIS

The table shows that the highest incidence in the etiology of odontogenic infections is periosseous infections (44.36%) followed by fascial spaces infections (31.83%) in which primary fascial spaces infections are majority. Also important is the pathology of acute lymphadenitis with a percentage of 13.25%, leaving all other infections to just about 10%.

TABLE NO. 7 – STUDY OF THE ODONTOGENIC INFECTIONS BY DURATION OF HOSPITALISATION

Duration of hospitalization	Number of cases	Percentage
≤ 5 days	788	71,06%
between 6 and 9 days	244	22,00%
between 10 and 15 days	51	4,59%
over 16 days	26	2,35%
TOTAL	**1109**	**100%**



GRAPHIC NO. VII - DISTRIBUTION OF CASES BY PERIOD OF HOSPITALISATION

From this study it appears that most cases of infections of odontogenic etiology have a period of hospitalisation of five days (71.06%).

Next I will present 12 of the 30 clinical cases that we had in supervision from their admission in the Oral and Maxillofacial Surgery Clinic of the Emergency County Hospital of Constanța between 01.01.2008 - 31.07.2011, till their discharge.

CLINICAL CASE 2

Patient PM, 51 years old, female, from Agigea had shown in the Oral and Maxillofacial Surgery Clinic for pain, left genian swelling, functional and esthetic disorder. The patient says that five days ago she accused a severe pain at 26 (upper left 1st molar) which ceded after common analgesics and observed after 24 hours increasing of genian swelling. She went to a dentist who guided her to the Department of Oral and Maxillofacial Surgery for examination and treatment. States that she suffers from hypertension.

The patient is hospitalized with a diagnosis of left maxillary vestibular abscess starting point 26 with complicated gangrene .

Local cervico-facial examination reveals facial asymmetry due to left genian swelling spontaneously painful and to palpation, with congested skin, pasty to palpation, integral bone contour, bilateral condylar movement in the TMJ, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

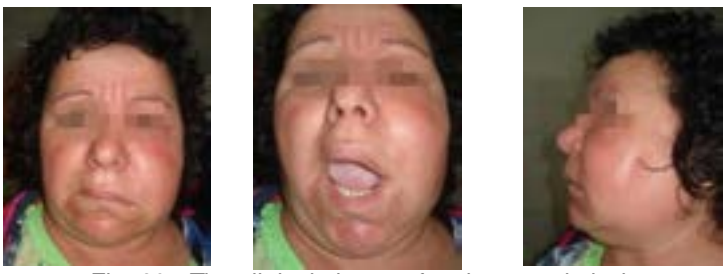


Fig. 80 - The clinical picture of patient at admission

Endo-oral examination reveals normal amplitude of mouth opening, congestion and fluctuance of right bucal mucosa, 26 painful to percussion. In laboratory tests it is found: serum glucose 108 mg/dL, WBC 11310/mL;

Treatment:

1. Surgical: we performed an incision in the left upper vestibule to discharge purulent secretion, hydrogen peroxide lavage and drainage was secured with a rubber blade.
2. Medication: Penicillin G 2 million u.i. every 12 hours iv, Gentamicin 80 mg every 8 hours and Ketonal 1 f every 12 hours.
3. Removal of odontal causal factor: the extraction of 26 and alveolar curettage were performed after 3 days, after the inflammatory symptoms have decreased.

Fig. 81 - Clinical intraoral appearance after extraction of 26

The evolution was favorable, the patient was discharged after 5 days.

Fig. 82 - The clinical picture of the patient at discharge

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infection of the 26 (left upper 1st molar), through the thickness of the alveolar bone and buccal cortical erosion, below lower insertion of buccinator's muscle, is exhibited at the buccal space of the left maxilla, internal to the mucosa.

CLINICAL CASE 4

Pacient PC, 66 years old, male, living in Valu lui Traian, shown in the Clinic of Oral and Maxillofacial Surgery for pain, slight swelling of right lower genian area, functional and esthetic disorder.

The patient is diagnosed with vestibular mandibular abscess with a starting point infected root cyst of 45.

Local cervico-facial examination revealed facial asymmetry due to discrete swelling of the lower right genian area, painful on palpation, integral bone contour, bilateral condylar movement in the TMJ, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

Endo-oral examination found: swelling and congestion of the right mandibular bucal mucosa, fluctuant and the root of 45 with deep cavity, painful to percussion.

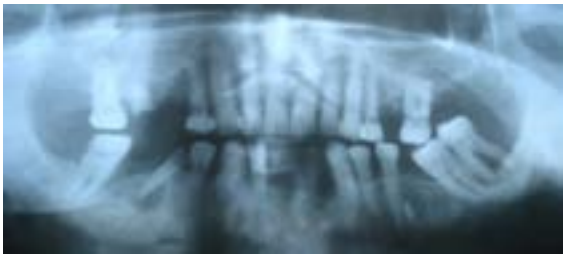


Fig. 92 - Radiological evidence of dental causal factor - 45

Fig. 91 – Endo-oral aspect

Radiological examination by orthopantomography confirmed that 45 is the dental causal factor that has a root cyst.

Treatment:

1. Surgical: the incision was performed under local anesthesia, the collection of purulent secretion was evacuated, lavage with hydrogen peroxide and drainage was maintained for 3 days;
2. Medication: Amoxicillin 500 mg orally every 8 hours; Ketonal 100 mg orally every 12 hours;
3. Removal of dental causal factor: the extraction of 45 and cystectomy were performed after 5 days.

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infectious of the 45 (right lower premolar 2), through thickness of the alveolar bone and erosion of buccal cortical, below the superior insertion of buccinator's muscle and then is exhibited in the right buccal area of mandibular alveolar process beneath the mucosa.

CLINICAL CASE 8

Patient IE, 48 years old, female, from Constanța, shown in the Clinic of Oral and Maxillofacial Surgery for pain, functional and esthetic disorders.

The patient says she noticed the appearance of swelling of left perimandibular area two days ago, before that she experience a repeated acute pain of 37 (lower left 2nd molar). The patient is treated with Ampicillin 500 mg every 6 hours per os (self medicated).

The patient is admitted with a diagnosis of left peribasilar abscess with the starting point 37 with complicated gangrene.

Local cervico-facial examination revealed cervico-facial asymmetry due to the well defined left peribasilar swelling, fluctuant and painful to palpation, with slight congested skin, integral bone contour, TMJ bilateral condylar movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

Fig. 118 - The clinical picture of patient at admission

Endo-oral examination found: normal mouth opening, 37 has a deep cavity and is slightly sensitive to percussion.

Dental radiographs confirmed the causal factor 37 with complicated gangrene.

Fig. 119 – Oral clinical aspect

Fig. 120 - Radiological evidence of dental causal factor - 37

Treatment:

1. Surgical: a 2 cm incision was made at the lowest point of collection, which concerns only the skin, purulent secretions was discharged, lavage with hydrogen peroxide and drainage was ensured;
2. Medication: Penicillin G 2 million u.i. every 12 hours iv, Gentamicin 80 mg im every 8 hours; Ketonal 1 f every 12 hours, 500 ml saline;
3. Removal of dental causal factor: extraction of 37 and alveolar curettage performed 2 days after incision.

Fig. 121 - Incision and evacuation of purulent collection

Fig. 122 – Oral aspect of alveolar wound after extraction

Fig. 123 - The patient 24 hours after incision

The evolution was favorable, the patient was discharged after 4 days.

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infectious of the 37 (left 2nd lower molar), through the alveolar bone and erosion of external cortical, below insertion of left buccinator's muscle, is exhibited in the left mandibular body space, internal to the skin and external to the superficial cervical fascia.

CLINICAL CASE 14

Patient PG, 65 years old, male shown in the Clinic of Oral and Maxillofacial Surgery for pain, trismus, functional and esthetic disorders.

The patient says he observed a swelling in the right genian area 4 days ago, preceded by an acute pain at 17 (2nd upper right molar), then appeared trismus

and fever (38°C).

The patient is hospitalized with a diagnosis of abscess of bucal space with the starting point 17 with deep chronic periodontitis.

Local cervico-facial examination is found: facial asymmetry due to the swelling of right genian area, spontaneously painful and at palpation, fluctuant (deep to the buccinator's muscle), integral bone contour, TMJ bilateral condylar movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

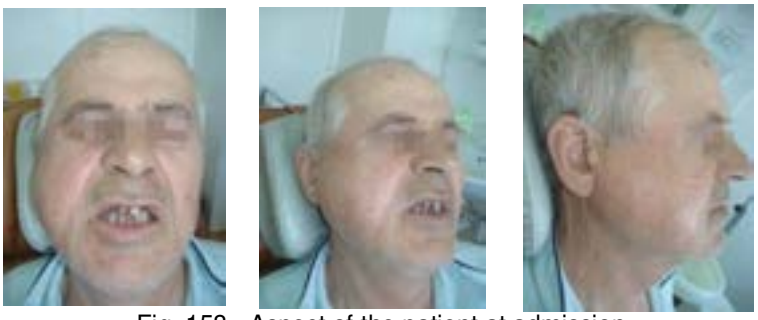


Fig. 158 - Aspect of the patient at admission

Endo-oral examination found: trismus, multiple destructed roots, swelling and congestion of jugale mucosa with print of buccal faces of the teeth and 17 with deep periodontal pockets.

Radiographs by dental orthopantomography confirm the causal factor as deep chronic periodontitis of 17.

Fig. 159 – Clinical oral aspect

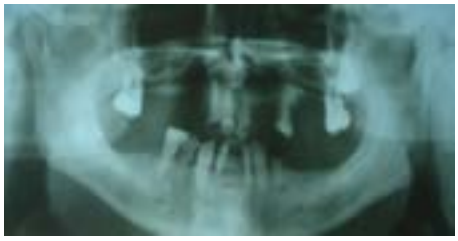


Fig. 160 - Radiological evidence of dental causal factor - 17

Treatment:

1. Surgical: an incision was performed parallel horizontally to white line of jugal mucosa and below Stenon channel ostium, to avoid injuring it, discharge of purulent secretions located medialy to the buccinator's muscle, lavage with oxygenated water and drainage.
2. Medication: Ampicillin 1g i.v. every 12 hours, Gentamicin 80 mg i.m. every 8 hours, Metronidazole 250 mg i.v. every 8 hours; Ketonal 100 mg i.m. every 12 hours.

Fig. 161 – Incision

Fig. 162 - Evacuation of purulent secretion

The evolution was favorable, with persistence of limited mouth opening; suppression of causal factor (extraction of 17) was delayed after the active mecanotherapy.

Fig. 163 - Aspect of the patient 3 days after incision

Dissemination of suppuration in this case was achieved by contiguity, from the infection of the periradicular pocket of 17 (2^{nd} right upper molar), through thickness of the alveolar bone and cortical erosion bellow the upper insertion of right buccinator's muscle, is exhibited at the maxillary right bucal space, internal to the buccinator's muscle.

CLINICAL CASE 17

Patient SG, 37 years old, male, living in Constanța, presented at County Emergency Hospital of Constanța for dysphagia, trismus, odinophagy, chills, low grade fever, pallor. Declares that the symptoms appeared 3-4 days ago, called the ambulance service and was advised to treat with Algocalmin and Augmentin.

The patient was admitted with a diagnosis of infratemporal space abscess with starting point 48 with infected root cyst.

Local cervico-facial examination revealed cervico-facial asymmetry given by a slight swelling at the right genio-maseteric region sensitive to palpation, right submandibular and temporal swelling painful to palpation, integral bone contour, TMJ bilateral condylar movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

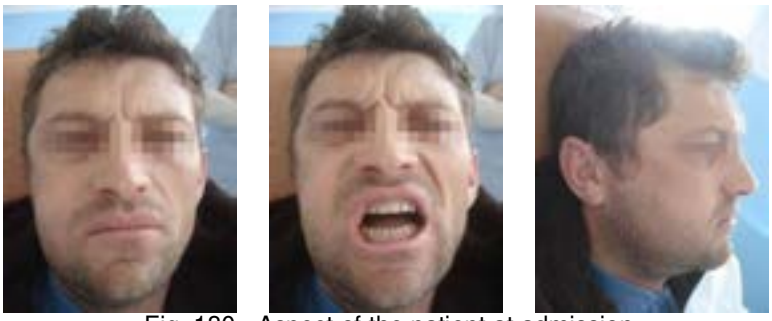


Fig. 180 - Aspect of the patient at admission

Endo-oral examination found: trismus, congestion and edema of right perituberozity mucosa, painful on palpation, congestion of right retromolar and jugal mucosa, congestion on the right soft palate, uvula being pushed to the left.

Laboratory tests found: WBC number 33000/micL.

X-ray examination: chest X-ray: no pathological changes; orthopantomography: highlights dental causal factor root cyst's infection at the level of 48.

Fig. 181 – Oral clinical aspect

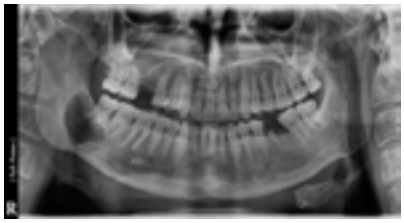


Fig. 183 - Radiological evidence of dental causal factor - 48

Treatment:

1. Surgical: we performed a right submandibular incision that interests skin, superficial cervical fascia and platysma muscle and entered the right submandibular space and pterigomandibular space of which were evacuated purulent secretions and ensured drainage with 4 drainage tubes;

Fig. 184 - Submandibular incision

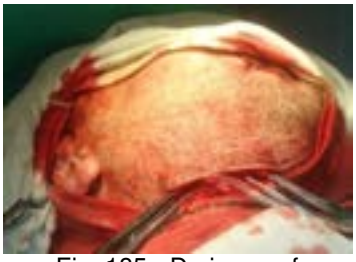


Fig. 185 - Drainage of submandibular space

Also we practiced endo-oral incision (right perituberozitary) communicating with other right temporal incision, which interest skin and right temporal muscle fascia, with a Pean clamp was entering and advancing beneath fascia until we reached the zygomatic fossa and then the perituberozitary incision and ensure drainage with two drainage tubes, for siphoned wash with hydrogen peroxide.


Fig. 186 -Temporal drainage


Fig. 187 – Endooral drainage

2. Medication:

• the first three days were given Penicillin 4000000 IU every 6 hours iv, Gentamicin 80 mg im every 8 hours, Metronidazole 1 f iv evrey 12 hours, Ketonal 1 f iv every 12 hours, 1 f Algocalmin im every 8 hours , 1 f Quamatel every 12 hours, Vitamin B1, B6 and C 500, Clexane 40 mg sc (At 18:00), Glucose 5% 1500 ml, 1000 ml saline.

• the next two weeks the dose was reduced to 4000000 IU Penicillin per day and has stopped taking Clexane.

Evolution was favorable but slow, the patient was discharged after 17 days.

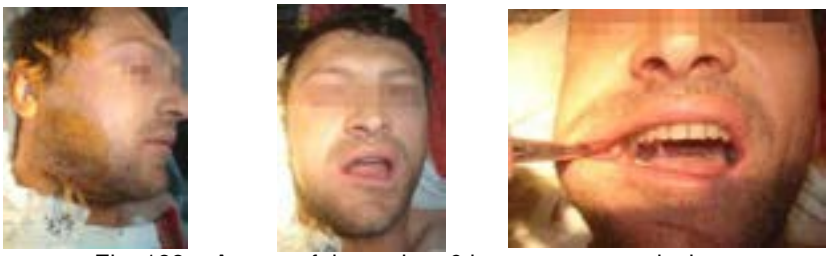


Fig. 188 – Aspect of the patient 6 hours postoperatively

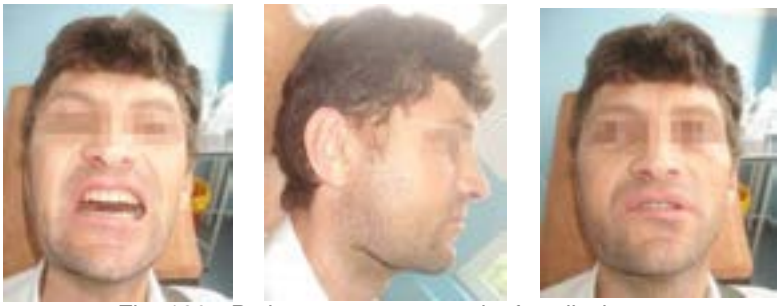


Fig. 190 - Patient's aspect a week after discharge

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infection of the 48 (3rd right lower molar), through thickness of the alveolar bone and erosion of lingual cortical, higher than the point of insertion of milohioidian muscle and diffused to right pterigomandibular space and then is exhibited in the right infratemporal space.

CLINICAL CASE 20

Patient MF, 25 years old, female, from Constanța, shown in the Clinic of Oral and Maxillofacial Surgery for pain, functional and esthetic disorders. Declares that the submental swelling started three days ago and was preceded by an episode of acute pain in the lower frontal teeth. The patient has followed for two days an antibiotic and anti-inflammatory orally administered treatement with

Ampicillin 500 mg every 6 hours and Ketonal 100 mg every 12 hours.

The patient was diagnosed with submental space abscess with starting point 43 with complicated gangrene.

Local cervico-facial examination revealed clearly defined submental swelling, fluctuant and painful to touch, congested covering skin, integral bone contour, TMJ with bilateral condylar movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

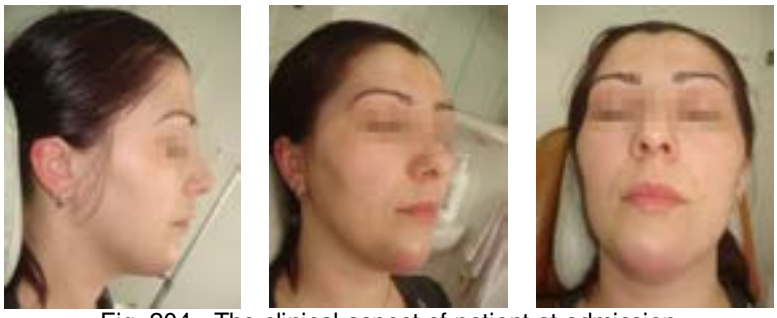


Fig. 204 - The clinical aspect of patient at admission

Endo-oral examination found anterior mandible's vestibular (bucal) mucosa of normal appearance and color, floor of mouth tender with normal coloration, acrylic bridge on 42 and 43, with the medial extension of 41.

Radiological examination confirmed that the 43 dental causal factor has a root cyst.

Fig. 205 - Clinical oral aspect

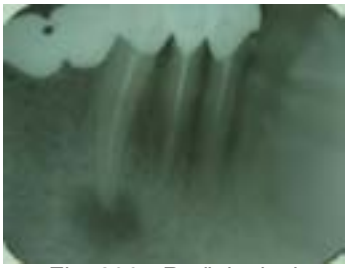


Fig. 206 - Radiological evidence of dental causal factor - 43

Treatment:

1. Surgical: we practiced a submental incision approximately 3 cm long that interests the skin and superficial cervical fascia, evacuate purulent secretions, lavage with hydrogen peroxide is carried out and drainage was ensured.
2. Medication: Ampicillin 500 mg every 6 hours orally; Ketonal 100 mg every 12 hours orally;
3. Removal of dental causal factor: a conservative treatment was performed by periapical curettage and apicectomy of 43.

Fig. 207 – Incision

Fig. 208 - Evacuation of purulent secretions

Fig. 212 - Highlighting and cutting of the apex

Fig. 214 - Bone defect after surgery

The evolution was favorable, the patient returned to control after 4 days and then 10 days to perform apicectomy of dental causal factor (43).

Fig. 215 - Patient's aspect at four days after the incision

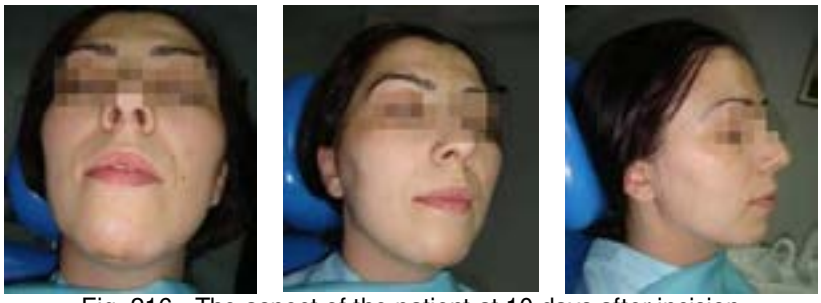


Fig. 216 - The aspect of the patient at 10 days after incision

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infection in the 43 (right lower canine), through thickness of the alveolar bone and erosion of external cortical, lower than the point of insertion of mental muscle, is exhibited in the submental space.

CLINICAL CASE 21

Patient DO, 14 years old, female, from Medgidia, presented in the Clinic of Oral and Maxillofacial Surgery for pain and swelling in the sublingual region, dysphagia. Says that two days ago accused pain at the root of 46 (1st lower right molar) followed by the appearance of sublingual swelling and dysphagia. From the family history we keep in mind that the patient's mother was diagnosed with diabetes.

The patient is hospitalized with a diagnosis of abscess of sublingual space with starting point at 46 with complicated gangrene.

Local cervico-facial examination had shown cervico-facial asymmetry due to submental swelling spontaneously painful, to palpation and during functional movements with normal looking covering skin; bone continuity is preserved, TMJ with bilateral condylar movement; points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

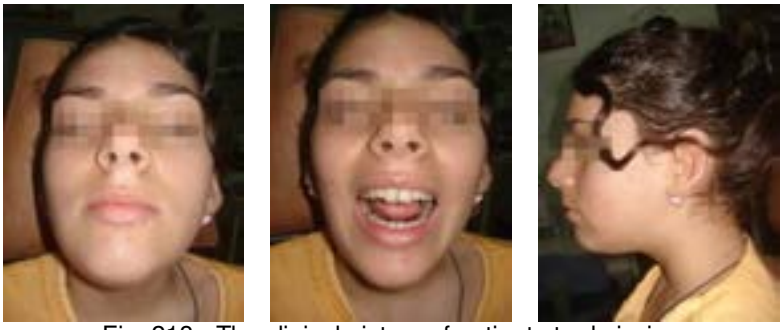


Fig. 218 - The clinical picture of patient at admission

Endo-oral examination showed normal opening of oral cavity, swelling located in the anterior third floor of the mouth, painful spontaneously, at palpation and in functional movements, congestion of the covering mucosa, covered with fibrinous deposits, 46 painful to percussion.

Laboratory tests found: glucose 115 mg/dL, x-ray examination: the X-ray in retroalveolar incidence confirms the causal factor as 46 (1st lower right molar).

Fig. 219 - Clinic oral aspect

Fig. 220 - Radiological evidence of dental causal factor - 46

Treatment:

1. Surgical: we performed an incision at the mandibulo-lingual groove, parallel to the alveolar process and as close to the reflectance of the floor mucosa, and the lingual cortical alveolar process, to extract a small amount of purulent discharge, lavage were performed with hydrogen peroxide and drainage was ensured with rubber blades.
2. Medication: Ampicillin 1 g iv every 12 hours, Gentamicin 80 mg im every 8

hours, Metronidazole 250 mg im every 8 hours, Ketonal 100 mg im every 12 hours.
3. Removal of dental causal factor: the extraction of 46 and alveolar curettage were performed after 4 days.

The evolution was favorable, the patient was discharged after 5 days.

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infectious of the 46 (1st lower right molar), through thickness of the alveolar bone and erosion of lingual cortical above milohioidian muscle insertion, is exhibited in the right sublingual space, just below the lining mucosa of the mouth floor.

CLINICAL CASE 22

Patient BC, 39 years old, male, from Hârşova shown in the Clinic of Oral and Maxillofacial Surgery for: acute pulsatile pain localized at the right periangulomandibular region, trismus, functional and esthetic disorders. Declares that 1 week ago he accused an acute pain at 47, 48 (lower right 2nd and 3rd molars), common pain relievers were taken and two days ago he noticed a swelling of the right maseteric region increasing in time, accompanied by trismus and pulsatile pain that radiates to the temporal region. Presented to a dentist who directed him to the Clinic of Oral and Maxillofacial Surgery for examination and specialized treatment.

The patient was admitted with a diagnosis of abscess of maseteric space with the starting point acute suppurative pericoronaritis of 48.

Local cervico-facial examination found: facial asymmetry given by a painful swelling at right genio-maseteric region spontaneously and at palpation, congested, shiny skin, integral bone contour, TMJ with bilateral condylar movement; points of trigeminal emergence with normal sensitivity, painless sinus points at palpation.

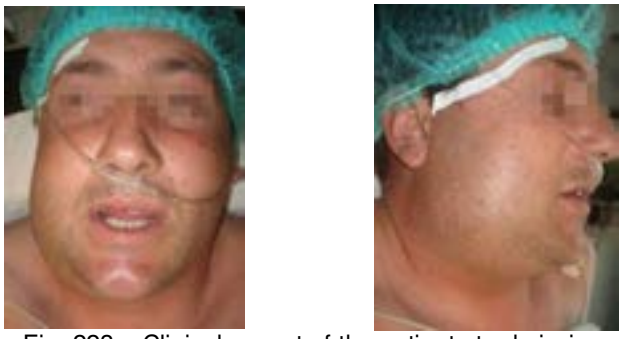


Fig. 223 – Clinical aspect of the patient at admission

Endo-oral examination found: trismus, halitosis fetid, 48 painful to percussion, jugal mucosa and anterior edge of coronoid process congested and painful to touch.

Laboratory examinations shall be recorded: number of leukocytes 14870/microL, X-ray examination: the right scroll mandibular incidence confirmed as the dental causal factor 48 (3rd lower right molar).

Fig. 224 - Clinical oral aspect

Fig. 225 - Radiological evidence of dental causal factor - 48

Treatment:

1. Surgical: a right submandibular incision about 4 cm long parallel to the edge of the basilar is practiced under local anesthesia and IV sedation which interest the skin, superficial cervical fascia and platysma muscle, entering maseteric space between masseter muscle and mandible ramus with Pean curved forceps and performing a desinseration of masseter muscle, purulent secretions was discharged and drainage was ensured with two drainage tubes through which lavage performed with hydrogen peroxide.
2. Medication: Ampicillin 1 g iv every 12 hours, Gentamicin 80 mg im every 8 hours; Ketonal 100 mg every 12 hours.
3. Removal of dental causal factor: the extraction of 48 and alveolar curettage.

Fig. 228 - Evacuation of purulent collection

Fig. 229 - Drainage

The evolution was favorable, the patient was discharged after 7 days.

Fig. 230 - Clinical aspect of patient 3 days after surgery

Dissemination of suppuration in this case was achieved by contiguity, from the pericoronar infectious process at the level of 48 (3rd right lower molar), by passing the front edge of the right mandibular ramus is exhibited in the right maseteric space external to mandibular ramus and medial to masseter muscle.

CLINICAL CASE 23

Patient IR, 69 years old, male, from Tulcea, shown in the Clinic of Oral and Maxillofacial Surgery for pain, functional and esthetic disorders, toxic and septic respiratory failure. Says that a week ago suffered an acute pain at the level of 38 (wisdom lower left molar), left submandibular swelling, which did not reverse with the empirical medication used. The patient presented in the ICU department of SCJU Constanța where he was examined by ENT specialist doctor who sent him to the Department of Oral and Maxillofacial Surgery for examination and treatment. Patient has a history of asthma, chronic obstructive pulmonary disease with acute lower respiratory tract infection, respiratory failure, and nonspecific chronic pulmonary heart insufficiency. Currently, the patient is under treatment: Teo-tard 400 mg/day, Ventolin as needed, Diurex 2 cp/day, Celebrex 1cp/zi, ACC 3 cp/day.

The patient is hospitalized with a diagnosis of phlegmon of floor of mouth (Ludwig's angina) starting point 38 with complicated gangrene.

Local cervico-facial examination found: facial asymmetry given by massive edema and bilateral submandibular painful swelling of cervical and suprasternal, cyanotic skin; gaseous crepitation at palpation, integral bone contour, TMJ with normal bilateral condylar movement, points of emergence normal trigeminal sensitivity, painless sinus points on palpation.

Endo-oral examination found: trismus, swelling of the mouth's floor, painful, dry sticky mucous secretions.

Laboratory tests it found: temperature 36 º C, creatinine 1.81 mg/dL, serum potassium 3.1 mmol/L, glucose 113 mg/dL, serum urea 144mg/dL, leukocytes 19070/mL, hemoglobin 11.1 g/dL, Quick time 18.4 sec, prothrombin percentage 57.8%, INR 1.58, fibrinogen 842 mg/dL, aPTT 27.9; sec X-ray revealed bilateral peribronhovascular drawing emphasized, predominantly hilo-basal, increased pulmonary opacity.

Treatment:

1. Surgical: bilateral submandibular incision continues from gonion to gonion which addresses all interested spaces (bilateral submandibular, sublingual submental and tongue base) found cyanotic tissue, partially necrotic and thrombosed vessels, discharge of purulent greenish, fetid and necrotic tissue; drainage is provided with 2 drain tubes for each interested space, extensive lavage with oxygenated and antiseptic solutions (hydrogen peroxide and cloramin).
2. Medication: Meropenem 1g iv every 8 hours, Gentamicin 80 mg iv every 8 hours; HHC 50 mg every 8 hours; Metronidazole 1 f iv every 12 hours, Ketonal 1 f every 12 hours; Quamatel 1 fl every 12 hours, normal saline 1000 ml, 1500 ml 10% Glucose 10 u. + insulin, Miofilin 60 mg every 8 hours; Furosemide as needed, Clexane 40 mg sc, vitamin B1, vitamin B6, vitamin C 500 1 fl each every 12 hours; Qsafundin 50 ml every 6 hours; ACC 1 f every 12 hours; Nutriflex 1850 ml.

Favorable evolution was slow, with daily serial necrectomy and lavage with oxygenated and antiseptic solution 2 times a day.

Fig. 232 - Clinical aspect of wound healing with deep cervical fascia necrosis (right)

The patient was discharged on request after 12 days.

Dissemination of suppuration in this case was achieved by contiguity, from the root infection of the 38 (wisdom lower left molar), through thickness of the alveolar bone and lingual cortical erosion below insertion of mylohioidian lower left muscle, is exhibited in the left submandibular space where spread in the left sublingual (through the hiogloso-mylohioidian gap) and controlateral to the right sublingual space (through retromental space), then along the superficial blade of the deep cervical fascia to deep anterior cervical region and below sternocleidomastoid muscle bilaterally.

CLINICAL CASE 25

A 69 year old male patient was brought to the ER with a right submandibular swelling and fever which had been treated by his family practitioner with oral administration of Oxacillin without response. At admission to the hospital, the patient presented fever, chills, malaise, tachycardia, anxiety and was uncooperative.

Patient was admitted with diagnosis of right submandibular abscess which diffused latero-cervical with starting point 48 with complicated gangrene.

Fig. 239 - The clinical aspect of the patient at admission

The physical examination revealed a septic mouth, important destruction of the 48 crown, an important right submandibulary and latero-cervical swelling with subcutaneous crepitation, dyspnea, diminished right lung base vesicular murmur, bronchial rales and a saturation of peripheral oxygen of 90%.

Laboratory values revealed leukocytosis, elevated levels of inflammatory markers and thrombocytopenia. The radiograph of the chest obtained at admission demonstrated a homogeneous, high-intensity opacity in the lower half of the right hemithorax. A computed tomography of the head and neck was performed, showing the right submandibular abscess and subcutaneous emphysema.

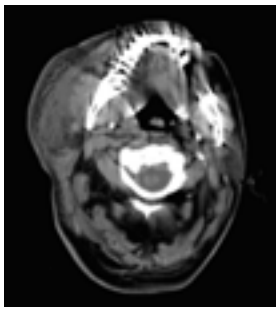


Fig. 240 - CT scan showing submandibulary swelling and subcutaneous emphysema

The patient received intravenous antibiotics (Ampicillin 2g every 12 hours, Gentamicin 80 mg every 8 hours, Metronidazole 500 mg every 12 hours), anti-inflamatories and anticoagulation agents (Fraxiparine 0.6 ml subcutaneous). He underwent emergency surgical drainage of the abscesses through an extraoral right submandibular and latero-cervical approach under general anesthesia revealing elimination of the gas from the subcutaneous layers, fragments of necrotized fascia and purulent secretions in moderate quantity from which stained cultures were obtained.

Fig. 241 - Fist incision

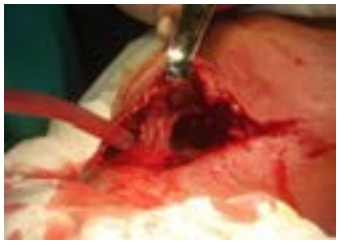


Fig. 242 -Cutting of the platysma muscle

During the debridement of the necrotized tissues we observed the thrombosis of the right internal jugular vein (which indicated *Lemierre syndrome)*.

Fig. 243 - Debridement of the necrotized tissues

Fig. 244 - Thrombosis of the internal jugular vein

After surgery, patient's condition has worsened; he remained intubated in the intensive care unit with hemodynamic and respiratory imbalance and died within 26 hours post admission.

In anaerobic cultures, colonies of Fusobacterium necrophorum developed, which together with internal jugular vein trombosis observed intraoperatively led to final diagnosis Lemierre syndrome.

Dissemination of suppuration in this case was achieved by contiguity, from the periapical infections of 48 (right lower 3rd molar), through thickness of the alveolar bone and erosion of the lingual cortical, beneath right mylohioidian muscle

insertion point, reaching right submandibular space, where diffuses posteriorly to the lateropharyngeal space and further more to the carotid sheath, causing the right internal jugular vein thrombosis.

CLINICAL CASE 26

Patient LA, 29 years old, female, from Constanța, shown at the Clinic of Oral and Maxillofacial Surgery for pain localized in the left submandibular region, swelling of the left submandibular region, esthetic and functional disorders. Says that about 4 days ago she suffered of left submandibular intense pain, followed by a left submandibular swelling which gradually increased in size. Patient presented to the ICU department of County Emergency Hospital Constanța where she was transferred to the Department of Oral and Maxillofacial Surgery for examination and treatment. Denies any chronic illness or previous admissions to hospital and says that she is pregnant in the 7th month.

The patient is admitted with a diagnosis of acute suppurative left submandibular adenitis with starting point 36 with complicated gangrene.

Local cervico-facial examination found: facial asymmetry given by left submandibular swelling, painful at palpation, covering skin is congested, integral bone contour, TMJ with bilateral movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

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Fig. 246 - The clinical aspect of the patient at admission

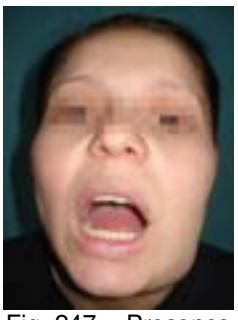

Fig. 247 - Presence of moderate trismus

Endo-oral clinical examination found: the limitation of mouth opening (3 cm) floor mouth looks normal, with a discreet bulge in the third left posterior hemi-floor of the mouth, 36 with a deep cavity, painful to percussion.

Laboratory examinations: number of erythrocytes 3.04 mil./µl, hemoglobin 8.7 g/dL, hematocrit 27%; number of platelets 95000/µL (thrombocytopenia and mild hypochromic).

She was also examined by a GYNO specialist.

Treatment:

1. Surgical: initially was performed an aspiratory puncture, purulent secretion harvested being sent to the laboratory in order to identify the causative microorganism, the result being negative (the culture media did not develop aerobic or anaerobic microbial flora); incision was performed under local anesthesia and sedation iv under the supervision of an anesthesiologist, evacuating a moderate amount of purulent secretions and was followed by lavage with oxygenated and antiseptic solutions and providing the drainage of the collection.
2. Medication: Ampicillin 1g iv every 12 hours; Perfalgan 10 mg every 12 hours iv
3. Removal of dental causal factor: the extraction of 36 and alveolar curettage.

The patient was discharged after five days, the evolution being favorable.

Dissemination of suppuration in this case was conducted by lymphatic way from the periapical infection at the level of 36 (lower left 1st molar) to the first lymph node station (left submandibular lymph node).

CLINICAL CASE 29

Patient RF, 21 years old, female, from Constanța presented at the Clinic of Oral and Maxillofacial Surgery for pain, limited right submandibular swelling, functional and esthetic disorders.

The patient is hospitalized with a diagnosis of acute right suppurative submandibular adenitis starting point 47 (complicated gangrene).

Local cervico-facial examination shown cervico-facial asymmetry given by the right submandibular swelling with spontaneous pain and on palpation, skin covering slightly congested, right submandibular node enlarged, painful on palpation, integral bone contour, TMJ with bilateral condylar movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

Endo-oral examination found: slight congestion in the right buccal mucosa beside 46 which has a deep cavity, 47 has a deep cavity and is painful to percussion.

Radiographs (orthopantomography) confirmed as the causal factor 47 with complicated gangrene.

Fig. 251 - The clinical aspect of the patient after admission

Fig. 252 -Oral clinical aspect

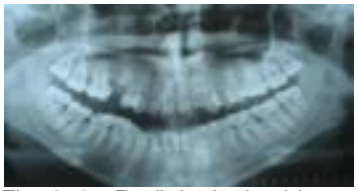

Fig. 253 - Radiological evidence of dental causal factor - 47

Treatment:

1. Surgical: incision of the skin, discharging of purulent secretions, lavage with antiseptic solutions and filiform drainage;
2. Medication: Penicillin G 2 million u.i.every 12 hours, Ketonal 1 f every 12 hours
3. Removal of dental causal factor: the extraction of 47 and alveolar curettage.

Fig. 254 - Patient's aspect after incision and drainage

The evolution was favorable, the patient was discharged after three days.

Dissemination of suppuration in this case was conducted by lymphatic way

from the periapical infection at the level of 47 (right lower 2nd molar) to the first lymph node station (right submandibular lymph node).

CLINICAL CASE 30

Patient AI, 49 years old, male, from Constanța, presented in the Clinic of Oral and Maxillofacial Surgery for pain, functional and esthetic disorders. The patient says he noticed the appearance of right submandibular swelling 4 days ago which he treated with common pain relievers.

Patient is diagnosed with right acute suppurative submandibular adenitis starting point 47 with deep chronic periodontitis.

Local cervico-facial examination found: facial asymmetry given by right submandibular swelling fluctuant to touch, painful spontaneously and on palpation, with congested and shiny covering skin, integrity of bone contours, TMJ with bilateral normal movement, points of trigeminal emergence with normal sensitivity, painless sinus points on palpation.

Endo-oral examination found: normal amplitude of mouth opening (differential diagnostic criteria for a suspected right submandibular adenitis), 47 with pathological grade III mobility, sensitive to percussion.

Fig. 256 – Aspect of the patient at admission

Laboratory examinations: number of leukocytes 14,960/microL; X-ray: radiographic incidence (scroll right mandible) confirmed as the dental causal factor 47.

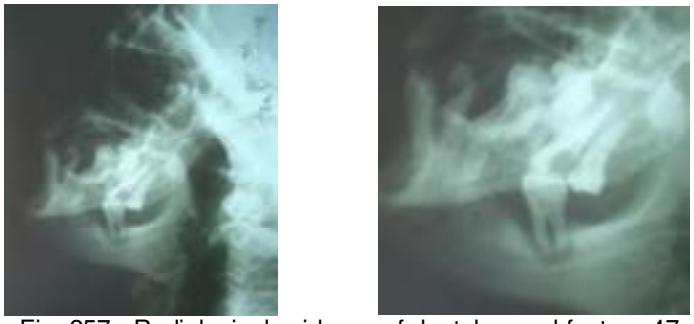

Fig. 257 - Radiological evidence of dental causal factor - 47

Treatment:

1. Surgical: an incision was performed parallel and 2 cm below the basilar jaw, discharge of purulent secretions, lavage with hydrogen peroxide and drainage; surgical exploration found that the surface of mandible body is not deperiostated, which confirms the diagnosis of right acute suppurative submandibular adenitis.
2. Medication: Ampicillin 1g iv every 12 hours, Gentamicin 80 mg im every 8

hours, Metronidazole 250 mg orally every 8 hours; Ketonal 100 mg im every 12 hours.
3. Removal of dental causal factor: the extraction of 47 after 48 hours from the incision.


Fig. 258 - Anesthesia


Fig. 259 - Incision


Fig. 260 - Evacuation of purulent secretion


Fig. 261 - Antiseptic lavage


Fig. 262 - Drainage


Fig. 264 - Extraction of 47


Fig. 265 - Wound after extraction

The evolution was favorable, the patient was discharged after 4 days.


Fig. 266 - The aspect of the patient 3 days after incision

Dissemination of suppuration in this case was conducted by lymphatic way from the periradicular infection at the level of 47 (right lower 2nd molar) to the first lymph node station (submandibular lymph node).

DISCUSSION

Diffusion of odontogenic infections can be made in three ways [1,2,3] by contiguity, lymphatic, and hematogenous.

Direct way of spread, through contiguity and lymphatic way have been described also by Ianeş E. et al in a study conducted in 2004 in the Department of Oral and Maxillofacial Surgery in Timişoara on life threatening head and neck odontogenic infections [4].

Hematogenous way of dissemination of odontogenic infections is rare and occurs in severe forms, leading to septic multiorgan metastases [5,6].

The most common way of dissemination is the direct dissemination by contiguity [5,7,8,9]; the starting point being the periapical odontogenic infection, resulting in pulp necrosis and subsequent periapical bacterial invasion or periodontal as a result of the presence of profound periodontal pockets that allows bacterial inoculation [10,11].

Bucur [12] describes four pathogenic mechanisms underlying perimaxilary infections:

1. transosseous route through which a periapical pathological process migrates along the channels Hawers, reaching subperiosteum level then after erosion of the periosteum clinically appearing as a periosseous or primary fascial spaces suppuration;
2. submucosa route, which is found in deep periodontitis or dental eruption accidents, the suppurative collection spreading between the bone and the covering fibromucosa and creating periosseous or primary fascial spaces infections;
3. direct way, which is found in the injuries with retention of foreign bodies and "septic puncture";
4. lymphatic route, in which the pharyngo-tonsillar infections and dento-periodontal spread directly to local or loco-regional lymph nodes.

Of the 30 cases described, in 25 (83.3%) the dissemination of the infection was done by contiguity and in 5 (16.6%) by lymphatic way. Among the cases of diffusion by contiguity, 22 (88%) were transosseous, starting from teeth with periapical pathology, 2 cases (8%) used the submucosa way, one having as starting point a deep chronic periodontitis and the other an acute suppurative pericoronaritis and 1 case (4%) occurred after extraction.

This last possibility is also described by Amithbabu [13] which lists the following points of departure for the odontogenic suppurations of head and neck: dental infections (periapical pathology, osteomyelitis or periodontal pathology), pericoronaritis of semi impacted wisdom teeth, tooth extractions and septic puncture. .

The literature cited cases of odontogenic suppuration with starting point in the pulp 81% and pericoronar 19% [11], dental-periodontal 79.66% and 9.92% after extraction [5], 33.8% dental, after extraction 11.9% and pericoronar 5.9% [14].

Diffusion tends to follow the path of least resistance due to bone and periosteum, muscle and fascia, as demonstrated by Grodinsky and Holyoke in 1938 [11,15,16].

The suppurative process initially located periapicaly diffuses through the bone marrow along the path of least resistance until it encounters a cortical bone which erodes, thus exiting to the soft tissues around the bone [5,17,18,19].

Location of periosseous suppuration started from a certain tooth is determined by tooth position in dental arch, thickness of bone covering the apex and the relationship between the level of cortical erosion and mandibulary muscle insertions [2,10,12,20].

Fig. 267 illustrates the suppurative process eroding the cortical bone and exteriorizing in the buccal soft tissues when causal tooth's apex is located closer to the bucal cortex (A) or palatal/lingual when the causal tooth's apex is located closer to palatal/lingual cortical (B) [13]. Palatal roots of upper molars, upper 1st premolar and upper lateral incisor are responsible for having palatal diffusion at the maxilla and lingual roots of lower molars are responsible for lingual diffusion at the mandible [20].

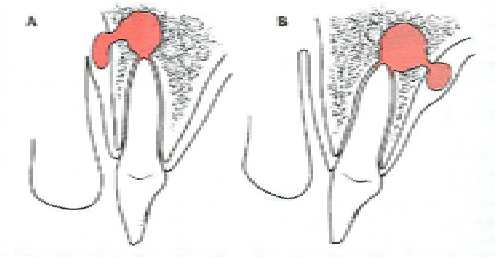

Fig. 267 – Erosion of buccal (A) or oral (B) cortex [after 10]

Once the suppurative process has eroded the bone cortex, the exact location will be determined by the topographic relationship between the location of cortical perforation which was performed and muscle insertions at the maxilla or mandible [10,12]. In Fig. 268 is exemplified the dissemination of the suppurative process from an upper molar and its exteriorization lower to the buccinator's muscle insertion, taking the clinical appearance of a buccal abscess (A) or above the muscle insertion, taking the clinical appearance of a genian abscess (B) [10].

The muscles involved in determining the location of periosseous suppuration and at the same time in the evolution towards a periosseous or a primary fascial spaces suppuration are represented by: orbicularis oris, levator anguli oris and buccinator at the maxilla and mentalis, deppresor anguli oris, buccinator and mylohiodian at the mandible [12].

Shafer adds some options for spreading in the mandible [2]: from the lower premolars through lingual cortical erosion to the sublingual space, from the 3rd lower molar to the pterigomandibular or maseteric space.

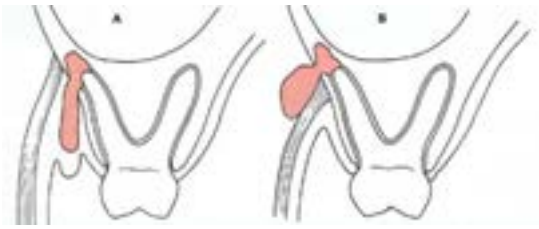

Fig. 268 – Erosion of cortical bone inferior (A) or superior (B) to muscle insertions [10]

Suppurations of *vestibular (buccal) space* are due to the exteriorization of periapical infections, most maxillary odontogenic infections manifested clinically as buccal (vestibular) abscesses. [10]. For a discharge to vestibular (buccal) area is necessary for cortical bone erosion to be located [12]: above buccinator's

muscle insertion in in posterior region of the mandible, above the insertion of the mentalis muscle in the mandible (anterior zone), bellow buccinator's muscle insertion in the maxilla in the posterior zone, bellow lip and nose wing levator muscle insertion on maxilla, in the front.

From presented cases, four were suppuration of the vestibular (buccal) area, two maxillary and two mandibulary, dissemination of infection being made following the presented pattern, with a starting point as follows:
• from an upper canine cortical bone erosion was made bellow lip and nose wing levator's muscle insertion;
• from an upper molar erosion of cortical bone was performed under buccinator's muscle insertion;
• from two lower premolars erosion of cortical bone was performed over buccinator's muscle insertion (Fig. 269 and 270).

Occasionally, periosseous suppurations can protrude to the *palatal area*, this occurring due to inclination of the upper lateral incisor root toward palate and because of upper premolars and molars palatal root [10]. The evolution of these suppurations is limited by the presence of dental arches above and lateral and the median raphe which prevents controlateral extension of infection [12]. The infections can also run in the maxillary sinus when superior molar apex lies within or near the maxillary sinus floor [20], wearing a clinical aspect of odontogenic maxillary sinusitis.

Fig. 269 - Radiological dental causal factor (45 - right lower 2nd premolar)

Fig. 270 - Vestibular (buccal) area suppuration

Implication of *mandible's body area* occurs when the starting point is located in the lower premolars and molars [12], the suppuration clinically discharging as peribasilar abscess (external perimandibular). Diffusion of the suppurative process is done toward buccal cortical of the mandible, its erosion being performed at a level below the lower insertion of buccinator's muscle.

In the cases presented, we described six peribasilar abscesses, 5 of them with suppuration diffusion that happened in the same manner described above, the starting point being in four cases a lower molar (Fig. 271 and 272) and in one case a lower premolar.

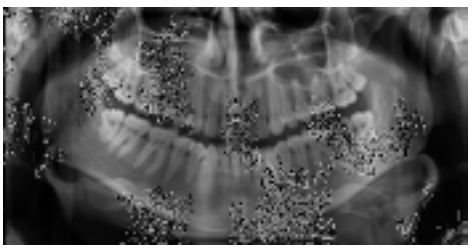

Fig. 271 - Radiological dental causal factor (37 – 2nd lower left molar)

Fig. 272 - Mandible's body area suppuration

One case had an unusual starting point for this particular type of suppuration namely a lower canine (Fig. 273 and 274), mostly suppurative processes in the mandibles' anterior teeth eroding vestibular (buccal) cortical over the muscle insertion [10,20]. Vestibular (buccal) cortical erosion in this case was done under the depressor angluli oris insertion due to canine root length, this situation being described also by FD Fragiskos, mentioning that suppurative infections started from lower incisors and canines may exteriorize extraoraly when dental apexes are under the muscles insertions [20].

Fig. 273 - Radiological dental causal factor (33 - lower left canine)

Fig. 274 – Mandible body area suppuration

From the mandible body area suppurative process may disseminate to the submandibular space and masticatory space [21].

Periosseous suppurations are the less serious odontogenic suppuration of the head and neck [22] and in the same time the most common. In the statistics made, periosseous suppurations are ranked first with a rate of 44.36% of all odontogenic infections and vestibular (buccal) abscesses are the majority (30% of all odontogenic infections). This is reported also in the literature [23,24,25,26], Peterson describing vestibular (buccal) abscess as the most common odontogenic suppuration [10].

Suppurations of *buccal space (genian)* arising from the dento-periodontal infections localized at the maxillary and mandibulary molars [20] and rarely at the premolars [12,22]. For the exteriorizing of suppuration to take place in the buccal (genian) space area and not the vestibular area, cortical bone perforation is necessary to be achieved superior to buccinator's muscle insertion in maxilla, and lower to it in the mandible [10,20,30]. Buccinator's muscle acts as a diaphragm, dividing the space into two compartments: one laterally, placed between the skin and buccinator and one medially, located between the buccinator and jugal mucosa [12]. Yonetsu, Izumi and Nakamura state that in buccal (genian) space abscesses involvement of masseter muscle always occurs [19], which explains the presence of trismus in most cases described.

We presented four cases of suppurations of the buccal space (genian), with starting points in the upper or lower molars; dissemination of suppurative process towards this type of space being described before. In 3 cases the external compartment of genian space was affected, suppuration started at the periapical process of molars being exteriorized laterally to buccinator's muscle (Fig. 275 and 276).

Fig. 275 - Radiological dental causal factor (38 - lower left wisdom tooth)

Fig. 276- Suppuration in the outer compartment of genian space

One of the cases had as a starting point a periodontal infection located at an upper molar, exteriorization of suppuration being made higher than buccinator muscle's insertion, in the medial compartment of genian space (Fig. 277, 278, 279).

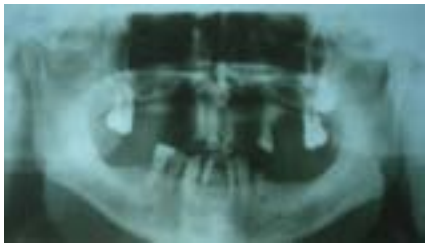

Fig. 277 - Radiological dental causal factor (17 – 2nd upper right molar)

Fig. 278 - Suppuration exteriorization to the internal compartment of genian space

Fig. 279 - Highlighting the purulent collection located in the internal compartment of genian space

Causes of *infratemporal space* suppurations are: septic anesthetic puncture at the tuberosity, dental and periodontal infections of upper molar and dissemination from the neighboring areas [12]. This last aspect makes the infratemporal space to be at the border of primary and secondary fascial spaces, being able to have both direct odontogenic etiology and the dissemination of infection from neighboring areas. Most authors in the literature asserts that the only tooth that can cause a suppuration at this level is upper wisdom tooth [12,22,30,31,32], dissemination of suppurative process being achieved by contiguity due to the posterior position of the upper wisdom molar at the maxillary tuberosity, the posterior limit of it being the anterior limit of infratemporal space.

Of the 3 cases of suppuration of the infratemporal space provided, only one had as a starting point an upper wisdom tooth, the other two having the lower wisdom tooth (Fig. 280 and 281). Although rare, this option is described in the

literature [20,33] and is possible through pterigomandibular space which communicates with the infratemporal space below [2,20].

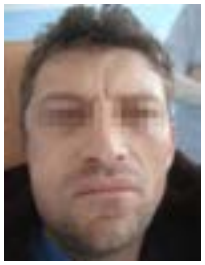

Fig. 15 Clinical aspect of infratemporal space suppuration

Fig. 14 Radiological dental causal factor (48 - lower right wisdom tooth)

Another aspect of one of these cases was the atypically extensive development to the epicranian aponeurosis (Fig. 282, 283, 284). The starting point of suppuration was the 3rd lower molar, dissemination of infection following the path described before by the pterigomandibular space toward infratemporal space which communicates upperly with the temporal space [27,30,32], thus allowing dissemination of suppuration along the deep temporal fascia to the epicranian aponeurosis.

Fig. 283 – Temporal space involvement

Fig. 282 - Radiological dental causal factor (38– lower left wisdom tooth)

From the infratemporal space, Bucur [12] describes the possibility of extension of the suppurative process towards: temporal space, parotid region, TMJ, maseteric space, pterigomandibular space, pharynx, orbit, pterigopalatin fossa and neurocranium. Extension toward maseteric space is described by Gallagher in a case of odontogenic suppuration occurred following an upper wisdom tooth extraction [31], and another case presented by Diacono, highlights the possibility of extending infection to the temporal space [33].

Fig. 284 – Necrosis of epicranial aponeurosis (vertex)

Suppurations of *submandibular space* can have dento-periodontal infections of lower molars as starting point and dissemination from neighboring areas (sublingual, genian, parotid, infratemporal) [12]. Causative teeth are always lower molars, periapical infection eroding the lingual cortical under the mylohiodian muscle insertion [2,10,12,20,21,22,34]. Some authors consider only 2nd and 3rd molars are being responsible for odontogenic infections appearance at this level [20,30,35,36].

We presented a case of suppuration of the submandibular space that start at a lower wisdom tooth, dissemination of suppurative process being accomplished by the way described (Fig. 285 and 286). It can be seen from the aspect of the patient (Fig. 286) consequent involvement of genian space by neighboring edema.

Fig. 286 – Clinical aspect of submandibular abcess with genian edema

Fig. 285 - Radiological dental causal factor (48 - right lower wisdom tooth)

From the submandibular space are described possibilities of extension of the suppurative process towards: sublingual space [19,20,21,22,30,36], submental [20,21,22,27], latero-pharyngeal [21.22, 27,34,36,40], maseteric [18,34,36,40] and parotid space [21].

Sublingual space suppurations have as etiological factors periapical pathological processes of frontal teeth, lower premolars and molars, septic anesthetic puncture and diffusion from neighboring areas (controlateral sublingual, submandibular, submental) [10,12,21]. Fragiskos [20] added to these the latero-pharyngeal space. Diffusion of the suppurative process from the periapical infections is made through erosion of the lingual cortical above mylohioidian muscle insertion [1,10,12,20,30,35].

We also presented a case of suppuration of sublingual space that started at a lower first molar (Fig. 287 and 288), medial root of which being usually located above the insertion of the mylohiodian muscle [12], thus allowing dissemination of suppurative process to the sublingual space.

Fig. 288 – Clinical aspect of sublingual space infection

Fig. 287 - Radiological dental causal factor (46 – 1st lower right molar)

From the sublingual space suppurations can diffuse to: submandibular space [19,20,21,22,30,36], submental area [20,35] and latero-pharyngeal [22].

Suppurations of *submental space* can have as starting point dental-periodontal infections of lower frontals [12,20,21,22,30,35] and infections from neighboring areas [12]. Maritz [36] and Zaya [30] consider that the implication of submental space is secondary to the submandibular space abscesses while Fragiskos [20] added to it sublingual space. Although suppurative process of the lower frontal teeth erodes vestibular (buccal) cortical, usually above the associated muscles [10], when erosion of external cortical takes place below mental muscle insertion, dissemination of suppurative process is toward the submental space [12,20,22].

In the cases presented we descriebed two cases of suppuration of the submental space, with starting points located at a lower central incisive and respectively a lower canine (Fig. 289 and 290), suppurative process diffusion taking place as described.

Fig. 290 – Clinical aspect of submental space infection

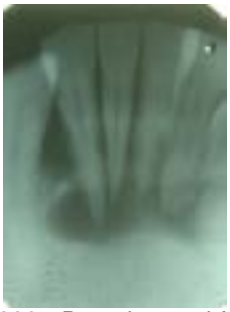

Fig. 289 - Dental causal factor (41 - right lower central incisor)

From the submental space suppurations can diffuse to: submandibular space [20,21,22,27,30,36] and sublingual space [20,35].

Suppurations of *maseteric space* have as starting point lower molars infections [12]. In the literature, most authors consider only lower wisdom tooth as starting point of these suppuration [2,13,20,22,32], the suppurative process localized at the lower wisdom tooth diffused to the retro molar area and from here to the maseteric space between the external face of the mandible ramus and masseteric muscle [2]. Suppuration may also spread from the neighboring areas: buccal (genian) [20,30], submandibular [18].

In the cases presented, we described a case of suppuration of maseteric space that started at a lower wisdom tooth with pericoronitis, dissemination of suppurative process being realized as described (Fig. 291, 292).

Fig. 292 – Clinical aspect of maseteric abcess

Fig. 291 - Radiological highlighting of dental causal factor (48)

Infections of *superficial and deep temporal* space appear from the extension of the suppurative process from neighboring areas: infratemporal [12,20,30], maseterin [41], genian [22,41], the starting point being located at the upper molars [19,22,35,40].

Since 1870 Juvara described *masticator space* (named by Coller and Yglesias in 1935), consisting of maseteric space, pterigomandibular and temporal. These compartments communicate freely with each other [12,18,19,21,27,30,35,40,41] and are considered by many authors to be involved simultaneously in suppurative processes at this level [18,19,30,35,40]. Some authors consider masticator space as a starting point of the spread of odontogenic infections [18,19,40], and spread to: anteriorly to buccal (genian) space [22,40], medially to lateropharyngeal space [19,22,40], inferiorly to submandibular space [19,40] and posteriorly to parotid space [19,22,40]. Propagation of suppurative processes is made in a vertical direction, due to the vertical orientation of the fascia that surrounds the structures that make up the masticator space, chewing forces that contribute to the anti-gravity expansion and limiting the inferior extension by the lower fascia insertion to the edge of mandibular basilar [27,40].

This type of vertical propagation through masticator space was noticed in one of the cases presented, an infratemporal space infection with atypical starting point at a lower wisdom tooth, dissemination of suppurative process being made through pterigomandibular space to the temporal space (Fig. 293, 294).

Fig. 294 – Temporal space implication

Fig. 293 - Infratemporal space infection

Systemizing odontogenic infections possibilities, we made a diagram showing multiple ways to extend the suppurative process in the head and neck fascial spaces (Fig. 295).

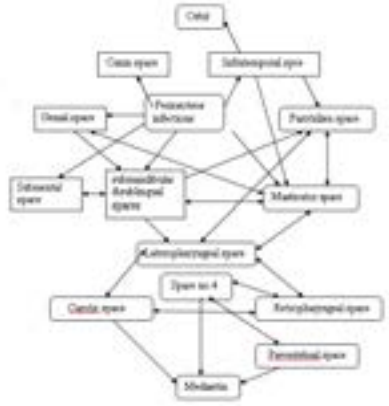

Fig. 295 - Schematic representation of possible dissemination of fascial spaces infections

Diffuse cervico-facial suppurations occur when immunity is low [44], microbial virulence is increased [45,46,47] or if an incorrect antibiotic therapy was applied [12,48,49].

Mouth floor phlegmon (Ludwig angina). The starting point is considered odontogenic suppurative process in 70-80% of cases [32] or even up to 90% [41] and is represented by periapical infections pathology and pericoronaritis of lower molars [12,13,20,32,35], the main focus of infection is most commonly located in the submandibular space [13], from where the suppuration can easily diffuse through hiogloso-mylohiodian gap to sublingual space [27] or posterior to the posterior edge of the mylohioidian muscle [21] and to submental space, deep to anterior belly of digastric's muscle [27]. Mouth floor phlegmon can cause acute upper airway obstruction [30,36,41,52], which may extend to asphyxiation and death [1,41,52] and also can extend to distance organs or regions causing complications: thrombophlebitis of cranial sinuses, septic meningitis, acute mediastinitis or pulmonary gangrene [12,41,50,52].

In the cases presented we have descriebed two cases of mouth floor phlegmon (Fig. 296 and 297), both with starting point at a lower wisdom tooth, the suppurative process started from the submandibulary space and then spreading to all parts of the mouth floor as described and further more. In one case discharge diffused along with the superficial layer of the deep cervical fascia toward the anterior cervical region and deep to bilateral sternocleidomastoid muscle, and the second discharge spreads to lateropharyingeal spaces and toward the carotid sheath.

Fig. 296 - Mouth floor phlegmon - highlighting deep cervical fascia necrosis

Fig. 297 - Mouth floor phlegmon involving the great vessels space of neck

Hemifacial diffuse phlegmon is not described by many authors in the literature. Bucur says that in its development it interested following areas: genian, maseteric, infratemporal, temporal, submandibular and may extend to the maxillary sinus and orbit [12]. With odontogenic cause [20] and starting point in the upper or lower molars, the initially most common space involved is the genian space or rarely the submandibular space [12]. Hemifacial phlegmon may be complicated by osteomyelitis of the maxilla and mandible, cavernous sinus thrombophlebitis or meningitis and can cause distance implication of pleuro-pulmonary or hepato-renal suppuration [12].

Lymphatic dissemination of odontogenic infections is incriminated in the occurance of nonspecific lymphadenitis infections of the head and neck. In cases of adenitis, regardless of location, should examine possible gateways of germs in the area that drains to these nodules (Table II) [12].

TABLE NO. 11 - THE LYMPHATIC DRAINAGE OF ORAL MAXILLOFACIAL REGIONS

Lymph nodes groups	Drained regions	Next chains
Occipital	Occipital region	Superior cervical
Mastoid	Parietal region and external part of ear	Parotidian and cervical
Superficial parotidian	Temporal, parietal , frontal regions	Profound cervical
Profound parotidian	Middle ear, soft palat, uvula, nose	Profound cervical
Submandibular	Face, lips, nose, tongue, teeth	Profound cervical
Submental	Chin, lips, lower lip, flour of mouth, tongue's tip	Profound cervical
Retropharyngeal	Nose, Eustachian canal, middle ear	Profound cervical
Profound facial	Masticator muscles, temporal region, pterigopalatin fossa, orbit, nose, soft palat, pharynx	Profound cervical
Profound anterior cervical	Larynx, thyroid, trachea	Profound cervical
Superficial anterior cervical	Anterior cervical region	Profound inferior cervical
Profound superior cervical	Afferents of all areas of head and neck through other chains	Left thorax canal and right lymphatic vein
Profound inferior cervical	Afferents of all areas of head and neck through other chains	Left thorax canal and right lymphatic vein
Spinal	Posterior triangle of neck	Profound cervical

The most frequently directly involved lymph nodes in dental periodontal infectious pathology are the submandibular ones.

Within the 30 cases we presented 5 cases of acute submandibulary adenitis, one in a congestive stage and 4 in a suppurative stage, with starting points in the lower 1st and 2nd molars, represented by dental pathology in 3 cases (Fig. 298 and 299), periodontal disease in 1 case (Fig. 300 and 301) and 1 case of adenitis occurring after extraction.

Fig. 299 - Acute suppurative submandibulary adenitis

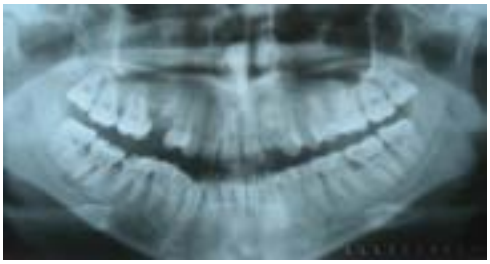

Fig. 298 - Radiological highlighting of dental causal factor (47 – 2nd lower right molar)

Hematogenous way of dissemination of odontogenic infections is rare and is incriminated in the occurrence of complications of head and neck infections (cavernous sinus thrombosis, Lemierre syndrome) and septic metastases (liver, spleen, brain abscess, bacterial endocarditis). Suppurations of head and neck areas can have a very serious development due to lack or delay of treatment or inadequate treatment and favored by immunosuppression existing in certain conditions (diabetes, corticosteroid therapy, organ transplants, malignancy, chemotherapy, chronic renal disease, malnutrition, alcoholism, HIV) [22,44,53,54]), up to a life-threatening condition. Thus, complications may occur by direct extension of the suppurative process to neighboring areas or

hematogenous way. Ling describes the following potential complications of odontogenic infections: extension of infection from local areas to regional, orbital complications - blindness, ophthalmoplegia, jugular vein thrombosis, septicemia, metastatic abscesses, airway obstruction, aspiration, carotid artery erosion, mediastinitis, osteomyelitis, chronic fistulas and cranial nerve deficits [35], while Walsh lists the following: mandible osteomyelitis, maxillary sinusitis and orbital abscess, Ludwig angina, necrotizing fasciitis, cavernous sinus thrombosis, persistent pyrexia of unknown origin, sepsis, disseminated intravascular coagulation, lung abscess, liver abscess, brain abscess and acute meningitis, paraspinal abscess and paraplegia, bacterial endocarditis, spleen abscess, mediastinitis and pneumonia [55].

Fig. 300 -. Radiological highlighting of dental causal factor (48 - right lower wisdom tooth)

Fig. 301 - Acute suppurative submandibulary adenitis

Lemierre syndrome is a rare form of disseminated septic thrombophlebitis characterized by overgrowth of Fusobacterium necrophorum, internal jugular vein thrombosis and distance septic metastasis [36,60,61,62]. Initial discharge is located in the lateropharyngeal area and the most commonly etiology is oropharyngeal, but can also be odontogenic [60,61,63]. Internal jugular vein septic thrombophlebitis occurs by direct extension of the suppurative process in the carotid sheath or through septic thrombi from anterior facial vein, pterygoid venous plexus and posterior facial vein to common facial vein that can reach internal jugular vein [60]. Hence, septic thrombi initially reach the pulmonary circulation, causing pulmonary abscesses and then forward, causing septic multiorgan metastases (liver, kidneys, joints, spleen, osteomyelitis) [36,60,63]. The dissemination of retrograde thrombophlebitis can cause brain abscess, meningitis or cavernous sinus thrombosis [60,61,63].

We presented a case of suppuration of the right submandibulary space with odontogenic etiology (right lower wisdom molar) with a very rapid fatal evolution for the patient, in which the intraoperative detection of right internal jugular vein thrombosis and subsequent identification of Fusobacterium necrophorum culture media confirmed the diagnosis of Lemierre syndrome (Fig. 303 and 304).

Fig. 303 – Clinical aspect of the patient

Fig. 304 - Internal jugular vein thrombosis

Complications that can occur by direct extension, through contiguity of the suppurative process are numerous and occur consecutive to the involvement of secondary fascial spaces.

Upper airway obstruction may occur in suppurationsof the retropharyngeal space marked by bulging posterior wall of the pharynx [12,20,30] and in the case of Ludwig angina [30,36,41], by pushing the tongue base to the palate, causing asphyxiation and death unless fast remedial measures are taken.

Infections of retropharyngeal space may progress to fistulization to the pharyngeal wall, with aspiration of purulent secretions in the tracheo-bronchial branches and the risk of aspiration bronchopneumonia [12,19,20,30,35,36].

Extending of suppurative process to the carotid sheath may cause erosion of the internal carotid artery [21,30,35,36] with the occurrence of fatal bleeding, internal jugular vein thrombophlebitis [30.36] with the occurrence of distance septic dissemination and IX-XII cranial nerve damage [30.36] with the occurrence of Horner syndrome or other neurological deficits.

Acute descending mediastinitis is a rare but extremely serious complication of odontogenic infections [12,64,65], with a mortality rate of 25-50% [66]. The starting point of suppuration is located in the retropharyngeal space, the odontogenic infection reaching this level through pterigomandibular space, infratemporal or mouth floor spaces involved in Ludwig angina [7,67]. Once in retropharyngeal space, suppurative process may spread to the mediastinum through 3 ways [7,66]:

• through pretraheal space which is not directly affected by odontogenic infections but may be involved during surgery (8% of cases) to the anterior mediastinum;

• through the carotid sheath (21% of cases) to the middle mediastinum, where arterial bleeding often occurs due to internal carotid artery erosion;

• through the prevertebral space (71% of cases) toward the posterior mediastinum.

Acute descending mediastinitis may be accompanied by other complications such as sepsis, pneumoperitoneum, pneumothorax, thoracic empyema, pericarditis, internal jugular vein thrombosis, carotid pseudoanevrism, aspiration pneumonia, epidural abscess, adult respiratory distress syndrome [7,66]. Onişor-Gligor describes a case of suppuration of the oral floor complicated with acute mediastinitis, pericarditis, congestive liver micro abscesses, pleuro-pulmonary inflammatory syndrome, multiple organ failure and severe hipoproteinimy [68].

Necrotizing fasciitis is characterized by rapid tissue destruction, progressive and disproportionate to the initial clinical symptoms and signs [69,70], located in the subcutaneous tissue and superficial fascia [71,72], determined by aerobic

and facultative anaerobic flora which act synergistically [12,73].

One of the cases presented had an atypical evolution, with an odontogenic starting point (lower wisdom tooth) and the spread of the suppurative process through pterigomandibular space to temporal space, which took characteristics of necrotizing fasciitis, moving quickly along the epicraneal aponeurosis of controlateral temporal region, which proven by identification of β-hemolytic streptococci in made culture (Fig. 305, 306, 307 and 308).

Fig. 305 - Epicraneal fascia necrosis (vertex)

Fig. 306 - Reaching of controlateral temporal region

This study identified odontogenic infection etiology as a majority (86.6%) in the infectious pathology of head and neck, the result being in line with the literature. In a study by Mihai Juncar et al [5] for a period of 10 years in the Clinic of Oral and Maxillofacial Surgery in Cluj odontogenic infections share is 79.66%, while in other countries indicated percentages are lower: 52% [16], 55% [11], due to the inclusion in these statistics of only serious infections, but probably also because of the effective prevention that patients are subjected in more developed countries.

Fig. 307 - Denude bone of vertex and per-secondum wound healing

Fig. 308 - The aspect of wound healing

Range of patients' age is from 1-90 years with an average of 32 years old of age and a maximum incidence in the second decade of life (25.24%) and third (18.66%). Mihai Juncar et al [5] indicates a similar situation, 1-88 years of age, with average of 30 years of age and maximum incidence between 21-40 years. Other studies relate similar situations, Uluibau et al [11] related a range of 19-88 years of studied patients and an average of 34.5 years and Anthony Rega et al [77] estimates the average age of 33 years, with variations between 7-93 years.

The sex ratio of patients show a greater involvement for men (56%) than women (44%), a situation which is consistent with the literature which are cited percentages ranging between 53% and 67% for males and from 33% and 47% for females [5,11,16,34,77].

Location of origin of patients was also analyzed, the most common cases arising from urban areas (68.26%). Lower percentage of rural (31.74%) is probably due to reduced targeting of the health care provider due to symptoms that draw attention only too late and limited financial possibilities to access to physicians in the city. This criteria I didn't find it in other statistics in the literature.

Analyzing dental causal factors we observed that mandible molars are the most involved in the etiology of 54% of all odontogenic infections, which is recorded by other authors [4,16,34]. With regard to areas affected by suppurative process, literature ranked first the submandibulary space, while in personal statistics periosseous infections come first with a rate of 44.36%, followed by buccal (genian) (10.45 %) and submandibulary (9.28%). This is because most studies in the literature exclude the periosseous suppurations from the statistics.

Next I will limit myself to the 30 cases that we presented and analyzed in greater detail than the total number of patients included in the statistics established.

Nine patients had associated systemic disease, of whom 4 patients presenting a disease, 3 patients with two diseases and two patients with three or more associated diseases. List of systemic diseases encountered is presented in Table 1 at the original thesis. In the literature on top are located mental illnesses with percentage between 10-19% and substance abuse (tobacco, alcohol, drugs) in 13-15% of patients [11.34], followed by diabetes mellitus in 6-8% of cases [11,16,34]. Patients with diabetes (10%) of my study had more severe infections with poor outcome and prolonged duration of hospitalization, situation also descriebed by other authors [5,16,34].

Before clinical presentation, most patients (79.16%) had dental painful symptoms and swelling for less than seven days, while 20.83% had symptoms for more than seven days. R. Sanchez et al [16] shows a very similar situation, with 81.8% of symptomatic patients less than 7 days and 18.2% more than 7 days, stating that 68.9% of patients received antibiotics before admission to hospital. Daramola O. et al [34] places the percentage of patients who have received antibiotics before presentation at 47.16% and the percentage found by me is at 30% of patients with antibiotics before presentation. The difference may be the result of hiding by some patients that have previously received treatment.

The patient's clinical presentation include pain and swelling in all cases, followed by trismus present in 46.66% of patients, the list of symptoms and signs are presented in Table 2 at the original thesis. In the literature we find similar situations, such as the study of IC Uluibau et al [11] with the following percentages: 100% pain, swelling 100% and 44% for trismus or trismus present at 35.1% of patients in the statistics made by R. Sanchez et al [16] as well as different findings like those of Daramola O. et al [34] indicating swelling, pain and fever as the main signs and symptoms presented by patients, but with lower percentages (60.3%, 21.7% and 11.3%).

Modified laboratory tests in patients with suppuration are suggestive of infection (leukocytosis) and inflammation (elevated ESR, increased serum fibrinogen) or are associated with underlying systemic disease expression (hyperglycemia, increased INR, increased serum creatinine). Leukocytosis is one of the criteria used by T. Handley et al [17] in recognition of systemic inflammatory response syndrome that is considered the first stage of the host systemic response to infection or trauma.

Radiological investigations were performed in 20 of patients, as follows: 7

panoramic radiographs (23.33%), 6 scrolled jaw radiographs incidence (20%), 4 retroalveolar radiographs (periapical) (13.3%), 2 skull radiographs (6.66%) and a CT (3.33%). Here are significant differences from the literature as in other countries are widely used expensive investigations inaccessible to the patients in this study, as shown by Daramola O. et al [34] in a statistical conducted in a clinic in Minneapolis where they were used CT in 79.2% of cases, and panoramic radiographs in 10.4%.

Surgical treatment consisting of incision and drainage of collections suppurated evacuation was performed in 29 patients (96.66%) of which 27 (90%) required one intervention and 2 (6.66%) were required more interventions. The literature indicates percentages of 97% [11], 91.5% [34], 86.6% [16] or even 100% [5] for patients requiring incisions and drainage, the last author stating the number of interventions required: an intervention in 33.23% of cases, two interventions in 50.21% of cases or more for 16.56% of cases.

Regarding to attitudes towards causal tooth, to 20 patients (66.66%) were performed extraction and in 2 patients conservative treatment (6.66%). Of the 8 patients who did not apply any treatment for causative tooth, 2 infections appeared after extraction, one was discharged on request prior to extraction, one patient died 24 hours after admission and the other four were not presented with radiographs after discharge to make extraction as were recommended. The literature cites only radical treatment, tooth extraction, in 41.5% of cases [34], 61.8% of cases [16] or 90% of cases [11].

Drug treatment was applied to all patients with odontogenic infections and in one case of adenitis (3.33%) incision was not necessary, a situation encountered in 8.5% of cases by Daramola O. [34] and 13.2% of cases by R. Sanchez [16]. Regimen most frequently used (63.32%) is: Penicillin G + Gentamicin + Metronidazole IV with variations that include the use of Ampicillin instead of Penicillin G and lack of Metronidazole for superficial abscesses. Patients who were outpatients were prescribed Ampicillin or Amoxacilin orally and in serious abscesses, Penicillin G was replaced from the classic scheme with Ciprinol, Meropenem, Timentin or Augmentin. Full list of regimens used is presented in Table 3. In the literature cites using Penicillin + Metronidazole (70%) or Cephazolin instead of Penicillin in patients allergic to it (17%) [11], Clindamycin + Gentamicin (33.1%), Augmentin (25.8%) and Augmentin + Clindamycin + Gentamicin (22.5%) [16].

Determination of microorganisms involved was performed in 4 patients (13.33%) and indicated the presence of the following aerobic and anaerobic bacteria: Streptococcus β haemoliticus group F and G, Streptococcus viridans, Streptococcus spp, Escherichia coli and Fusobacterium necrophorum. In the specialized literature, the number of determinations is higher (21% [5], 31.7% [16]), indicating involvement in order of frequency of the following microorganisms: Streptococcus viridans, Prevotella, Staphylococcus aureus, Peptostreptococcus, Streptococcus spp, Escherichia coli [4,5,16,34,77].

Evolution was favorable in 25 patients (83.33%), slow positive improvement in 4 patients (13.33%) who experienced severe life-threatening suppuration and 1 patient (3.33%) died at 26 hours after admission by cardiopulmonary arrest. The number of days of hospitalization ranged from 2-23 days with an average of 5 days. Five patients (16.66%) did not require hospitalization, presenting superficial infections with low gravity. Juncar et al [5] reported between 1-52 days of hospitalization, with a median of 6 days, Uluibau et al [11] between 1-16 days,

with average of 3.33 days, Sanchez et al [16] between 1-31 days with average of 4 days of hospitalization and Daramola et al [34] between 1-34 days of hospitalization.

CONCLUSIONS

Anatomical pathways of dissemination of odontogenic infections in head and neck regions present an important aspect in their diagnosis and treatment.

Infectious pathology is an important part the conditions in the head and neck (18.7% according to the statistics I made), and within it, infections of odontogenic etiology are the majority. In the study conducted, their share amounts to 87%, according to the percentage found in the literature, which places odontogenic infections of head and neck at 90-95%. Beside the high percentage of odontogenic infections, I also noted a large number of patients with such pathology. Thus, in the statistics performed over a period of 3 years and 7 months, we found 1109 patients with odontogenic infection who presented at the Department of Oral and Maxillofacial Surgery in Constanța. In another study over a period of 10 years in the Department of Oral and Maxillofacial Surgery in Cluj-Napoca I dr.Juncar Mihai [1], have been discovered 1008 patients who had infections of the superficial and deep fascial spaces of head and neck (cases of periosseous infections were excluded from this study). An increasing number of patients with these conditions in Romania, compared to other countries, is probably due to more effective prevention to which patients are subjected in developed countries.

Another feature that highlights the importance of profounding our knowledge in this area is the potential vital risk that odontogenic infections can have. While the scope of suppurative processes of head and neck is usually limited, their location in the deep fascial spaces and their complications, present a particularly serious severity and may endanger patients' lives. Great progress has been made in reducing this risk with the advent and development of antibiotics, but still, conditions such as angina Ludwig, necrotized fasciitis, descending mediastinitis are still life threatening diseases.

The starting point of odontogenic infections is periapical as a result of pulp necrosis and subsequent bacterial invasion in the periapical tissues or periodontal as a result of the presence of deep periodontal pockets, which allow bacterial inoculation in underlying tissues. From this level, dissemination of suppurative process in head and neck areas can be achieved by three ways: directly (by contiguity), lymphatic and hematogenous.

Direct way, by contiguity, is the predominant method by which the odontogenic infections spread and tends to follow the path of least resistance determined by the bone and periosteum, muscle and fascia, as demonstrated by Grodinsky and Holyoke [2] since 1938.

The infectious process initially localized periapical diffuses through bone marrow across the path of least resistance until it encounters a cortical bone which erodes, then exteriorizing to soft tissues. Location of periosseous infections which have a tooth as an etiology factor, is determined by tooth position in dental arch, the thickness of bone covering the tooth apex and the relationship between the level of cortical erosion and mandible or maxillary

muscle insertions.

Suppurative process extending beyond the anatomical boundaries (buccinator muscle insertions, mylohiodian, orbicularis oris) of the vestibular (buccal) area, leads to fascial space involvement. Fascial spaces are bounded by fascia that can stretch or can be perforated by purulent exudates, while directing and limiting dissemination of infection, for which knowledge of the anatomy of fascia and fascial spaces of head and neck are of special importance in diagnosis and treatment of odontogenic infections. This explains the description of fascia and fascial spaces by many authors in the literature and the arising controversies by specialists since their first description by Burns in 1811. Each author has used its own terms in their description, which has given rise to numerous classifications and names and was very plastic expressed by Malgaigne "cervical fascia (and therefore also spaces) appear in a new form under the pen of each author is trying to describe them".

Fascial spaces that can be directly affected by infectious process by transosseous diffusion and erosion of cortex, are called primary fascial spaces, which are bordering the alveolar process of maxilla and mandible. Infections of secondary fascial spaces arise from the dissemination of infection from the primary fascial spaces, where the purulent discharge becomes severe and complications and morbidity are amplified. Primary and secondary fascial spaces communicate with each other, which explains the spread of infectious process from one space to another and makes possible the simultaneously impairment of multiple spaces and the occurence of cervico-facial infections, especially when the immunity is low, the microbial virulence is increased or an improperly antibiotherapy is conducted.

Lymphatic way of dissemination of odontogenic infections is most commonly incriminated in the occurrence of nonspecific lymphadenitis of head and neck which involves most frequently the submandibulary lymph nodes.

Hematogenous way of dissemination of odontogenic infections is rare and is incriminated in the occurrence of complications of head and neck infections (cavernous sinus thrombosis, Lemierre syndrome) and distance septic metastases (brain abscess, liver, spleen, bacterial endocarditis). Suppurations of head and neck regions can have a very serious development due to lack or delay of treatment or inadequate treatment and favored by immunosuppression existing in certain circumstances. Thus, complications may occur by direct extension of the infectious process to neighboring areas (upper airway obstruction, aspiration bronchopneumonia, erosion of internal carotid artery, internal jugular vein thrombophlebitis, impaired cranial nerves IX-XII, acute descending mediastinitis, necrotizing fasciitis) as in hematogenous (septicemia, septic remote metastases, cavernous sinus thrombosis, Lemierre syndrome).

Early application of appropriate treatment is essential for a good, brief and uncomplicated evolution of odontogenic infections of the head and neck. This consists in at least three stages that are generally valid regardless of the type and location of the suppuration namely: surgical, medical treatment and removal of dental causal factor.

Surgical treatment consists of incision and evacuation of purulent collections followed by antiseptic lavage and providing drainage.

Medicationaims to fight infection (antibiotics), inflammation and pain (antiinflammatory and analgesic) and is administered orally or IV injection. First-line antibiotherapy commonly uses empiric antibiotics, preferably in combination,

effective on aerobic and anaerobic flora.

Dental causal factor treatment can be conservative or radical, depending on the scale of the suppurative process and the condition of the causal tooth. Conservative treatment of teeth consists in periapical curettage and apicectomy and sealing of the section surface of the root and is applied only after resolution of acute inflammatory phenomena. This procedure is preceded by endodontic drainage therapy, performed during the acute episode. Radical treatment is tooth extraction and removal by curettage of the periapical lesion.

As a result of the treatment steps it appears the importance of knowledge of the anatomical pathways of dissemination of odontogenic infections in order to determine which is the dental starting point of the infection and also which fascial spaces are affected by the infectious process.

Since primary care, in most cases of odontogenic infections, is given by dentists, they should know the ways and means of spreading of cervico-facial infectious processes and the potential signs and symptoms of severe infection (swelling localized under the mandible basilar edge, fever, accentuated trismus, bulging tongue and floor of mouth, pharyngeal wall deviation) to submit as soon as posible the patient to a specialized oral and maxillofacial surgeon in order to implement early appropriate treatment and reduce morbidity and mortality of these serious infections.

The main conclusion that emerges from this study is that broadcast of odontogenic infections of head and neck is achieved by a pattern set by the anatomical particularities of the region. Hence the difficulty of standardizing these broadcast channels, there are still differences in the description, but also in head and neck fascial spaces nomenclature, which hampers comparison of personal results and literature. There are also significant differences between the methods of investigation used in current medical practice in Romania and the developed countries, especially in medical imaging. Investigations commonly used in patients in this study are limited, the most commonly used being conventional radiological explorations and only exceptionally CT scan, which can lead to delayed diagnosis or misdiagnosis of some infections of head and neck and complications. investigations that are useful in these conditions: CT scan which allows accurate assessment of infection dissemination and deciding the most effective surgical approach, magnetic resonance imaging (MRI), which has a higher specificity than CT in differentiating suppurated collections of cellulites and muscle infiltration, color Doppler ultrasound, contrast CT and high resolution CT to investigate some of the major complications of head and neck infections. These investigations are costly and unfortunately could not be used for most patients in the study, leaving the weight of proper diagnosis on the shoulders of clinical experience of treating physicians, experience based also on the theoretical concepts in this paper.

In conclusion, I want to emphasize that my study on anatomical pathways of distribution of odontogenic infections in head and neck regions can not claim to be complete and perfect and want to remind that a study is impossible to exhaust a subject keeping in mind that whenever you can add and discover other aspects that have not been described enough or that you failed even to treat them. I believe that by this study I brought a modest contribution to improving knowledge about the distribution of odontogenic infections of cervico-facial regions.

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