

## CURRENT DIAGNOSIS, PREVENTION AND TREATMENT OF DRY SOCKET (literature review)

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**Background.** Tooth extraction is the most common surgical intervention in the outpatient practice of a dental surgeon. In most cases, bone wound healing is uncomplicated. However, in some patients the course of healing is complicated by acute inflammatory process of dry socket (alveolar osteitis), the frequency of which increases with increasing trauma of surgery. In dentally healthy patients with typical tooth extraction, dry socket occurs in 2.55%, with difficult – in 9.84%, with atypical extraction of the lower wisdom tooth – in 31.03% of cases. In the presence of diabetes, the incidence of dry socket with typical removal is much higher and according to various authors it is 9.7-13.5%.

**Objective.** The aim of the research was to study the publications and their analysis on the current diagnosis, prevention and treatment of patients with dry socket.

**Methods.** Scientific sources were the articles in world periodicals on dental surgery and therapy, microbiology as well as some electronic resources and patents.

**Results.** At present, many techniques, methods, schemes, compositions for treatment of various forms of dry socket are established. Most often, antibacterial drugs or their combinations with other drugs are used. However, antibacterial drugs do not always have a pronounced anti-inflammatory effect due to the high resistance of the oral microflora. In these cases, contemporary drugs in the form of a composition with long-term antiseptic, anti-inflammatory and analgesic action are rational.

**Conclusions.** The action of a Flupetsal composition, which contains antimicrobial and immunomodulatory drug flurenizide, was clinically proven for treatment of patients with dry socket; the properties of the available ingredients provide a high disinfectant effect, prevent development of inflammation in the tissues and its transition to purulence. A contemporary effective method of treating patients with dry socket is carried out according to the developed method.

**KEYWORDS:** dry socket; treatment; compositions; medicines; Flupetsal.

### Introduction

Outpatient dental care is one of the most popular types of medical care [1]. Tooth extraction is the most common surgical dental surgery performed at outpatient clinic [2].

Improving the quality of dental surgery depends on the qualifications of a dental surgeon and effective drugs for treatment after reducing complications. Improvements in dental treatment methods, recent dental equipment and the latest filling materials have significantly limited the indications for tooth extraction surgery. Indications for tooth extraction are pathological processes caused by complicated caries, which cannot be eliminated by other methods of treatment. Sometimes tooth preservation is not possible due to the large resorption of alveolar tissue caused by periodontal

disease. Improperly erupted teeth are removed only when orthodontic treatments are ineffective. Removal of overcomplete teeth that erupted outside the dental arch also is possible.

A simple or atypical method of hollowing out and alveolotomy are often used. Frequently these methods are combined, an experienced doctor chooses the least traumatic. The surgery can be very simple or technically complex, long, sometimes requiring hospitalization of the patient. Surgical intervention in the removal of teeth is the rupture of periodontal tissues associated with simultaneous damage to the bone tissue of the alveolar processes of the jaws resulting in a wound of varying degrees of infection [2]. During the surgery, it is necessary to remember to treat the tissues sparingly, to avoid unnecessary injuries and ruptures of the mucous membrane. In the case of tooth extraction, the peculiarities of the structure of the dental-maxillary system, general diseases of the patient and local pathological processes

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are taken into account. In other cases, post-operative pain continues for a long time after tooth extraction due to a violation of tooth extraction techniques and improper treatment of the cavity.

Anaesthesia is a very important stage of the surgery. Anaesthetic effect and effective anaesthesia provide for surgical manipulations, allow avoiding tissue injuries [2, 3]. The wound is healed by the type of secondary tension under the cover of a blood clot. In dental practice, it is important to eliminate the negative impact of psycho-emotional state on the patient's CNS after surgery and the feeling of post-extraction pain [4]. Currently, foreign-made painkillers are used in various dosage forms, which are produced using the latest pharmaceutical technologies [5]. In recent years, dentists have used ketones (syn. Trome-thamine, ketorolac) – a non-steroidal non-nar-cotic analgesic that relieves pain of various origins. Its positive effect on hemodynamics and oxygenation of blood is proved. Anaesthesia, proper selection of tools for removal, compliance with the rules of asepsis and antiseptics, timely treatment and prevention minimize the possible complications after tooth and root removal [6].

### Review

After the tooth is removed, the hole is filled with a blood clot. The formation of a blood clot in the hole is the main condition for the healing of the postoperative wound by primary tension. The blood clot should be properly formed with a sterile tissue. The first stage of healing is the formation of a blood clot in the hole with fibrin deposition, which occurs within an hour after the tooth extraction operation. For the next 4-5 days after the tooth extraction surgery, the blood clot is replaced with granulation tissue. Then the granulation tissue is replaced by connective tissue rich in collagen fibres. At this time, the epithelium at the edges of the hole begins to proliferate and grow rapidly towards the centre of the hole to completely cover it in 24-35 days after tooth extraction. In about 1 month, a net of spongy beams appears in the area of the hole; in 2-2.5 months the bone structure of the alveoli becomes almost identical to the surrounding bone tissue; in 3-4 months the formation of bone tissue is finally completed. During this period, the alveolar edges are resorbed and rebuilt, they become lower and thinner than before tooth extraction [6].

One of the most common complications associated with direct tooth extraction is bleeding from the hole. Bleeding may be from vessels of the mucous membrane, the periosteum of the hole, the granulation tissue left in the hole, or from damaged branches of the interdental artery during the curettage of the hole. These types of bleeding depend on the degree of injury to the soft and bone tissues that develop during the surgery. In some cases, bleeding may occur later due to purulent melting of the clot that closes the lumen of the vessel. The cause should be established and the bleeding is stopped by stitching the soft tissues, tamponade of the hole with iodoform turund or haemostatic sponge, hemophobin [7].

If there is pain after extraction in the absence of a blood clot, it is necessary to scrape the hole with a sharp surgical spoon after anaesthesia, clean it of the softened bone and form a "fresh" full-fledged blood clot, but do not always completely scrape the hole. Inaccuracies in the treatment of periodontal and periodontal diseases in the absence of radiographs were observed in more than 75% of patients [8].

Thus, the qualification of the dentist-surgeon, preliminary X-ray examination, choice of analgesic, high quality haemostasis and management after the extraction wound is the key to the prevention of dry socket.

Dry socket (dolores post extractionem) is inflammation of the walls of the alveoli of the tooth with suppuration of the bone wound after its removal [9]. Dry socket is significant among the complications after tooth extraction surgery. According to the authors, dry socket occurs from 33.2% to 35% of the number of cases of all complications after tooth extraction [10].

In the monograph by O.O. Timofeev it is established that 33.2% of removed teeth are complicated by dry socket. Treatment of dry socket should be preceded by X-ray examination of the tooth removal site, in 92.3% of cases the radiograph reveals bone fragments, tooth root and others that are important in choosing treatment tactics.

If examination of a patient with dry socket does not reveal a blood clot in the hole, after anaesthesia it is necessary to cure the hole, clean it of the softened bone and form a "fresh" full-fledged blood clot. If a blood clot is partially preserved in the tooth cavity, the cavity should be rinsed with a warm solution of antiseptic

(furacillin, chlorhexidine, Givalex, Flupetsal, etc.) after anaesthesia the alveolar bone fragments, food debris and decay products should be removed. Then an excavator or a sharp surgical spoon is used to remove the surface layer of the blood clot and fill the hole with the drug (iodoform turunda, solcoseril gel, gelevin, oxycelodex, dermazin cream) [11].

The cause of dry socket is caused by objective and subjective factors. Objective causes of dry socket occur after removing of retained teeth, including third molars of the mandible, tooth removal surgeries, traumatic tooth extraction without a blood clot in the hole, after prolonged bleeding, repeated removal of adjacent tooth roots [12].

Anaesthesia, proper selection of tools for removal, compliance with the rules of asepsis and antiseptics, timely treatment and prevention measures minimize the possible complications after tooth and root removal [13].

Currently, the issue of haemostasis after tooth extraction is still topical, despite the sufficient number of haemostatic agents. Bleeding after tooth extraction is stopped by local haemostatic agents. Studies have shown the advantage of collagen sponge over hemophobin and oxycelodex [14]. An antiseptic sponge with kanamycin is promising for prevention of complications after tooth extraction. Antiseptic sponge with kanamycin has not only pronounced haemostatic, antimicrobial properties, but also stimulates reparative processes in the wound leading to its high therapeutic efficacy [14].

Patients with hemophilia A should have their teeth removed in the haematology department. Patients with pathology of the hepatobiliary system are allowed local targeted haemostatic agents [15]. The results of research prove that the causes of bleeding after tooth extraction might be mild and latent forms of coagulopathies and thrombocytopathies, which have certain clinical and laboratory features and require appropriate treatment [16, 17].

Clinical observations in patients with ventricular haemorrhage caused by bone trauma due to difficult tooth or atypical root removal, as well as the experience in use of gelevin, oxycelodex, traumacil and honsuride dental pins have been described [18]. Although the risk of inflammatory complications in such interventions is not significant, it is necessary to provide antimicrobial treatment of the wound with local antiseptics. The choice of a drug for local preoperative prevention of

infectious complications in tooth extraction surgeries is determined by the nature of surgery, its duration, trauma, degree of wound infection, individual sensitivity to a drug, availability and other general and local factors [19, 20].

It is established that the oral cavity is under the influence of both the body and the environment. Clinical, epidemiological, microbiological studies have shown that the violation of the microbial biocenosis is one of the main factors in the emergence and development of dry socket [21-24].

the diagnosis of giardiasis in the oral cavity are described in some research. Yu.V. Lakhtin [25], studying the morphobiological features of oral protozoa, suggested the most rational methods of diagnosis and treatment of generalized periodontitis in the invasion of oral protozoa.

Thus, the literature suggests that, one of the reasons for development of dental diseases is a wide range of microorganisms. The use of microbiological technologies allows effective treatment and prevention of dental diseases [26, 27].

It is established that the main condition for rational antimicrobial therapy is the isolation of pathogens from the source of infection, their identification and determination of antibiotic susceptibility. Currently, due to the lack of bacteriological results on the day of drug administration, the choice of antibacterial drug, dosage and duration of its reception is determined mainly empirically [28]. The selected drug does not always adequately affect the microorganisms of the lesion, which does not improve the patient's condition and leads to significant disruption of microbiocenosis, reduced local and general immunological reactivity, deficiency or elimination of obligate microflora of the oral cavity. The irrational, often uncontrolled and widespread use of antibiotics at high rates of bacterial reproduction leads to acceleration of resistant strains, and, consequently, reduces the effectiveness of drugs used.

Thus, bacteriological research is urgent for the final diagnosis and treatment planning, justification of indications for antimicrobial therapy and evaluation of its effectiveness [29, 30].

It is proved that the microflora of the serous or purulent contents of the post-extraction area is quite diverse that should be taken into account in combined antimicrobial therapy

aimed at various components of microbial associations (including fungi). The variety of pathogens of nonspecific and specific inflammatory processes, their different sensitivity to antibiotics have determined a large number of antibacterial drugs that are offered in clinical practice. However, the widespread use of antibacterial therapy has led to an increase in the number of resistant strains and polyresistance. This is due to both chromosomal and non-chromosomal mechanisms (R-plasmids that provide the transfer of genetic information during recombination). R-plasmid genes control various mechanisms of resistance to antibacterial drugs, primarily the bacterial synthesis of enzymes such as  $\beta$ -lactamases, which destroy antibiotics.

There are different ways and methods of administration of antibacterial drugs. However, in the treatment of dry socket local administration of drugs are used in the form of solutions for short-term washing of the hole, water-soluble ointments – as part of complex drugs, antibiotics are introduced for electrophoresis etc. Administration of the main drugs may be combined with the of antibiotics in injections or tablet form.

The method of administration of the antibacterial drug into the body depends on its solubility, toxicity, irritant effect, ability to be absorbed through the gastrointestinal tract, and in some cases taking into account patient's condition. It is established that all antibacterial agents are divided into drugs for the most common use (drugs of choice), for severe cases and support. Maxillofacial infections require a similar treatment; antibacterial drugs, both for local and general treatment, can be used.

Antibacterial therapy to obtain data on the composition of the microflora and its sensitivity is chosen taking into account the literature on the highest frequency and structure of pathogens depending on the nosological form of the disease [30, 31].

According to the literature, main drugs for treatment (furacillin, lysozyme, balis-2) should be used. The sharp decrease in their antibacterial activity is caused by developed resistance to pathogens of purulent-inflammatory diseases of the maxillofacial area and neck (especially odontogenic); thus, their use is impractical.

Treatment and prevention of dry socket involves various antimicrobial drugs depending on the sensitivity of the isolated microorganisms. Since chemotherapeutic drugs are administered through the oral cavity to treat diseases of va-

rious organs and systems of the body, it is necessary to study their influence on the microbiocenosis of various human habitats, possible development of resistance of microorganisms to drugs.

The study of the physiological microbial system, microbial landscape and identification of oral microorganisms during various dental diseases provides not only objective data on the nature of the pathological process, but can significantly assist in diagnosis, choice of antibiotics, treatment plans, oral hygiene procedures, and formation of a protective physiological microbial system [31].

Nevertheless, the volume of primary medical care is large and a mass microbiological research in dental pathology is quite complex and economically unprofitable, it can be useful and justified. Various microorganisms can be detected using microbiological research methods such as bacterioscopic, bacteriological, serological, genetic and immunological.

The material for microbiological examination in dry socket is the contents of the hole, nose, throat, saliva, scrape from the tongue, especially in its posterior parts. It must be collected in the morning on an empty stomach with a sterile swab.

Therefore, the reasons for the development of dry socket are violation of microbiocenosis of the oral cavity towards the predominance of aggressive microflora, the complexity of microbiological methods, insufficient effectiveness of antibacterial drugs that necessitates the search for new methods of diagnosis and treatment.

The problem of prevention of postoperative complications, purulent-inflammatory diseases of the maxillofacial area is a topical issue for scientists and practitioners. In order to prevent postoperative complications in outpatient surgeries on the jaw, it is suggested to use drugs that contain chlorhexidine bigluconate [32-34]. Chlorhexidine bigluconate 0.05%, 0.2% aqueous solution in the form of irrigation, rinsing, applications, affects bacteroids, actinomycetes, is effective in the treatment of dry socket.

Chlorhexidine is established to have not only antimicrobial but also anti-inflammatory effect. For the favourable course of the first phase of the wound process using the film Diplendent HD for isolation of the bone wound in the first phase of healing of purulent-inflammatory diseases of the maxillofacial area new combined drugs were used: chlorhexidine +

calcium carbonate called elgidium "Pierre Fabre Medicament", chlorhexidine + metronidazole "Metrogil dent", chlorhexidine + lidocaine called lidochlor by Unique Pharmaceutical Laboratories; chlorhexidine + thyrotricin + lidocaine under the trade name "Trachisan" [35, 36].

For prevention of infectious-inflammatory complications and dry socket, restoration of microbiocenosis in surgical dentistry, phyto rinsing of the oral cavity "Naturorsept" is used for patients after tooth extraction that reduces development of opportunistic microflora in the tooth cavity by 20%. [37, 38]. The drugs used for prevention: elgidium (toothpaste), elugel (gel, 0.2%), eludril (solution, 0.1%). This preparation allows healing the wound in the oral cavity as a "clean" wound and preventing microbial infection during surgery.

Antiseptic and disinfectant "D08A" are the drugs to improve trophism, "D0ZAN" to stimulate regeneration processes. It is recommended to use doxidine, gramicidin, furagin, chloramphenicol in various combinations: in the form of solution, ointment, gel [38].

In outpatient surgical and dental practice, antibiotic prophylaxis is prescribed in two cases: high risk of postoperative infection, secondary (opportunistic) infection, which develops on the background of a burdensome history and is a direct threat to the patient's life. General requirements for the choice of antibiotic for dental surgeries, i.e.: the spectrum of action of the antibiotic should cover microflora of the patient, the drug should at least induce resistance of microflora, the antibiotic should easily penetrate into the tissues in the area of surgery and excrete antibiotic fluid, gums in tissues, wounds, should exceed the minimum inhibitory concentration for possible pathogens during surgery, the antibiotic should be characterized by minimal side effects (do not interact with anaesthetics, analgesics and other drugs). For preoperative prevention, the antibiotic is chosen according to the peculiarities of its pharmacodynamics, pharmacokinetics and spectrum [39-42].

Givalex is one of the remedies that can be used for application and irrigation with preventive and curative effects in dry socket. The antimicrobial action of Givalex is caused by hexitidine, which has antibacterial effect on gram-positive, gram-negative microorganisms. Givalex has antifungal and weak bactericidal action [41].

A new antiseptic drug "Gorosten" is promising in prevention of dental diseases [43-47]. The antiseptic "Natursept" of antiseptic, wound-healing and anti-inflammatory action, is quite effective [37].

In contemporary dental practice, Ukrainian-made Dimexid is most often used in combination with well-known antiseptic, disinfectant, antibacterial, anti-inflammatory, anaesthetic agents in order to expand the spectrum of action on the resistant microflora of the oral cavity, to achieve the best clinical effect. The use of Dimexid with various drugs in the complex treatment of dental patients in outpatient dental practice has proved to have positive results. The day reduction or control of pain, facial oedema, cessation of discharge, normalization of body temperature, appetite, sleep, full recovery were evidenced. The authors confirmed significant antiseptic and anti-inflammatory effect of Dimexid and the feasibility of its use in treatment of various inflammatory diseases in dental patients [48]. In addition to antimicrobial action, Dimexid has a local anesthetic, anti-inflammatory, desensitizing, antifungal, high penetrating action, activates and potentiates the effect of drugs. The largest arsenal of drugs is used in the postoperative period, especially widely represented means for processing the postoperative hole. Thus, parasept, autopack, and septopack bandages are effective for interventions on the alveolar process. Sodium mefenamate and methyluracil are administered to reduce the treatment duration.

The effectiveness of "Aloroma" and Trichopol, "Alvostaz" and "Povisep", "Alvogyl" and polybiolin-curiosone mixture for treatment of dry socket has been proven [49, 50]. Currently, according to the Law of Ukraine "On Medicinal Products", a new drug flurenizide has been widely used [51-55]. "Flupetsal", the composition based on flureniside, has antimicrobial and immunomodulatory properties and significant therapeutic effect [56-58].

### Conclusions

Thus, the contemporary drug composition of "Flupetsal" according to the developed method is quite effective, affordable, low-cost for treatment of patients with dry socket.

### Conflict of Interests

Authors declare no conflict of interest.

# СУЧАСНІ ПІДХОДИ ЩОДО ДІАГНОСТИКИ, ПРОФІЛАКТИКИ ТА ЛІКУВАННЯ АЛЬВЕОЛІТУ (огляд літератури)

Н.С. Гутор

ТЕРНОПІЛЬСЬКИЙ НАЦІОНАЛЬНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ ІМЕНІ І.Я. ГОРБАЧЕВСЬКОГО МОЗ УКРАЇНИ, ТЕРНОПІЛЬ, УКРАЇНА

**Вступ.** Екстракція зуба є найчастішим оперативним втручанням в амбулаторній практиці хірурга-стоматолога. У більшості випадків загоєння кісткової рани проходить без ускладнень. Однак у частини пацієнтів перебіг загоєння ускладнюється гострим запальним процесом – альвеолітом, частота виникнення якого зростає по мірі росту травматичності оперативного втручання. У соматично здорових пацієнтів при типовому видаленні альвеоліт виникає у 2,55%, при складному – у 9,84%, при атиповому видаленні нижнього зуба мудрості – у 31,03% випадків. При наявності діабету відсоток виникнення альвеоліту при типовому видаленні значно вищий і за даними різних авторів складає 9,7-13,5%.

**Мета.** Метою нашого огляду було дослідження опублікованої інформації та її аналіз щодо застосування сучасної діагностики, профілактики та лікування у хворих на альвеоліт.

**Методи.** Науковими джерелами були статті у зарубіжних періодичних виданнях з хірургічної та терапевтичної стоматології, мікробіології, електронні ресурси, патенти.

**Результати.** На сьогоднішній день відомо багато методик, методів, схем, композицій для лікування різних форм альвеоліту. Найчастіше при цьому використовуються антибактеріальні препарати або їх комбінації з іншими лікарськими препаратами. Однак антибактеріальним препаратам не завжди притаманний виражений протизапальний ефект через високу резистентність мікрофлори ротової порожнини. Раціональним в цих випадках є місцеве застосування лікарських препаратів в вигляді композиції з тривалою антисептичною, протизапальною та анальгезуючою дією.

**Висновки.** Клінічно підтверджено дію композиції під назвою „Флупетсаль“, яка містить проти-мікробний та імуномодуляційний лікарський засіб флуренізид для лікування хворих на альвеоліт, властивості наявних інгредієнтів забезпечують високий знезаражувальний ефект, запобігають розвитку процесу запалення у тканинах та його переходу в гнійно-некротичну фазу. Сучасний, ефективний метод лікування хворих на альвеоліт здійснюють згідно з розробленою методикою.

**КЛЮЧОВІ СЛОВА:** альвеоліт; лікування; композиції; лікарські засоби; „Флупетсаль“.

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*Received 23 November 2021; revised 30 November 2021; accepted 10 December 2021.*

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