

Incidence of postoperative infections in dental procedures

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The risk of post-surgical infections in dental surgery and the management of the same has been widely studied and referenced in medical literature.¹

Actually, it is known that in order for any surgical wound to heal properly and in a predictable manner, two conditions that I would define as "milestones" must be met: the wound should be protected from any trauma and prevent superinfection of the same. These two conditions can hardly be met in the oral cavity. It is well known that the oral cavity, which is the first section of the digestive system, is an intrinsically contaminated environment and the risk of infection during intra-oral surgery is increased compared to other types of surgeries and comparable to surgery on the intestine. In fact, it is practically impossible to en-

sure an aseptic environment due to the large number of microorganisms present in the oral cavity; as we all know, bacteria, fungi and protozoa live in the soft tissues creating a biofilm. The life cycle of the biofilm depends on the attack, the colonisation and the proliferation of these micro-organisms.

Common bacterial flora in the oral cavity is variable and consists of aerobic and anaerobic bacteria with pathogenic potential.² Temporary reduction of the amount of such bacteria may reduce the risk of post-surgical infection.³

Therefore, before performing a surgical procedure, it is essential to consider that the wound is never sterile and when subjected to an infection, the latter is due to perioral skin microflora.

Moreover, surgical wounds caused by dental surgery are continuously subjected to trauma: mastication, dental prosthesis, movement of the tongue or perioral muscles. In fact, this involuntary and persistent trauma cannot be eliminated in any way and, obviously, affects significantly the wound healing time.

Speaking with my youngest colleagues as well, they usually pay a great deal of attention to the operating sequence ignoring the key factor that conditions the outcome of the intervention: the proper healing of the wound. In fact, if there is a superinfection of the wound with consequent dehiscence of the flap, the intervention itself and/or the grafted material are likely to turn into failure or unsuccessful operation. Therefore, it is critical to set wound healing as the main goal

Fig. 1 Severe facial infection after mandibular third molar extraction.



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Fig. 2

Fig. 2_ Adequately prepared surgical table.

and make sure the wound is protected against superinfection and trauma, although it is located in a dynamic and contaminated environment.

But how can a post-surgical infection be prevented?

Based on medical literature and my extensive experience as an ER surgeon and dental surgeon, I think that there are different parameters to take into consideration when performing a dental surgery: the experience of the surgeon, the duration of the surgery itself, the concomitant risk factors, the aseptic conditions of the operating field and the careful selection of the materials used.

It is also essential to keep in mind that oral surgery is not just about implants or various regenerative techniques. Even a seemingly common avulsion can be fully considered a surgical intervention, hence subject to infection with more or less serious side effects for the patient (Fig.1).

Fig. 3_ Incorrect preparation of a surgical table.

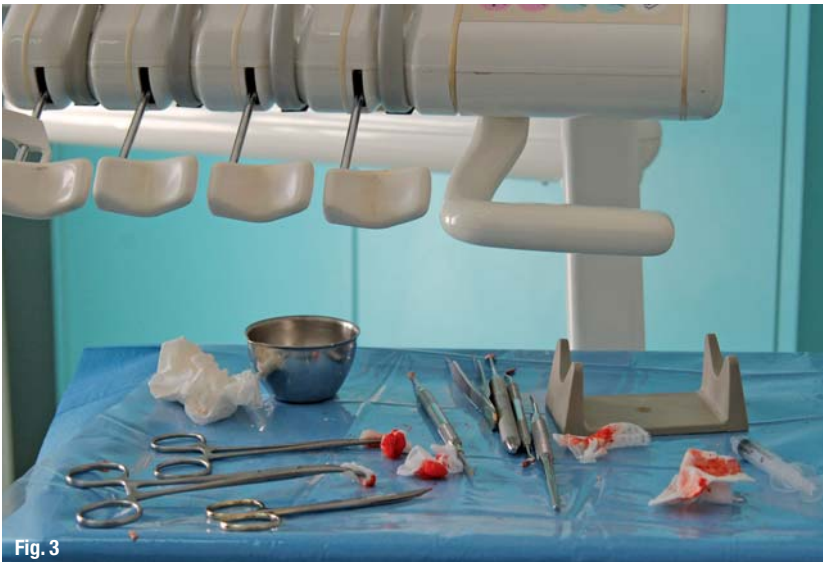


Fig. 3

We will now review the above risk factors for an in-depth examination of every single situation.

_Experience

Experience proves to be the most important factor in a successful outcome of a surgical intervention. It has been reported that the risk of infection in the case of less experienced surgeons is four times higher compared to that of more experienced surgeons.⁴ Nevertheless, experience is definitely not a parameter that can be changed (unless by aging and through hard work!) but it is necessary to take note of it, and then young colleagues who face surgery should pay more attention to their work aware of this aspect.

_Duration

In defining the duration of the intervention, there are two factors that must be considered: the duration, in a relative sense and in an absolute sense. The absolute value indicates the time required for the execution of the surgical procedure in optimum conditions by a surgeon with adequate experience. Virtually, the right execution time, with no rush but also without unnecessary expenditure of time. On the other hand, when lack of experience or insecurity lead to extended duration, we talk about relative value: basically, it is the time actually spent but that could have been reduced. It has been reported that a duration of the intervention below one hour poses a risk of superinfection of 1.3 %, while such risk is increased to 4% if the intervention lasts for about three hours. Every additional hour doubles the risk of superinfection⁵. Once again, it should be mentioned that these values refer to the correct duration of the intervention. To clear this up, if an intervention executed correctly lasts one hour, the risk is 1.3 %, if it lasts three hours, the risk rises to 4 %. But if the relative intervention can be done in one hour, but it takes three hours due to surgeon's lack of experience, the risk of infection increases considerably beyond the above said 1.3 %.

_Systemic factors

There are systemic factors that promote superinfection of the blood clot including uncompensated diabetes (which also prolongs healing time much more than usual), autoimmune and systemic disorders, and smoking.^{6,7,8} Concomitant use of drugs should also be carefully considered to avoid that some of them could heavily interfere with the healing process (just think of the bisphosphonates, a problem that is more and more present in our clinical activity). The age of the patient should also be carefully evaluated; during the avulsion procedure of a third molar, the risk of post-surgery complications is of 10% in twenty-years-of-age patients and 30% in a 40-year-old patient.⁹ Actually, age involves very often the use of medicines and impaired

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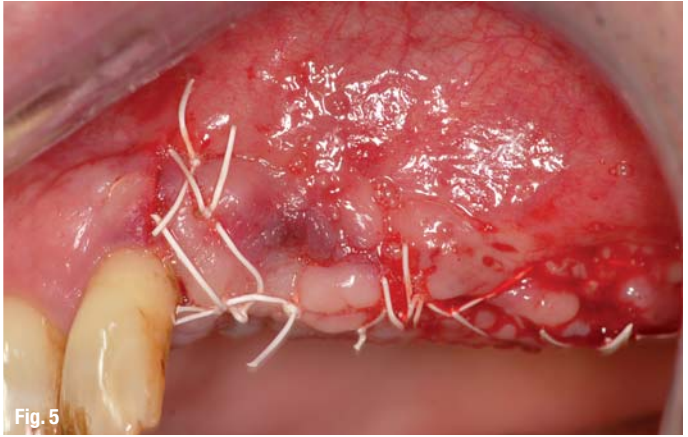
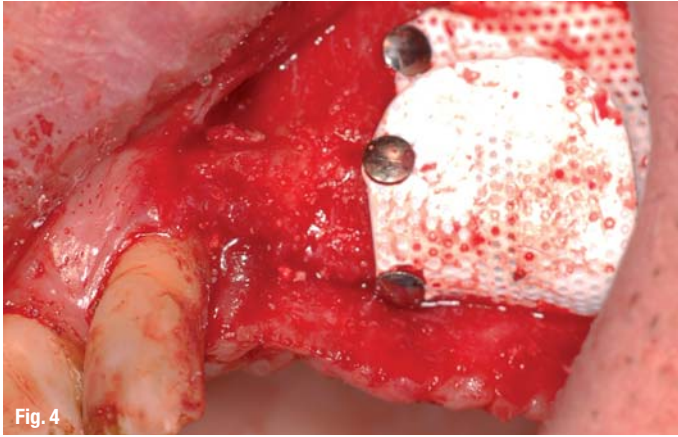


Fig. 4 Bone regeneration surgery.
Fig. 5 The importance of proper closure as the first priority, without tension on the flap.

immune system, in addition to the presence of concomitant syndromes.

Antisepsis

Several studies have highlighted how in oral and implant surgery the proper preparation of a so-called clean operating room is sufficient to achieve a success rate comparable to that obtainable in a sterile room (Fig. 2).^{10, 11}

The above data can and should be interpreted in two different manners. On the one hand, it means that it is not therefore necessary to prepare our operating room as if it were a veritable operating theatre each time we perform a surgery; on the other hand, if minimum procedures for the preparation of the operating room and the operating field, that require little time and modest investment, are not ensured, this could lead to unnecessary and significant increase in the risk of failure or infection of the wound (Fig. 3). The prescription of a systemic antibiotic therapy provided by the majority of existing guidelines, is certainly an important and useful additional procedure aimed to reduce the bacterial load usually present in the oral cavity, but however insufficient to prevent or to exclude the risk of infection. Therefore, although prescribed, such therapy must not be considered as a substitute

for the application of all the necessary antisepsis rules. Since it has a preventive purpose, the antibiotic therapy must be started from the day before the surgery. The same applies to topical antibiotics (very often useless). The use of mouthwashes before surgery and in the following days, although common and appropriate, has no influence whatsoever over the reduction of the risk of infection.

Presence of foreign bodies

Very often, it is not considered that the insertion into the tissue of a material or a device such as an implant, a biomaterial or a membrane, can induce a foreign-body reaction (Figs. 4–5). Surgeons' way of thinking is completely opposite to the biological response; their goal is to improve the health condition of the patient, focusing on what kind of materials to insert, materials that act from a biological point of view as foreign bodies, causing a biological response and inflammation (sometimes even an immune response). Finally, in order to close the wound properly, we use sutures which are also perceived by the body as a foreign body that triggers a consequent reaction (Figs. 6–7). For this reason we are facing a conceptual antagonism: the professional chooses a material to heal the patient, but the same triggers a foreign-body reaction. The choice and use of the materials is therefore crucial in our effort to minimise the for-

Tab. 1 Risk factors in oral surgery.

Risk factors	
Experience	Level of experience of the surgeon
Duration	Relative and absolute duration of the intervention
Systemic factors	Age, diabetes, autoimmune and systemic disorders, smoking, medication
Antisepsis	Operating room set-up and equipment, use of local and systemic antibiotics
Materials used and grafted	Implant, biomaterials, membrane, sutures

Natural sutures	Indications
Non-absorbable silk suture	Extractive surgery with low risk of superinfection
Synthetic sutures	
Absorbable multifilament coated suture (e.g. VICRYL, Ethicon)	In all specialties in which the sutures used cannot be removed (e.g. mucogingival surgery)
Monofilament absorbable suture (e.g. MONOCRYL, Ethicon)	Gingival surgery; very useful to use as continuous suture
Non-absorbable multifilament coated suture (e.g. ETHIBOND EXCEL, Ethicon)	It replaces silk in complex cases of extractive surgery (e.g. regenerative surgery); maintenance of haemostatic products on the sites of extraction
Non-absorbable monofilament suture (e.g. PROLENE, Ethicon)	Ideal for continuous sutures, elongation of clinical crown, apicectomy

Tab. 2_Types of sutures for different clinical indications.

eign-body response. The use of sutures, for example, does not directly cause infection, but may promote the development thereof. Often I am asked what type of suture I prefer: it is a question that I definitely do not like because it assumes that you have only one type of patient, only one type of surgery and only one type of situation. The surgeon must assess each case individually and select the material that can best promote healing by reducing the risk of infection. The main purpose of the suture must obviously be to achieve a first intention

wound healing, as top priority. To get a second intention healing is always a failure, which involves serious likelihood of dehiscence of the wound and high probability of failure. For this reason, both the knowledge of adequate suturing and knotting techniques (a topic that is so extensive that we cannot cover it in this work) and the selection of the most suitable suture material are of fundamental importance. There are different types of suture threads, which for the sake of simplicity are summarised in the following table. Sutures can be classified

Fig. 6_Apicectomy and application of biomaterial.

Fig. 7_A monofilament suture.

Fig. 8_A post-extraction monofilament suture.

Fig. 9_Excellent healing of tissue in only six days after extraction.

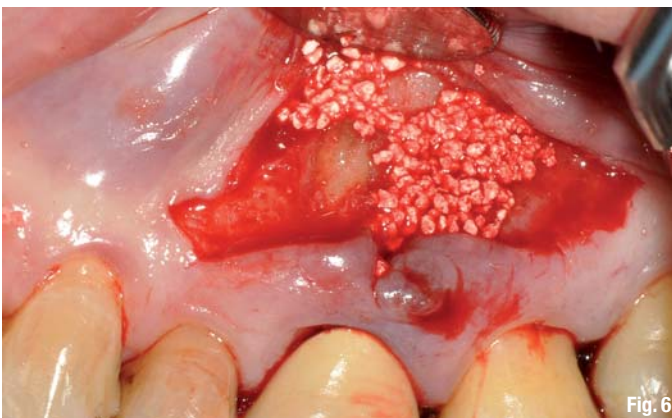


Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10

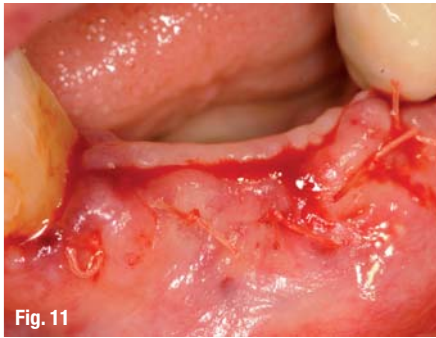


Fig. 11

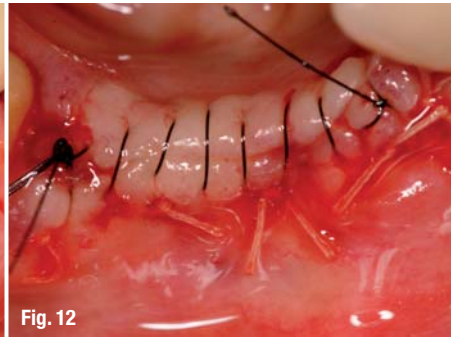


Fig. 12

Fig. 10_Post-extraction site after suture removal with no inflammatory reaction.

Fig. 11_Suturing deep-layer stitches using the horizontal mattress technique with an absorbable suture.

Fig. 12_A continuous suture with an absorbable monofilament.

according to their origin in natural or synthetic, or based on their stay in the tissues in absorbable or non-absorbable and yet according to their structure in monofilament or multifilament. Synthetic sutures have considerable advantages with respect to natural sutures such as silk. Synthetic sutures output lower tissue reaction and greater tensile strength that allows hence the use of thinner threads (Figs. 8–10).

The absorbable sutures allow a temporary sealing of the flaps because they are broken down by the body through a hydrolytic process. This process could be more rapid where there is no homeostasis of the subject, as in the presence of fever, infections or protein deficiencies, and this could lead to an acceleration in the process of absorption of the suture with an inadequate seal of the suture in the wound for the time required (and of course, this aspect must be carefully considered by the surgeon during the surgery and when choosing the type of suture). Absorbable threads are often preferred for suturing the deeper layers of the wounds, where blood clot stability is absolutely necessary (Fig. 11). Non-absorbable sutures that should be removed by the surgeon are used in the superficial layers of the wounds or in the case of overt infections and immunodepressed patients. Multifilament sutures are composed of several filaments which ensure greater tensile strength and flexibility. Monofilament sutures on the other hand, are more inert, but less easy to manage at the time of their use due to their fragility and the difficulty upon knotting because of their extreme smoothness (Fig. 12). There are also suture threads, recently introduced on the market, coated with bacteriostatic agents that can play an active role in the prevention and protection against the risk of bacterial post-surgery superinfection. It is obvious, however, that the choice of the suture is a key factor in predicting the outcome of our surgery and, therefore, it is the most important phase of the intervention.^{12,13} We should, therefore, pay due attention to this moment, at least equal to that paid when we choose the implant or the biomaterial. Instead, I often see that this step is regarded as an unnecessary loss of time, therefore a step treated with superficiality and negligence. To face later problems like a dehiscence of the flap for which we have no rea-

sonable explanation and, even worst, no adequate solution.

Conclusion

Dentistry is among the other medical disciplines, the one that evolved the most significantly over the past few years, from the practice of barber surgeons to a real and veritable medical work, worthy of all the consequent attention and due respect. The dental surgery, likewise, has experienced a major acceleration in these years, making interventions that 50 years ago were almost unthinkable routine and predictable procedures. But perhaps, surgical culture has not kept pace with this evolution, as if dental surgery were a minor surgery and therefore not deserving an adequate and serious approach. Too many times I had to assist to improperly managed interventions, although important, with little or no attention to room sterility, the preparation of the auxiliary staff, the setup of the surgical table. And choosing for the suture the first (or only!) suture found in the drawer. Actually, a failure or a preventable infection as a result of dental surgery, and such may still be responsible for a significant morbidity and a certain risk of mortality. I therefore hope that surgeons will act with an ever-increasing "surgical" approach, not only with regard to surgery itself but also in the preparation and management of the intervention, applying the medical procedures and preventive measures that will not only provide for a better understanding of the biological processes that promote healing but also prevent dangerous and avoidable post-surgery infection which should not burden our surgery.

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