Acute dental abscess is a frequent and sometimes underestimated disease of the oral cavity. The acute dental abscess usually occurs secondary to caries, trauma, or failed endodontic treatment. After the intact pulp chamber is opened, colonization of the root canals takes place with a variable set of anaerobic bacteria, which colonize the walls of the necrotic root canals forming a specialized mixed anaerobic biofilm. Asymptomatic necrosis is common. However, abscess formation occurs when these bacteria and their toxic products breach into the periapical tissues through the apical foramen and induce acute inflammation and pus formation. The main signs and symptoms of the acute dental abscess (often referred to as a periapical abscess or infection) are pain, swelling, erythema, and suppuration usually localized to the affected tooth, even if the abscess can eventually spread causing a severe odontogenic infection which is characterized by local and systemic involvement culminating in sepsis syndrome. The vast majority of dental abscesses respond to antibiotic treatment, however, in some patients surgical management of the [...]


DOI: 10.1097/SCS.0000000000003250
PMID: 27930461
Abstract: Acute dental abscess is a frequent and sometimes underestimated disease of the oral cavity. The acute dental abscess usually occurs secondary to caries, trauma, or failed endodontic treatment. After the intact pulp chamber is opened, colonization of the root canals takes place with a variable set of anaerobic bacteria, which colonize the walls of the necrotic root canals forming a specialized mixed anaerobic biofilm. Asymptomatic necrosis is common. However, abscess formation occurs when these bacteria and their toxic products breach through the periapical tissues through the apical foramen and induce acute inflammation and pus formation. The main signs and symptoms of the acute dental abscess (often referred to as a periapical abscess or infection) are pain, swelling, erythema, and suppuration usually localized to the affected tooth, even if the abscess can eventually spread causing a severe odontogenic infection which is characterized by local and systemic involvement culminating in sepsis syndrome. The vast majority of dental abscesses respond to antibiotic treatment, however, in some patients surgical management of the infection may be indicated. In the present work, a retrospective analysis of the patients with dental orofacial infections referred to the Unit of Dentistry and Maxillofacial Surgery of the University of Verona from 1991 to 2011 has been performed.

Key Words: Odontogenic, orofacial infections, retrospective analysis.

RESULTS

After an initial analysis of 690 patients treated over 16 years, it can be observed that 418 patients (60.58%) involved males and 372 females (39.42%) (Fig. 1). We analyzed the age of onset of the disease. Pediatric patients, under 17 years, represent the 8.41% of the total with 58 reported patients (Fig. 2). Through a division into age groups of treated patients, data described the higher prevalence of the disease in age from 11 to 60 years. The highest incidence is between 21 and 30 years (Fig. 3). The division between sexes within each age group provides a more detailed analysis. In this way, we observed that how the male/female ratio in the different intervals tends to increase, especially in the 4th, 5th, and 6th decades (Fig. 4).

The disease onset site has been certainly identified in 571 patients (82.75%) while in the remaining 119 (17.25%) surveys conducted by the operators did not identify a single causative factor but an association of several elements (Fig. 5).

We have analyzed what are the areas primarily involved in the disease onset. The sector most frequently responsible for disease is the posterior jaw, which was affected by abscesses 276 times on the left and 272 times on the right. Unlike that, the upper jaw is involved in forms that require patient hospitalization in a lower percentage of patients, and our data indicate that it was the site of infection in 140 patients in total (Fig. 6).

A further consideration is the detection of unique onset locations of the disease, which allows the classification in order of frequency of infection-related teeth. In our series, the tooth most frequently associated with odontogenic abscesses is 4.6, which has been associated the pathology in 76 patients. Then, the element 3.8 caused 74 patients, 3.6 and 4.8 caused 70 patients each, 3.7 was involved in 64 patients, and 4.7 in 53 patients. All other elements were involved in a much lower percentage of patients, or even have never been associated with disease (Fig. 7). Considering only the age from 21 to 30 years, the one with higher frequency of occurrence of the disease, we can confirm the general pattern: the back of the jaw is the more involved site. It is also evident in the simultaneous involvement of multiple elements (Fig. 8). We registered 18 patients originated from the deciduous dentition. Also in this subgroup inferior-posterior areas of the mouth have a higher involvement frequency (Fig. 9).

The microbiological pattern of the infections has also been studied. Most infections seem to be polymicrobial synergistic aerobic and obligate anaerobic pathogenic processes. By means of sterile collected specimen cultures, 7% of the patients contained exclusively aerobic bacteria and 20% of the specimens only anaerobic bacteria. On the other hand, 68% of the patients presented with combined aerobic/anaerobic bacteria, whereas in 5% no organisms were detected.

The graphic elaboration of recovery days by patient is represented by a Gaussian curve with peak at 4 days of comparable with those obtained from similar studies. Microbiological pattern and main features of therapy and hospitalization also were taken into account.
hospitalization. Patients hospitalized for 4 days were 187 (27.10%), for 5 days 140 (20.28%), and for 3 days (2.46%), whereas the patients with hospitalization for a period exceeding 10 days were 17 (2.46%) (Fig. 10). The increased length of hospitalization of the 17 patients hospitalized for more than 10 days is due to the clinical severity and therefore to the need for interventions that required a longer postoperative course (Fig. 11). A patient with mediastinitis required a 37-day hospitalization. It is important to point out that 5 patients resulted in a lateral cervical areas involvement with cervicofacial necrotizing fasciitis. In 3 patients, there were oral floor and suprahyoid area involvement that caused tongue dislocation and eventually Ludwig angina. Four patients presented the tonsillar pillar involvement. In 1 patient, the disease has spread to the parapharyngeal space. In another patient, it has spread to the temporal and infratemporal fossa. In 1 patient, it involved the orbital cavity and in 1 patient was observed multiple abscess formation with brain involvement.
We have subdivided the disease treatment methods into 4
groups. The 61.45% of patients (424 patients) underwent abscess
drainage associated with the extraction of involved elements, the
alveolus remodeling, and an appropriate medical care. This includes
the use of intravenous and/or oral antibiotics, hot-humid pack,
appropriate exercises of mouth opening, non-steroid anti-inflam-
matory drugs, and the use of myorelaxants.

The 17.10% (118 patients) was subjected to pulpectomy and root
canal medication, medical treatment and drainage of abscess often
through the root canals. The 14.49% (100 patients) was treated with
medical therapy and drainage of abscess, delaying dental treatment
element. Finally, the 6.96% (48 patients) of patients were treated
with medical therapy alone, the involved teeth were treated by
private dentists (Fig. 12).

The 13.04% of patients (45 patients) needed general anesthesia
for the complexity and type of intervention and the age. In the
remaining 86.96% of patients, we used no anesthesia or
regional anesthesia.

DISCUSSION

It is evident how the conditions that lay indication to the patient’s
hospitalization are those who involve the posterior of the jaw. This
is due to an extreme danger of an untreated or incorrectly treated
abscess in these parts that can cause the onset of complications
which could endanger the patient’s life.

The 3rd molar covers a major role in the frequency of pathology
because it represents the cause in one-third of the patients that
involves patients in the third of age. The dystopic or incomplete
eruption of these elements induces a major susceptibility to
the onset of decay and periodontal pathology and, then, of
periradicular infections.

As far as microbiology is concerned, it is a common opinion
that most odontogenic infections initially present as an aerobic
bacteria-supported cellulitis. The cellulitis, when left untreated,
enables the subsequent development of anaerobic infection. With
the growing severity of the infection, a mixed flora takes over.
Several proteolytic enzymes, endotoxins, and exotoxins are pro-
duced by the anaerobic share of the flora, with consequent tissue
degradation, and immune reaction with abscess formation and pus.
Eventually, if the host defense mechanisms succeed in limiting the
infection as a well-circumscribed abscess, anaerobic bacteria only
make it through.3

Aerobic gram-positive cocci like the α-hemolytic Streptococcus
viridans group, often involved in subacute bacterial endocarditis, or
the Streptococcus milleri group, often responsible of dental
abscesses, appear to make up for the greatest part of early com-
ponents of infections in the head and neck district. Streptococcus
**pyogenes**, a β-hemolytic streptococcus, has recently had its role stressed in necrotizing fasciitis. *Staphylococcus aureus* is often found in toxic shock, endocarditis, chronic osteomyelitis, post-operative wound infections, and acute parotitis. *Hemophilus influenzae*, on the other hand, is often implicated in sinusitis and infections of the ear.8

The subsequent anaerobic share of orofacial infections comprehends anaerobic gram-positive cocci and anaerobic gram-negative rods, such as the *Bacteroides* and *Fusobacterium* species. The mixed aerobic/anaerobic combination of *Streptococcus milleri* and *Fusobacterium* has been involved in life-threatening lateral and retropharyngeal descending infections, which may complicate into mediastinitis.9

Patients with abscesses that endanger patient’s life are very rare, only 2.46% of treated patients needed hospitalization that lasted more than 10 days, and exclusively 1 patient needed to be referred to a thoracic surgery department.

Adequate antibiotic therapy must consider the microbiology and timing of the infection, antibiotic resistance, patient compliance, and cost. Early and outpatient infections seem to be adequately treated with therapy targeting aerobic streptococcal pathogens. In our experience, penicillins have been widely and successfully used.

Penicillin-resistance rate among outpatient odontogenic infections remained low (5%), a data consistent with literature findings.10 In patient with allergy to penicillin, erythromycin and macrolides proved to be a valid alternative. Cephalosporins also have been used, although less frequently because of the risk of cross-reaction with penicillins.

In more important infections, anaerobic gram-negative rods, which are often penicillin resistant (25–60%) must be targeted. Our antibiotic of choice in this patients was clindamycin, aiming to cover both streptococcus and anaerobes. Metronidazole is also valuable alternative against anaerobes, in association with ampicillin versus oral streptococci. Antibiotic management of nonresponsive outpatient odontogenic infections or more severe or life-threatening orofacial infections must be customized according to culture and sensitivity reports.10

The most severe and life-threatening complications of orofacial infections are Ludwig angina, cervicofacial necrotizing fasciitis, descending necrotizing mediastinitis, cavernous sinus thrombosis, and brain abscess. Despite their rarity, these complications present themselves still nowadays with remarkable morbidity and mortality.

Ludwig’s angina is a form of severe diffuse cellulitis with acute onset and rapid spread resulting in bilateral affection of the submaxillary, sublingual and submental spaces, and woody-like swelling.11 Due to the proximity of dental roots with these spaces, odontogenic infections are the most common etiology.12 Ludwig angina can also be caused by other infective pathologies of the head and neck districts or by squamous cell carcinoma associated tissue necrosis.13

Systemic diseases causing severe impairment of health status may also be associated. Kurien et al14 reported that in 52% of the adult patients, Ludwig angina was of dental origin and in 39%, the presence of predisposing systemic diseases could be identified; no predisposing illnesses could be detected in pediatric patients.14

The germ activity in Ludwig angina leads to significant muscular necrosis with late suppuration and locally aggressive behavior. Despite the strong impairment of the patient health status, there is no severe local discomfort. There is throat inflammatory swelling with clear edema of the oral pelvis. Airway patency may be impaired; moreover, the infection can complicate with sepsis.

On the other hand, parapharyngeal spaces can also be involved with possible thoracic empyema. *Ab ingestis* pneumonia, meningitis, and vascular erosion have been cited as possible complications.15

Diagnosis is clinical. Computed tomography scan may help to precisely detect the diffusion of the infection.16 Early antibiotic administration and prophylactic debridement of the spaces involved...
Dental infections are a common cause of systemic complications, with the brain as a direct propagation or via the bloodstream. Related factors are the presence of associated diseases, such as diabetes, cardiovascular disease, and immunosuppression. Health status is strongly associated with mortality, and patients with diabetes have a higher mortality rate than those without. Malignant hypertension, congestive heart failure, and cerebrovascular disease are also risk factors.

Mortality rates due to diabetes have been reported to range from 4% to 60%. Cervical necrotizing fasciitis is an uncommon soft tissue infection characterized by rapid spread. Large necrotic lesions and gas formation, located in the subcutaneous cell tissue and in the superficial fascia, can be observed. There is consequent myonecrosis and formation of petechiae.

When left untreated, cervical necrotizing fasciitis evolves toward toxic shock and multorgan failure. Dental infections are the most frequent cause of the illness, although pharyngeal infections may also be associated. Vasculopathies of various origin have been reported to be predisposing factors; however, the disease is observed also in healthy patients.

The initial presentation of the disease can be misdiagnosed with a dental infection with soft tissue involvement until the progress of the pathology takes place, with resulting gangrene of the subcutaneous cell tissue and muscular aponeurosis, with swelling. Although the onset is intense, later paraesthesia or even anesthesia may be observed because of nerve involvement. Skin may become affected, with poorly defined edges and almost black color. Gas and exudate formation may come to surface, from the 5th to the 9th day.

Later involvement of the neighboring tissues is possible, with local or systemic complications. Health status is strongly impaired, with the signs of sepsis. The semiology of mediastinitis presents with dysphagia, dyspnoea, swelling of the neck, and crepitation in the upper thorax are present. The patient usually presents with fever, headache, nausea, vomiting, supraposition, paraesthesia, proptosis, photophobia, ophthalmoplegia, chemosis, and ocular pain. Drainage of the infraorbital or infratemporal spaces and treatment of the responsible tooth are mandatory. High-dose intravenous antibiotics able to cross the blood brain barrier are indicated. The role for anticoagulation and steroids in these patients is not clear.

Very few brain abscesses can be ascribed to dental origin. Bacteria can reach the brain as direct propagation or via the bloodstream. Brain abscesses present with fever, headache, and focal neurological deficits. Computed tomography scan and magnetic resonance imaging are pathognomonic. The microbiological pattern of the brain abscess reflects the original infective site. Intravenous adequate antibiotic therapy is mandatory. Surgical options include aspiration or excision. Adequate monitoring must take place in neurological intensive care unit. Repeated aspiration may be necessary, but it may avoid residual neurological deficits associated with excision. Mortality rates is 20%.

CONCLUSIONS

Most orofacial infections are routine, innocuous lesions treated by all dental practitioners. Whenever the complications discussed above take place, adequate clinical examination, selective diagnostic imaging, appropriate antibiotic therapy, safe airway control, and time-effective surgery are the tools that the clinician has to master in order to preserve patient’s life. Future evaluations will also have to consider the socioeconomic aspects of population regarding to migration and to the significant presence of foreign patients (within the casuistry) who represent today, 15.94% of the patients (110 patients).

REFERENCES