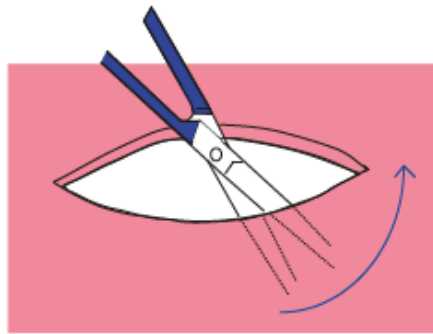




# **MASTEROPPGAVE**

## **Minor oral soft tissue surgery**

### **for the general dental practitioner**



**Ingvild Årøen Lein**  
**Veileder: Geir Støre**

**UNIVERSITETET I TROMSØ**  
**Det helsevitenskapelige fakultet**  
Institutt for Klinisk Odontologi

## **Summary**

There is a geographic imbalance in the distribution of specialists in oral surgery and pedodontology in Norway, and it may be that the general dental practitioner could become better at performing simple surgery. This may save the patient long journeys, and may even reduce doctor's delay in the diagnosis of cancer.

In this study, a guide for soft tissue surgery has been made, based on a review. The guide should serve as an update and reminder of selected surgical procedures for the general dental practitioner. Some of the procedures are documented with clinical photos, but due to limited time, every procedure was not possible to observe, and the result must be considered preliminary.

## Table of Contents

<b>1. INTRODUCTION .....</b>	<b>4</b>
<b>2. AIM .....</b>	<b>4</b>
<b>3. MATERIAL AND METHODS.....</b>	<b>5</b>
<b>4. LITERATURE REVIEW.....</b>	<b>6</b>
4.1 PREOPERATIVE CONSIDERATIONS .....	6
4.1.1 <i>Antibiotic prophylaxis</i> .....	6
4.1.2 <i>Prevention of bleeding complications</i> .....	7
4.1.3 <i>Adrenal insufficiency</i> .....	8
4.1.4 <i>Factors affecting wound healing</i> .....	9
4.1.5 <i>Cancer patients</i> .....	10
4.1.6 <i>Oral bisphosphonates</i> .....	10
4.1.7 <i>Psychological considerations</i> .....	12
4.2 GENERAL SURGICAL PROCEDURES .....	12
4.2.1 <i>Analgesia</i> .....	12
4.2.2 <i>Preoperative antisepsis</i> .....	13
4.2.3 <i>Making incisions</i> .....	14
4.2.4 <i>Wound closure</i> .....	14
4.2.5 <i>Suture material</i> .....	15
4.2.6 <i>Suture removal</i> .....	16
4.2.7 <i>Postoperative pain management</i> .....	16
4.2.8 <i>Oral hygiene</i> .....	17
4.3 SPECIFIC SURGICAL PROCEDURES .....	17
4.3.1 <i>Oral biopsy</i> .....	17
4.3.2 <i>Salivary mucocele</i> .....	22
4.3.3 <i>Denture-induced fibrous hyperplasia</i> .....	24
4.3.4 <i>The superior labial frenum</i> .....	25
4.3.5 <i>Ankyloglossia</i> .....	28
4.3.6 <i>Abscess drainage</i> .....	30
4.3.7 <i>Oro-antral communications</i> .....	32
<b>5. RESULTS AND DISCUSSION .....</b>	<b>34</b>
5.1 THE LITERATURE REVIEW .....	34
5.2 THE ROLE OF THE GENERAL PRACTITIONER .....	34
5.3 THE MANUAL.....	35
<b>6. ACKNOWLEDGEMENTS.....</b>	<b>37</b>
<b>7. REFERENCES .....</b>	<b>38</b>

# 1. Introduction

In everyday work, the general dentist has the opportunity to experience a great variety of type of work with contributions from many odontologic fields, like, for example, oral surgery.

Today, there is a geographic imbalance in the distribution of specialists in oral surgery and pedodontology in Norway. Compared to other countries, there are few specialists in oral surgery<sup>1</sup>, and the waiting lists for referral to an oral surgeon may be long.<sup>2</sup>

It is not desirable that the general dentist avoids referring difficult cases, but it may be possible for the general dentist to become better at performing simple surgery. This will be in correlation with the principle of LEON, that treatment should be done at the lowest possible level.<sup>3</sup> This is especially relevant for the dentist working in remote places, where it is unrealistic for the dentist to carry out extensive referral of patients.

Searching in "Sambok" (Norsk samkatalog for bøker<sup>4</sup>) for associated terms, there are no findings of Norwegian or partly Norwegian text books in oral surgery published since 1986. It may be difficult for the dentist to find easy-read up-to-date sources for the knowledge needed for performing simple surgery in general dental practice.

## 2. Aim

The aim of this study is to produce a guide for soft tissue surgery in general dental practice, based on a review, consisting of a description of procedures as an update and reminder of surgical principles. It will not be a replacement for text books in oral medicine, pathology or surgery.

### 3. Material and methods

PubMed was searched for reviews and meta-analysis of related subjects. Articles with best coverage and most related to the guide were chosen, and when further sources were needed, other studies were included in the search. In addition, Tidende (Norsk tannlegeforenings tidsskrift) and Tandläkartidningen (Sveriges Tandläkarförbunds organ) were searched for related material.

Established textbooks in odontology were used to find description of techniques and to serve as a base for the management.

The main procedures and conditions chosen for this study were:

- Oral biopsy
  - Incisional
  - Excisional
  - Management of the specimen
- Superior labial frenum
- Ankyloglossia
- Salivary mucoceles
- Denture-induced fibrous hyperplasia
- The acute dentoalveolar abscess
- Oro-antral communications

In addition, a description of necessary pre- and postoperative considerations and surgical management was included. Clinical photos were taken to illustrate the procedures.

## **4. Literature review**

### **4.1 Preoperative considerations**

A general dental practitioner should know the patient's present and previous medical condition, and a thorough medical history should be recorded before starting any kind of treatment. Patient care should in general be done in same manner as other dental visits, but some aspects elementary for oral surgery are recapitulated here.

#### **4.1.1 Antibiotic prophylaxis**

In every surgical procedure the oral mucosa will be penetrated, and even in healthy-appearing mouths a penetration of the mucosa may lead to a transient bacteraemia. A bacteraemia may in certain groups of patients lead to infective endocarditis (IE). It is shown that IE is much more likely to result from random bacteraemias from daily activities, like tooth-brushing, and earlier recommendations for antibiotic prophylaxis is now reduced to be given only to the patient where an IE has the highest risk for adverse outcome: Patients with a previous history of IE, prosthetic cardiac valve or cardiac valve reparation with prosthetic material, with certain congenital heart diseases (unless completely repaired without replacements or residual defects) and cardiac transplantation patients who develop cardiac valvulopathy.<sup>5,6</sup> When in doubt, the patient's medical doctor has to be consulted prior to surgery.

The prophylaxis to prevent IE is not necessary only for routine anaesthetic injections through non-infected tissue, but should be given in advance of biopsies, suture removal and other oral mucosal perforations. A one-dosage prophylactic 1 hour before the surgical procedure is sufficient: Amoxicillin 2 g, for children: 50 mg/kg, maximum 2 g. In cases of penicillin allergy: Clindamycin 600 mg, for children: 20 mg/kg, maximum 600 mg.<sup>5,6</sup>

Use of antibiotics to prevent local wound infection and general infection (septicaemia) is not supposed to be a routine procedure for the healthy dental patient.<sup>7</sup> However, patients with reduced defensive capacity need antibiotic protection, even when wound contamination is low. This includes the patient with an immune response not considered adequate, such as the

patient with uncontrolled metabolic disorder (diabetes mellitus), congenital or acquired immunodeficiency (agammaglobulinemia, HIV-infection or AIDS) and the patient on immunosuppressive drugs (chemotherapeutics, prolonged corticosteroid therapy).<sup>8</sup> In cases of long-term corticosteroid therapy, antibiotics may be necessary when the patient is using more than 20 mg prednisone per day. Use of prophylactic antibiotics should also be considered in cases of prolonged surgery (> 3 h) or when a foreign body is inserted into the wound.<sup>7</sup> Because antibiotics only are useful when the bacterial defense is low, and its use may reduce the patient's normal flora and defense to viral and fungal infections,<sup>7</sup> a mapping of the individual situation in each immunocompromised patient should be done by consulting the medical doctor.

The tissue antibiotic levels should be high during surgery, and the antibiotics should be used for as short time as possible. A single dosage 30-60 minutes preoperatively is sufficient.<sup>7</sup> The first choice of antibiotics is penicillin (phenoxymethylpenicillin), which has a bactericidal effect on streptococcal species and oral anaerobic bacteria. A dosage at least twice of that of therapeutic antibiotics should be used. The causative organisms of wound infection are most often oral streptococcal bacteria, and besides being effective on these, penicillin is small-spectrum, which means low toxicity and low contribution to resistance development. Clindamycin or macrolides may be used in case of penicillin allergy.<sup>9</sup>

#### **4.1.2 Prevention of bleeding complications**

Before starting surgery, the dentist should assess the patient's ability to achieve hemostasis. In a patient with a risk for venous or arterial thrombosis, anticoagulants or platelet-inhibitors are commonly used as prevention. These medications are associated with an increased risk of postoperative hemorrhage, and additional measures must be taken to prevent this.

Local hemostatic materials together with good postoperative information are sufficient to stop bleeding for the patient who is using platelet inhibitors (ticlopidine, acetylsalicylic acid (ASA), clopidogrel). For the patient using anticoagulants (warfarin), the coagulation profile must be calculated, and this should preferably be done the same day or as close to surgery as possible. If the value of INR (International Normalized Ratio) is lower than 3, the surgery may be done with only local hemostatic measures<sup>10</sup>. When local procedures are done to

minimize bleeding, minor surgical procedures are considered safe within a range of 1.0 to 4.0.<sup>11</sup>

Examples of local hemostatic procedures are application of tranexamic acid solution (Cyclocapron®) or oxidated cellulosis (Surgicel®) to the bleeding field. The patient may be asked to rinse the mouth with tranexamic acid 2-3 days postoperatively if needed. Additional use of nonsteroidal anti-inflammatory drugs (NSAIDS) and ASA should be avoided.<sup>10</sup>

Atraumatic surgical technique is essential, and the use of local anesthetics with vasoconstrictor will contribute to hemostasis.<sup>11</sup> To be sure that a possible bleeding problem may be dealt with during the working weekdays, the procedures should be performed early in the week and at the beginning of the day. Postoperative information about the clot and how to keep it undisturbed should be given the patient.

If the INR-value is higher than 3, or if other factors contribute to higher bleeding risk, the patient's physician should be contacted for a possible reduction or stop of medication.<sup>10</sup>

### **4.1.3 Adrenal insufficiency**

Glucocorticoids are produced in the zona fasciculata of the adrenal cortex under the regulation of the hypothalamic-pituitary-adrenal (HPA) axis. The endogenous rate of cortisol production is about 10mg/day. Examples of its role are maintenance of vascular tone and metabolism.<sup>12</sup>

During the stress following minor surgery, the rate of cortisol production may increase to 50mg/day. Patients with a primary dysfunction of the HPA axis (e.g. patients with Addison's disease, congenital adrenal hyperplasia or secondary adrenal insufficiency due to hypopituitarism) will not be able to increase their endogenous cortisol production during stress. They will need supplemental glucocorticoid doses in addition to their daily physiologic replacement dose of glucocorticoids. Their total dose on the day of surgery should equal 50 mg of cortisol<sup>13</sup> This equals about 50 mg hydrocortisone, 12,5 mg prednisone or 10 mg prednisolone.<sup>14</sup>

Patients using high doses of glucocorticoids (e.g. due to rheumatoid arthritis, organ transplantation, etc) may have a decreased glucocorticoid response to stress due to adrenal



gland suppression and atrophy.<sup>15</sup> They will in most cases be able to meet the preoperative and postoperative demands for cortisol by a combination of endogenous production and maintenance of their usual daily dosage of glucocorticoids.<sup>13</sup> However, the lack of adverse effects of taking a supplemental dosage and the seriousness if the patient should get an adrenal crisis, makes it reasonable to recommend an adjustment of the dosage for the patient using glucocorticoid doses equivalent to 10 mg prednisolone or greater. A doubling of their normal dosage on the day of surgery will be sufficient,<sup>15</sup> and should be easy to remember in the daily dental practice.

#### **4.1.4 Factors affecting wound healing**

Microorganisms always contaminate the wound, but a wound infection is present when the wound bioburden is increased to be about  $10^5$  organisms per gram of tissue. If the wound is poorly oxygenated, collagen synthesis and epithelial and fibroblastic proliferation is delayed or depressed, and the risk of infection increases due to a poorer immune response, resulting in further delay of healing. Tissue hypoxia may be caused by rough handling, desiccation of the tissues during surgery, tightly knotted sutures and poor design of flaps, and such factors must be given proper attention.<sup>16</sup>

Systemic factors like atherosclerosis, diabetes mellitus, cardiovascular disease, pain, fear and smoking may also predispose to wound ischemia. Each cigarette smoke may be followed by a peripheral vasoconstriction that lasts up to 1 hour. To avoid the peripheral vasoconstriction due to cigarette smoking, the patient should be motivated to avoid smoking the week before and a week after a surgical procedure.<sup>16</sup> This may be difficult in praxis, but a reduction of smoking at least on the day of surgery should be attempted, and information about its effects should be given.

Continued tissue-trauma (e.g. from prostheses), the presence of hematoma, necrotic tissue and foreign bodies contribute to an increased risk of infection. Wound closure must be done according to principles and systemic antibiotics and local antiseptics used when necessary, to reduce the risk of postoperative infection.<sup>16</sup>

Finally, poor healing is expected in the elderly and malnourished patient and whenever the immune response is lowered or altered (e.g. due to chronic renal failure and uremia).<sup>16</sup>

#### **4.1.5 Cancer patients**

The patient with cancer has a debilitated immune response and may have significant risk of impaired healing due to adverse effect of the therapeutic measures.

A tissue that has been radiated with a dosage of more than 50 Gy has poor healing capacity, partly due to damage to small blood vessels. Submucosa becomes thickened and fibrotic with impaired fibroblast function and the epithelium becomes thin and fragile. Wounds heal slowly and are often infected.<sup>16</sup> Patients with a history of irradiation for head and neck cancer should be referred to specialist services.

Chemoterapeutics impair wound healing, but this is mainly in the period during and directly after the treatment.<sup>16</sup> Surgery that is not absolutely necessary should be avoided the first year after using antineoplastic agents, and if necessary earlier, prophylactic antibiotics should be provided, since the number of circulating immune cells may be lowered.<sup>9</sup>

Bisphosphonates are common medications in the treatment of metastasis and hypercalcemia related to breast cancer, lung cancer, prostate cancer and multiple myeloma.<sup>17</sup> If the patient has received intravenous (IV) bisphosphonates (zoledronate), surgery should be avoided in the tissues overlying the jaw bones, due to a permanent risk of bisphosphonate-related osteonecrosis of the jaws (BONJ) and failure of closure of the mucosal wound.<sup>16</sup> If surgery is absolutely necessary, a specialist should be consulted.

#### **4.1.6 Oral bisphosphonates**

Oral bisphosphonates (alendronate, residronate, inbandronate) are standard medications in the treatment of osteoporosis.<sup>17</sup> They are also used in diseases like Paget's disease and renal osteodystrophy and in other diseases where a reduction in osteoclastic activity is required for treatment. The role of oral bisphosphonates in relation to osteonecrosis is not as clear as for IV bisphosphonates.<sup>18</sup> More knowledge of the effects of bisphosphonates is available, and there

seems to be a direct effect on oral mucosa and other tissues, that may play a role in osteonecrosis initiation.<sup>18</sup>

After start of the medication, the dentist should be very restrictive in performing surgery. Preferably, all surgery should be done before or as short as possible after the start of medication, but because of a presumed gradually increase in risk of osteonecrosis as the medication accumulates in the alveolar bone, this complication will probably not appear during the first three years after start of medication. Concomitant use of steroids (e.g. prednisone) may further increase the risk of osteonecrosis.<sup>17</sup>

Recommendations for any necessary bone surgery or extractions in a patient using these medications include an attempt of wound closure by primary intention and advising the patient to rinse the mouth with chlorhexidine (0,1% or 0,2%) before surgery and twice a day the first two weeks after surgery.<sup>17,19</sup> Several authors recommend a drug holiday before and after surgery.<sup>19,20</sup> This should be done in collaboration with the prescribing physician. The duration of such drug holiday is controversial, but current evidence support a 3 months stop of medication before any invasive procedure (6 months in cases of comorbidities, and long duration of medicament use), and until healing has completed. In urgent cases, the use of bisphosphonates may be discontinued on the day of the surgery and until healing is complete.<sup>19</sup>

The literature according to the need for prophylactic antibiotics is not consistent, but even though there may be a lack of evidence for the effect of prophylactic antibiotics in prevention of osteonecrosis,<sup>7</sup> antibiotics reduce postoperative infection after surgery, and may reduce the local wound inflammation, and all measures to reduce the risk of osteonecrosis should be considered due to the seriousness of the condition.<sup>19</sup> 3 g amoxicillin may be given 1 hour before surgery, and penicillin V (500 mg x 4) may then be used up to the first 5 days after surgery, until mucosal coverage is accomplished. Clindamycin may be used preoperatively and doxycycline postoperatively, in patients allergic to penicillin.<sup>19</sup>

In this guide, these mentioned approaches are recommended for biopsies on alveolar crest or other soft-tissue surgery that involves bone exposure, until further evidence of the effects of oral bisphosphonates is available.

### **4.1.7 Psychological considerations**

Even minor oral surgery can be an emotionally loaded event for the patient, and surgical healing and postoperative recovery may be delayed if the patient is stressed. For example it is shown that highly anxious patients experience greater postsurgical pain. The patients do not always share their concerns with the practitioner, and this is important to remember in the clinical situation.<sup>21</sup> The patients' concern may be something that the practitioner doesn't expect, like worries about getting excessive fluid collection in the mouth or jaw fatigue during the session.<sup>22</sup>

Several interventions are suggested to improve the patients' psychological condition before surgery and, by that, improve their physical response during surgery. Examples of interventions are to give thorough information about what the surgery entails, to describe the upcoming surgical event and to inform about pain and oedema expected both after and during surgery. In addition the patient should be prepared for what he or she is expected to participate in postsurgically (e.g. oral hygiene measures).<sup>21</sup>

If the patient has depressive symptoms or seem to harbour anger, this may have an additional negative effect on the result. It may be wise to figure out what the patient thinks and feels and what he or she would like to get of information. It is important to speak a language the patient understands and to ensure trust and patient cooperation. By that, the surgical outcome will be optimized.<sup>21</sup>

## **4.2 General surgical procedures**

### **4.2.1 Analgesia**

In most minor soft-tissue surgery local analgesia may be assured by the use of infiltration anaesthetics. A variety of local anaesthetic agents may be applied, and their differences in properties can be advantageous in different clinical situations.

Bupivacaine with epinephrine (Marcain-Adrenalin®) is a long-acting local anaesthetic, and

may be administered both to achieve adequate anaesthesia and as a supplement to manage postoperative pain in adults. Because of children's tendency to traumatize their oral tissues after dental procedures, like chewing on their lips, they should rather be provided with an anaesthetic with shorter duration, such as Lidocaine (Xylocaine®). Lidocaine with epinephrine is considered the gold standard when evaluating efficacy and safety of newer anaesthetics. Articaine with vasoconstrictor (Septocaine Forte®) has comparable properties, but may have slightly better diffusion properties related to pulpal anaesthesia.<sup>23</sup>

An option without an adrenergic vasoconstrictor is Prilocain with Felypressin (Citanest dental Octapressin®). Felypressin is a non-catecholamine vasoconstrictor that will not stimulate the cardiovascular system and is safely used in risk patients.<sup>24</sup> However, the minor surgical procedures presented in this manual will not require excessive injection of local anaesthesia, and cardiovascular stimulation by the adrenergic vasoconstrictor should not be a considerable problem.

#### **4.2.2 Preoperative antisepsis**

Before, during and after oral surgery measures should be done to prevent local postoperative infections. Postoperative infections are most often caused by wound contamination by the intraoral bacterial flora, and a temporary reduction in intraoral bacterial counts before surgery may reduce the risk.<sup>25</sup> Routinely, patients are allowed to rinse for one minute with 0,2% chlorhexidine solution, but we were unable to find studies documenting clinically effect of this procedure. However, one study shows that the desired bacteria reduction may be achieved by mechanically washing the mouth of the patient 5 minutes preoperatively with a 1% chlorhexidine-gluconate or povidone-iodine solution.<sup>25</sup> During surgery, an aseptic surgical technique should be followed.<sup>8</sup>

### **4.2.3 Making incisions**

Incisions in oral surgery are often made by the use of scalpel, electrosurgery (diathermy) or laser. It is assumed that the general dentist at least is equipped with either scalpel or electrosurgery, and a description of lasers is not included.

The use of an electrosurgery device may provide consistent cutting, immediate haemostasis, a nearly painless wound after the procedure and minimal trauma to the tissues. Disadvantages are a burning-flesh odour and a loss of tactile sense. Besides, the production of heat makes monopolar electrosurgery inappropriate to use around implants. Electrosurgery should also be avoided in patients with pacemaker.<sup>26</sup> Wound healing may be delayed for the electrosurgical wound compared with the scalpel wound, but there should not be great difference when the electrosurgery is done according to principles.<sup>27</sup> Examples of indications are crown lengthening, gingivoplasty, operculectomy, biopsy (if wide margins from target tissue can be achieved) and tuberosity reduction.<sup>26</sup>

The scalpel is easy to use and has got low costs and the tissues heal fast and uneventful. It cuts precisely, but disadvantages include a lack of haemostasis during surgery.<sup>26</sup>

### **4.2.4 Wound closure**

Before closure the wound should be made clean of nonviable tissue and foreign bodies, irrigated with saline (diluting the bacterial counts and other contaminants) and uneven wound margins should be revised. All dead space should be eliminated, and undermining of wound margins (e.g. with blunt scissors) may be required to achieve a tension-free closure.<sup>16</sup>

Surgical sutures are used to keep the wound-edges approximated until the wound has healed enough to withstand normal functional stresses. Suturing will contribute to patient comfort, haemostasis and wound size reduction. When appropriate closure of a surgical flap is done, healing by primary intention will occur. The choice of suture technique, suture material and knot should not be random, but selected on a basis of needs.<sup>28</sup>

When there is no tissue to approximate and suturing is not applicable, e.g. after a biopsy in the

hard palate or attached gingiva, the wound is allowed to heal by secondary intention.<sup>29</sup> This is also valid for other areas when the wound is of limited size, as when a small diameter of tissue cylinder is obtained during the punch biopsy procedure.<sup>30</sup> This healing process may take longer time, and a dressing may be applied for patient comfort.<sup>16</sup>

#### **4.2.5 Suture material**

Non-absorbable materials must always be removed, as they will not disappear by themselves. Both synthetic and natural variants exist. Silk is a natural multifilamental thread that is shown to produce a more profound inflammatory reaction in both gingiva and oral mucosa compared to synthetic non-absorbable materials (e.g. polyamide),<sup>31</sup> and should not be the material of choice.

Absorbable suture materials will eventually be absorbed in the tissue. They will lose their tensile strength before they are completely absorbed, and the practitioner must be sure that they do not lose their tensile strength before the wound has regained its strength.<sup>31</sup> Non-absorbable sutures may be a better choice where the wound is under tension.<sup>16</sup> The natural absorbable sutures, such as catgut, will lead to a more profound inflammatory reaction than the synthetic ones (e.g. polymers of glycolic or lactic acids)<sup>32</sup>, and synthetic absorbable threads should be chosen. Situations where absorbable materials may be of advantage are during treatment of young children, phobic patients or others who may be spared for a second session. They are also recommended in high-risk situations, such as when treating patients infected by HIV.<sup>32</sup>

The suture threads are multifilaments, monofilaments or pseudofilaments. The multifilaments may be advantageous with regards to knot security, but studies show that multifilaments lead to more plaque retention and higher tissue response than monofilaments.<sup>31</sup>

The higher the value of thread size (e.g. 7/0), the smaller diameter of the thread. A smaller thread traumatizes the tissues less, but will not give the same support as a larger diameter, as may be needed when the wound is closed with tension or in areas of functional tension.<sup>28</sup> A suggestion is to use size 4/0 with 45 cm length as a standard, and consider smaller thread sizes in aesthetically demanding areas.

The suture needles used most commonly in dentistry are curved with a curvature expressed as a fraction of the arch of the circle. Greatest curvatures used are 3/8 and 1/2 circle, and both are appropriate for most types of oral surgery.<sup>32</sup> The shape of the needle is important to prevent tissue trauma and laceration during suturing. In oral surgery the preferred shape is a "reverse cutting" needle with the cutting edge located on its outer (convex) side, and with a non-sharpened inner curvature.<sup>28, 32</sup>

#### **4.2.6 Suture removal**

When the wound-edges are sufficiently stabilized, the sutures must be removed. Sutures may act like an entrance for microorganisms, and should not be left in place for longer than necessary. After a few days the suture canal (the tissues immediately around the thread) will be epithelialized and may give rise to an intense inflammatory reaction, followed by tissue necrosis.<sup>31</sup>

It is shown that incisional wounds in alveolar mucosa have gained a good barrier of flap-displacement already after 48 hours. Sutures may be removed after 3-5 days. In periodontal surgery it may take more time before physical attachment of fibres to the dentin, and the function of the suture is required for 7-10 days.<sup>31</sup> Also when there is tension in the flaps, for instance when closing a wound from an excisional biopsy, or when the wound is in an area with great tension, the suture may need to be retained for longer.

#### **4.2.7 Postoperative pain management**

After surgical insults, several peripheral pain stimuli are encountered at nociceptors in the tissue, and these stimuli are processed, transmitted and eventually relayed to the cerebral cortex and give rise to the perception of pain. Factors like anxiety, depression, fear and learned behaviour may exert influence on the perceived pain,<sup>33</sup> and some interventions to affect these are already mentioned.

Totally blocking the central perception of pain during the surgery session may prevent



postoperative pain and hasten recovery, and this is achieved by means of a pre-emptive approach. An example of a pre-emptive approach is administering NSAIDS preoperatively or immediately postoperative, before pain onset. Adjunctive analgesic measures like using a long-acting local anaesthetic solution may also be efficacious.<sup>33</sup> According to current evidence, a combination of paracetamol and NSAIDS may provide better analgesia than either of the drugs alone.<sup>34</sup>

#### **4.2.8 Oral hygiene**

To provide optimal oral hygiene during the days after surgery, when mechanical cleansing (tooth brushing, tongue brushing) can be difficult due to pain and may put the wound integrity at risk, local antisepsis with a mouth rinse (e.g. 0,2% chlorhexidine-gluconate) may be recommended as a supplement to the daily hygiene routines the first week after surgery.

### **4.3 Specific surgical procedures**

#### **4.3.1 Oral biopsy**

The general dental practitioner has a role in finding the definite diagnosis of oral soft-tissue lesions and to discover oral cancer at early stages. In this study some recommendations for the diagnosis of oral diseases by surgical removal of tissue is given.

##### **Definition**

A biopsy is the sampling of tissue from a living organism to examine it with the help of a microscope in order to establish a diagnosis.<sup>30</sup>

Incisional biopsy is a biopsy where only a representative part of the lesion is sampled. It is taken when the lesion is large (e.g. more than 1 cm in diameter) and where total excision of the lesion is difficult due to localization.<sup>29</sup> An incisional biopsy is also always chosen for a lesion considered malignant, even if the lesion is small. This is because an excision and the

following healing of surface mucosa may obscure the original lesion, and hinder definitive treatment planning by the specialist.<sup>35</sup>

Excisional biopsy is a biopsy where the whole lesion is excised for examination, and in most cases this is a combined definitive diagnostic and treatment approach.<sup>29</sup>

### **Indications**

A biopsy should be taken of every pathological condition where the clinical picture is not completely characteristic and convincing. A biopsy is a good way to find a true diagnosis, and may be taken to confirm or exclude a clinical diagnosis.<sup>36</sup>

Specific conditions may be: any lip or oral mucosal lesion (including ulcers) that persists following the removal of traumatic or inflammatory local irritation; mucosal surfaces that show obvious and persistent color changes (white, red or pigmented); mucosal surfaces that show changes in appearance (ulceration, cracking, proliferation) with deep-lying induration detected upon palpation; other premalignant mucosal lesions, such as lichen planus in persistent atrophic-erosive areas; suspected systemic conditions, e.g. lupus erythematosus or amyloidosis; as a complement in the diagnosis of infectious diseases like tuberculosis or syphilis; blister lesions of mucocutaneous disease (pemphigus vulgaris, mucous membrane pemphigoid); benign tumors;<sup>30</sup> all conditions that do not respond to adequate therapy in a limited given time.<sup>36</sup>

### **Contraindications**

If the clinical findings suggest hemangioma, the risk of bleeding is high, and a biopsy should not be done in general practice. If there is a suspicion of multiple neurofibroma, major salivary gland tumour or malignant melanoma it is recommended to refer the patient to be treated by specialists.<sup>30, 36</sup> Also when the lesion to be examined is in an area with difficult access, or if it is in deep regions and the surgical technique may result in iatrogenic damage to neighbouring tissues, the patient should be referred.<sup>30</sup>

Some of the mucosal features should be recognized as normal anatomic variants and therefore not be taken a biopsy of. Examples are linea alba, tori or exostosis, physiological pigmentation,<sup>30</sup> fordyces granules, ectopic lymph tissue and lingual tonsils. Another condition where a biopsy may be regarded unnecessary is lingua geographica.

If necrotic ulcers in the mucosa is detected, and the patient has been feeling unwell lately, an hematologic examination (Hb, SR, leukocyte counts, CRP and differential counts) should be considered done prior to biopsy to rule out leukemia or other malignant blood disease.<sup>36</sup>

Lesions in the palate should have a high suspiciousness, because intraoral tumours of the minor salivary glands most commonly occur on the palate. Benign pleomorphic adenoma is the most common neoplasm, but malignant lesion like mucoepidermoid carcinoma and adenoid cystic carcinoma may occur here.<sup>37</sup>

### **Timing**

Oral soft-tissue lesions are in many cases transient, and may resolve when treating or removing the suspected etiologic factor. In a recommendation regarding screening for Oral squamous cell carcinoma,<sup>38</sup> it is suggested that lesions looking innocuous should be followed up in a period of seven to fourteen days after removing any possible cause. This will contribute to reducing the numbers of false-positive results and the number of unnecessary biopsies. Examples of cause elimination are smoothing of sharp teeth and relining or relieving ill-fitting dentures.<sup>29</sup>

### **Technique for incisional biopsy**

During anaesthesia, distortion of the tissue of interest should be avoided.<sup>39</sup> The biopsy should be taken in a way that includes as much as possible of the disease process or the abnormal tissue, with minimal tissue artefacts. It may be necessary to select several sites for incision, in particular for larger lesions or lesions with variable features.<sup>40</sup> A part of healthy tissue should be included.<sup>30</sup>

With scalpel, an elliptic incision is made with length three times the width. The depth may generally be down to and include a few mm of the lamina propria<sup>39</sup>, but the most important principle is to include enough material to study of the area of interest.<sup>30</sup> When taking biopsy of swellings, a deep biopsy usually is more representative than a shallow one.<sup>40</sup> The incision should always be done in a parallel manner to the expected position of nerves and blood vessels.<sup>39</sup>

A suture thread may be useful to orient the specimen for the pathologist. Toothed forceps may be used to hold the tissue when making the incision, but without putting pressure on the part of the tissue that is considered important for the tissue examination.<sup>39</sup> Use of suture thread to stabilize tissue during incision should in general be avoided due to production of artefacts<sup>41</sup> but in difficult sites like the soft palate, placing of a suture thread may make tissue handling easier.<sup>40</sup>

### **Punch biopsy**

A punch-biopsy is an alternative to the scalpel, and it is a rapid, simple and safe method for the sampling of tissue. The punch has a circular cutting blade connected to a handle. The blade is available in different diameters (from 2-10 mm).<sup>39</sup> To take the biopsy, grasp the punch between the index and thumb to support the cylinder over the lesion for sampling.<sup>30</sup> The circular blade releases a core of tissue, and the base may easily be cut with curved scissors or lifted and cut with a scalpel. This type of biopsy is difficult to perform in certain sites, for example in the soft palate or the floor of the mouth, and it is generally not the choice of technique when the lesion is deep, but may be used to examine epithelial or superficial mesenchymal targets. Caution is required in highly innervated or vascularized areas and where important submucosal structures are located.<sup>30</sup> The larger punch diameter may be safer to use to avoid handling problems. The dentist should be certain that the laboratory is familiar with handling of these specimens.<sup>39</sup>

### **Different approaches to different lesions**

When sampling from an area with an ulcer, adjacent non-ulcerated mucosa should be included.<sup>39, 40</sup> This may reveal whether or not the lesion arises from the overlying epithelium or from deeper within the tissue or from other sites. If a tumour lesion contains a central area of necrosis, this area should be avoided, as its sampling will not yield diagnostic material.<sup>39</sup>

For mucocutaneous lesions (lichen planus, lichenoid reactions, etc.), an area that is non-erosive should be chosen for sampling (except when the biopsy is taken to investigate a suspicion of malignant transformation). Erosive areas often show non-specific inflammatory changes. Normal epithelium is not generally required for these lesions.<sup>39</sup>

If the lesion is of vesicobullous character, the specimen should be taken from the area with intact epithelium adjacent to the bulla or erosion. For oral bullous diseases the laboratory may

also need a fresh tissue specimen to allow direct immunofluorescence. In case of desquamative gingivitis, a biopsy from the region with the most intact mucosa should be taken, which often is at the attached gingiva.<sup>39</sup>

When sampling from precancerous lesions of leukoplakia, areas that are speckled or non-homogenous should be targeted. More than one biopsy should be taken if the lesion is extensive or contains several erythematous areas.<sup>39</sup>

For granulomatous diseases a deep incisional biopsy is often needed. A fresh specimen for microbiological testing may be required when there is a suspicion of infection (e.g. tuberculosis).<sup>39</sup>

### **Technique for excisional biopsy**

An electroscalpel may be used, but then the marginal incision should be in a good distance from the zone of tissue sampling, since the heat may give rise to tissue alterations. The lesion should be palpated for its depth, and the incisions should slightly exceed it.<sup>30</sup> An elliptical incision around the lesion is made. A lesion considered benign is sampled with a margin of 2-3 mm of the surrounding tissue, to ensure total removal. 5 mm is required if the lesion is pigmented, vascular or with diffuse borders.<sup>29</sup>

### **Management of the specimen**

The excised material needs to be fixed to inhibit autolysis of tissues.<sup>30</sup> Place each tissue sample in its own container, unless it is otherwise marked. Formaline (10%), a dilute solution of formaldehyde buffered to neutral pH, is the standard fixative, except for material that is to be submitted for immunofluorescence testing.<sup>39, 40</sup>

For lesions suspected to be of an oral bullous disease, a formaline-placed biopsy should be supplemented by a fresh specimen.<sup>39</sup> The piece of tissue is placed on physiological saline solution, and should keep a temperature of about 2-8°C during transport to the pathologic laboratory. The lab should be provided with the fresh sample as quickly as possible. Different kinds of antibody-antigen testing will be performed, and this may be useful to identify diseases like lupus erythematosus, pemphigus and pemphigoid.<sup>30</sup> A practical approach is to take a 4-5 mm punch biopsy and divide the specimen into two pieces, and then deliver one of

the pieces as a fresh sample and the other in the standard fixative for histopathological examination.

Information to the pathologist should include a tentative clinical diagnosis, and if the diagnosis returned by the pathologist is not consistent with the clinical look of the lesion, the dentist should contact the pathologist.<sup>40</sup> A schematic description of the location of the lesion is useful to attach,<sup>30</sup> and as a general rule the pathologist's work will benefit from all obtained information.

### **Patient information**

The patient may be informed that a biopsy is a routine procedure to establish a definitive diagnosis, and that the result may be important to choose the right treatment, or not to treat.<sup>40</sup> As in other surgery, site related tissue damages may occur, and some discomfort may be expected.<sup>39</sup> In a study on pain and swelling following oral mucosal biopsy, the maximum swelling after the biopsy was experienced between 6-48 hours, with maximum pain recorded after about two hours with pain decreasing considerably on the third postoperative day.<sup>42</sup>

### **4.3.2 Salivary mucocele**

An oral mucocele is a cavity of mucus that develops in association with the salivary glands. It may be a retention cyst or an extravasation phenomena, depending on etiological and histopathological features.<sup>43</sup>

When the duct is totally or partially obstructed, and there is accumulation of saliva behind the obstruction, a retention cyst develops. This collection of mucus is surrounded by duct epithelium, and is therefore by definition a true cyst. Most retention cysts develop in the major salivary glands,<sup>43</sup> and they are most commonly seen in adults. The reason for the obstruction may be a mucous plug.<sup>44</sup>

Extravasation phenomena is the most common reason for the development of mucoceles in the accessory salivary glands. A physical trauma to the duct or the acini may lead to a rupture, followed by leakage of saliva into the tissues surrounding the gland. This pool of mucous saliva will be surrounded by connective tissue, which per definition makes it a pseudocyst.<sup>43</sup>

A ranula is a mucocele in the floor of the mouth. These are most commonly pseudocysts originated in the deeper portion of the sublingual gland, but may be retention cyst from the ducts of Rivini (of the superficial portion of the sublingual gland). To a lesser degree they also may be retention cysts from the the Wharton's duct of the submandibular gland.<sup>43</sup>

### **Diagnosis**

The pseudocyst is clinically seen as a soft, painless swelling ranging from deep blue to mucosa-pink in colour. The size is rarely larger than 1,5 cm, with exception for the ranula, which may be significantly larger.<sup>43</sup> Mucoceles caused by extravasation phenomena will often show periods of appearance and disappearance.<sup>37, 44</sup> Mucoceles do not blanch when testing with a diascopy, something that differentiate them from vascular malformations.<sup>45</sup>

### **Indications for treatment**

Some mucoceles may resolve spontaneously,<sup>46</sup> and a persisting mucocele may not require treatment, unless the patient is bothered by the swelling. If there is any doubt of the clinical diagnosis, an excision should be performed. Mucoceles in the upper lip is uncommon, and swellings in this area should be carefully and completely excised and the excised material submitted for histopathological examination, in case it proves to be a minor salivary gland tumour.<sup>39, 45</sup>

Larger ranulas may be prone to give discomfort and interfere with speech, mastication and swallowing, due to its size and location.<sup>43</sup>

### **Management**

The size of the mucocele should be considered before removing a mucocele in the cheek, lip or palate. Unroofing is the choice of treatment of larger ones, while dissection is appropriate for the moderate-sized. Excision in the lower lip may be harmful to the labial branches of the mental nerve, but is used for the removal of smaller mucoceles.<sup>43</sup>

It has been shown that the best method of treatment for a ranula is removal of the related sublingual gland. This is because the simple method of marsupialization has high rates of recurrence (> 60 %). If the marsupialization method is accompanied by packing with gauze, the recurrence rate is lowered to about 10 %. Because of this being a simpler method with less

morbidity than a removal of the sublingual gland, this may be attempted at first<sup>47</sup>, and if the ranula recur or persists, the patient should be referred to a specialist for gland removal.

#### **Technique for excision of smaller mucoceles**

The mucocele is excised in an elliptical fashion, down to the muscular layer<sup>46</sup>, and all of the marginal glands and associated gland tissue are removed before primary closure.<sup>39, 43, 44</sup>

Recurrence is a common complication<sup>46</sup>, but if the procedures are done right, and if the surgeon ensures not to damage the neighbouring salivary glands during surgery, recurrence may be inhibited.<sup>43, 44</sup>

#### **Technique for removal of ranulas**

The ranula is unroofed and the wound margins are sutured to the floor of the mouth. The cavity floor is explored for the entire depth and the source of the extravasation, and then the cavity is packed with gauze to its depth. The gauze should be left in place for 7-10 days. The aim is to induce a foreign body response to the gauze, which will produce a fibrous tissue that seals off the leak from the associated acini, thus the acini eventually becomes atrophic.<sup>48</sup>

### **4.3.3 Denture-induced fibrous hyperplasia**

Dentures may be associated with different oral mucosal lesions. These lesions may be due to infections or they may be a response to mechanical trauma and poor denture retention.<sup>49</sup>

Denture-induced fibrous hyperplasia (epulis fissuratum) is a fibrous growth beneath and around ill-fitting dentures, as a response to chronic trauma by poorly fitting dentures.

#### **Diagnosis**

The lesion manifests as folds of elongated tissue growths in the mucovestibular sulcus where the dentures are fitted.<sup>50</sup> The condition is often asymptomatic and with the same colour as the oral mucosa, but may sometimes contain areas of irritation and erythema.<sup>44</sup> The lesion seems to be most frequent in patients wearing complete dentures.<sup>49</sup>

#### **Indications for removal**

The fibrous tissue may be reduced in size after relining of the prosthesis or removing the prosthesis for a long time. Surgical excision can be used to remove remaining reactive



tissue.<sup>44</sup> Removal and pathological examination is essential to make a firm diagnosis, even if the lesion has a benign appearance.<sup>50</sup>

### **Technique for removal**

Minimally enlarged hyperplasias may be removed electrosurgically. For larger hyperplasias: grasp the tissue with surgical forceps and make horizontal incisions at the base of the fibrous extension with a scalpel. The incision should be down to the periosteum. Undermine the tissue next to the hyperplasia, and set interrupted or continuous sutures.<sup>51</sup>

For even more extensive hyperplasias, the tissue should be released in the same way, but suturing to adapt the tissue margins will not be possible. Suture the margins closest to the vestibule to the periosteum, this minimal suturing will leave exposed periosteum. The wound is left to heal by secondary intention.<sup>51</sup>

After surgery, a soft tissue conditioner should be applied to refit the dentures. This will allow the vestibular mucosa to re-adapt to the new situation, without further loss of vestibular depth.<sup>50</sup> The denture should be used without interruption for the first 5-7 days, and only be removed for oral rinses with sterile saline. After 4 weeks, impressions for permanent dentures may be made.<sup>51</sup>

Recurrence is expected if the fibrous tissue is excised without relining or making new well-fitting dentures.<sup>50</sup>

### **4.3.4 The superior labial frenum**

The superior labial frenum is a triangular fold of tissue that originates in the lip and inserts into the attached gingiva at the maxillary midline. It is a remnant of embryonal structures (the tectolabial bands). An apical relocation usually takes place during normal growth of the alveolar process, but an abnormal frenum attachment may be seen between the central incisors when this migration fails. The residual fibres may attach to the periosteum and internal connective tissue of the (V-shaped) intermaxillary suture.<sup>52</sup>

## **Diagnosis**

An abnormal frenum will appear excessively wide and/or attached especially close to the gingival margin.<sup>52</sup> A lack of apparent zone of attached gingiva along the midline may be observed, and stretching of the upper lip and observing the movement and ischemia/blanching of interdental and/or palatal tissues may be helpful.<sup>52, 53</sup>

When a hypertrophic frenum is associated with an incomplete fusion of the intermaxillary suture, the contour of the alveolar process between the central incisors is W-shaped or irregular ovoid instead of the normal V-shape.<sup>53</sup> Such notching is associated with a higher tendency of relapse of an orthodontic corrected maxillary midline diastema.<sup>52</sup>

## **Indications for removal**

The main indications for removal are when the fraenum restricts lip movement, a frenal attachment that compromises prostheses on an edentulous ridge, or in correlation with closure of a midline diastema.<sup>54</sup>

A maxillary midline diastema is associated with an abnormal frenum, but further studies are required to define a clear cause-effect-relationship. There are several etiologic factors that may contribute to, or cause, a midline diastema, and these factors must be determined to treat the diastema cause-related. Examples of factors are imperfect fusion of the premaxilla, small teeth, congenitally missing lateral incisors, genetics and the presence of supernumerary teeth. It must also be remembered that the diastema in the mixed dentition is a normal characteristic of the development of the tooth arch, and an initial diastema of less than 2 mm in size will in general not remain after eruption of permanent lateral incisors or canines. In cases where a hypertrophic frenum contributes to a diastema, the fibers are deeply inserted into the tissues. They may be attached to the periosteum and connective tissue in a residual intermaxillary suture or interrupt the continuity of gingival fibers, in particular the interdental fibers.<sup>53</sup>

When a frenum attaches with a high insertion point into the gingival margin, this may have consequences for proper plaque removal, and tension on the frenum may tend to open the gingival sulcus. In these cases, and especially when a frenum attachment prevents mechanical tooth cleansing, a frenectomy should be considered.<sup>54</sup>

## **Timing**

The timing is dependent upon the indications for removal. In cases with a maxillary midline diastema there are different options for timing of the removal. The first alternative is initial diastema closure by orthodontic treatment, followed by removal of the frenum and retention appliances. Then the wound contraction will contribute to retention of the treatment result. Another option is to remove the frenum before the end of active orthodontic treatment. This is performed when the frenum may inhibit orthodontic closure. In both of these cases, the removal is usually done after the eruption of the permanent canines.<sup>53</sup> In some selected cases, where the major etiology of the diastema is a frenum with high attachment, it may be that an early removal (before eruption of the canines) may lead to a spontaneous closure of the diastema (without orthodontic intervention) and in that way may prevent orthodontic treatment at a later stage, which would be less time consuming, less expensive and require less patient compliance.<sup>55</sup>

## **Technique**

Several techniques are described in the literature. Frenectomy is the complete excision of the frenum and the term frenotomy indicates a partial removal (a relocation). The procedure of "Z-plasty" entails a modulating of the frenum so the pull on the interdental tissues are prevented.<sup>52</sup>

A simple frenectomy technique is done by making an incision across the attachment of the frenum with depth down to the periosteum, and continue the incision along both sides of the frenum up to its attachment on the labial mucosa, where the fibrous band may be placed on traction and excised from the lip together with the alveolar attachment and by releasing any fibrous adhesions to the underlying periosteum. The wound is closed with sutures over the mucogingival line, and the attached gingiva is left to heal by secondary intention.<sup>56</sup>

The Z-plasty involves excision of the frenum and making two oblique incisions down to periosteum. The resulting triangular flaps are raised and sutured with interrupted sutures in a reverse position, i.e. the most superior flap is placed inferior to the inferior flap.<sup>35</sup>

### **4.3.5 Ankyloglossia**

When the lingual frenum is short and thick, or if the tongue is fused to the floor of the mouth, the terms "ankyloglossia" or "tongue-tie" are used. There is no universally accepted definition of the condition.<sup>57</sup>

#### **Diagnosis**

Clinical observation and patient anamnesis should be sufficient to diagnose the condition. The frenum is often abnormally short and thick and with decreased mobility. A heart-shaped tongue may be seen during protrusion.<sup>57, 58</sup>

#### **Management**

The different methods for removal are frenotomy, frenectomy and frenuloplasty. There are not enough evidence in the literature to favour one surgical method over the other,<sup>57</sup> but a frenotomy is likely to be an effective treatment for ankyloglossia in neonates.<sup>58</sup> Infants' frenum is thin, small and membranous, and frenotomy is a quick and painless procedure where the frenum is divided without sutures.<sup>59</sup> A frenectomy technique will also be described in this guide, and may be performed where the frenum is more extensive (i.e. older children and adults).

#### **Indications**

There is a higher prevalence of nipple pain in mothers feeding infants with ankyloglossia than in mothers feeding infants without ankyloglossia. Breastfeeding mechanics are likely to improve and maternal pain is likely to decrease after release of a tongue-tie,<sup>58</sup> and surgical intervention should be considered.

Because there is lack of agreement on the impact of ankyloglossia on speech, an individual assessment must be made before any surgery is done. The patient may consider their speech articulation to be worse than what may be objectively recorded. Some difficulties in articulation are evident, e.g. rolling an "r" and pronouncing certain consonants and sounds. Other problems related to reduced tongue mobility may be discomfort, difficulties with licking the lips, keeping the teeth clean, kissing, etc.<sup>57</sup>

Because of intense pulling, ankyloglossia has been associated with gingival recessions. There is evidence that removal will not have any effect if an initial plaque control is not obtained, and often the elimination of gingival inflammation will lead to improvements of the recessions without any surgical intervention.<sup>57</sup>

It has also been hypothesized that a tongue that is in low position may predispose for maxillary hypodevelopment and mandibular prognathism, typical features of class III malocclusions, and that ankyloglossia indirectly can cause malocclusion. Today it is not per se an indication for surgical intervention.<sup>57</sup>

At last, a frenal attachment may interfere with denture stability, dislodging the denture when the tongue is moved.<sup>51</sup> Some authors has discussed the possibility that milder forms of ankyloglossia may resolve with growth<sup>57</sup>, but removing or manipulation of the lingual frenum by surgery should be considered when any of these mentioned problems are likely to be resolved or prevented by surgical interference.

### **Timing**

There is not enough evidence in the literature to draw general conclusions about the timing of surgery of ankyloglossia.<sup>57</sup> With regards to breastfeeding difficulties, the removal should be done after an assessment of alternative explanations for the poor feeding,<sup>58</sup> and after an attempt to improve the feeding by receiving professional advice and instruction.<sup>57</sup>

### **Surgical technique**

A frenotomy is not associated with much discomfort and may be performed without anaesthesia in children below 1 year of age. The tongue may be stabilized with holding the tongue with gauze during the procedure. Release the frenum with one or several cuts with straight scissors. The cut should be done into the uppermost free part of the frenum, and extended posterior close to the tongue until the tongue has increased its mobility sufficiently.<sup>59</sup> During the procedure, haemostats can be used to ensure haemostasis. For instance by clamping a straight haemostat parallel to the tongue at the ventral attachment of the frenum, and then making cuts into the frenum.

A frenectomy is performed by the cutting of the frenum from its alveolar ridge attachment and making parallel incisions that extend along the frenum. The band of tissue is removed, and

relaxing incisions are made at the junction of the floor of the mouth and the surface of the tongue. This latter incision makes the defect to form a "V" (with the apex towards the tip of the tongue). After undermining the wound-edges, the wound may be closed as an "Y" with sutures.<sup>56</sup>

The localization of the submandibular duct should be observed.<sup>59</sup> Recurrences and unsatisfying results are observed, but serious complications are rare.<sup>57</sup>

#### **4.3.6 Abscess drainage**

An acute apical abscess is a periapical infection resulting from an untreated, non-vital pulp,<sup>60</sup> and the recommended causal treatment is removal of the necrotic tissue. Removing the entrapped exudate by establishment of drainage will relieve the patient from swelling and pain. The drainage may be accomplished by extirpation of the necrotic pulp, extracting the infected tooth and surgical incision of the soft tissues that line the abscess area.<sup>61</sup>

#### **Diagnosis**

Most often both clinical and radiological signs are clear. The patient has had a rapid onset pain, which may be in the range of slight tenderness to intense, throbbing pain. Pain to percussion and biting is marked, and may be accompanied by a localized sense of fullness. The swelling is palpable and fluctuant. Radiological signs ranges from no changes to large periapical radiolucency and the involved tooth is non-vital.<sup>60, 61</sup>

#### **Indications for surgical incision and drainage**

Performing surgical incision alone will only give short-term relief, but should be done when entrapped tissue exudate cannot be drained sufficiently through the root canal (or the alveolus), or as an emergency treatment prior to starting root canal treatment when the patient has a fluctuant swelling.<sup>62</sup>

#### **Antibiotics**

When the patient is immunocompromised or shows signs of systemic involvement, the surgical drainage should be followed by adjunctive antibiotic treatment.<sup>60, 61</sup> Clinical signs of systemic involvement are fever, lymphadenopathy, malaise or rigors.<sup>61</sup> Antibiotics should also

be used in cases where the abscess has spread, like cases with gross facial swelling, dysphagia, tachycardia, closure of the eye, trismus<sup>63</sup> and when the abscess cannot be completely drained.<sup>60</sup>

Infections of the periapical tissues are comprised of strictly anaerobe gram-positive cocci and gram-negative rods mixed with facultative anaerobic flora.<sup>63</sup> A systematic review of the management of AAA in adult patients published in 2003, found no evidence to recommend one antibiotic over another.<sup>61</sup> However, a recently published critical review concludes that because there is a strong tendency towards resistance to penicillin among the anaerobic bacteria (more than 20 % of isolated microorganisms are in some studies shown to produce beta-lactamase), other antibiotics than penicillin V (phenoxymethylpenicillin) are to be the preferred. These antibiotics are amoxicillin (with co-amoxiclav), metronidazole and clindamycin.<sup>63</sup> Metronidazole alone is active only against anaerobic microorganisms, and though these are the predominant microorganisms in dento-alveolar abscesses, a combination with penicillin V is suggested as a first choice in this guide. A suggested dosage regime is Penicillin V 1000 mg x 4-6 in combination with metronidazole 400 mg x 3. In cases of penicillin allergy, clindamycin 300 mg x 4-5 may be taken to substitute penicillin and metronidazole.<sup>64</sup> A prescription of 6-10 days should be written, depending on infection control.<sup>9</sup>

Microbiological sampling is not necessary for routine treatment of odontogenic infections (due to known causative agents and their antibiotic sensitivity). Sampling should be considered when the patient is immunocompromised, the infection has a rapid onset or is spreading rapidly.<sup>9</sup> There is also a clear indication if the initial treatment has no significant clinical effect after 24-48 hours after its initiation. The type of antibiotics is then changed as soon as the sampling result is ready.<sup>64</sup>

### **Surgical technique**

Sampling for microbiological sensitivity testing should be done initially in the incision procedure, if needed. A 16-18G needle is used to aspirate pus from the abscess. Sterile paper points may be used to sample from the root canal. Optionally, sterile saline may be gauged into the root canal and then suctioned back into the syringe.<sup>64</sup> Anaesthesia is obtained and an incision is made into the fluctuant swelling and drainage established. A drain may be positioned into the wound of incision to maintain the drainage. The incision should be short,

preferably not more than 1 cm, and directed over the most prominent area. Artery forceps are used to open areas with trapped pus, without making the initial incision any larger. The pus should be evacuated from the mouth continuously.<sup>9</sup>

#### **4.3.7 Oro-antral communications**

During extractions of molars and premolars in the upper jaw, the tissues between the maxillary antrum and the tooth-socket may be perforated. The resulting opening is called an oral sinus communication or an oro-antral communication (OAC). This communication may result in the development of a permanent and epithelialized communication, a fistula, and eventually a chronic sinusitis.<sup>65, 66</sup> If a dentist encounter an acute OAC in general practice, he or she should know what to do to prevent such sequel. Surgical intervention is one option, and will be presented here.

##### **Diagnosis**

The intraoperative diagnosis is usually made with the Valsalva maneuver, probing with Bowman's probe, visual inspection and/or alveolar palpation.<sup>66</sup> Probing the socket is, according to some literature, absolutely contraindicated. This is because of the risk of perforating the sinus lining, which, despite the bone perforation, still may be intact. The probing may also introduce bacteria or other foreign material.<sup>67</sup>

##### **Management**

The choice of treatment of an OAC, should be done based on the size of the communication, the time of diagnosing, the presence of an infection and the amount and condition of the tissue available for repair. When there is a small OAC it should be sufficient to close the perforation by only suturing the gingiva. A buccal or palatal flap procedure is the treatment of choice when primary suturing of gingiva is not sufficient to provide adequate closure.<sup>65</sup> When the patient has got a low alveolar bone height it may be more difficult to obtain a stable coagulum, and this must also be taken into account when the proper management is chosen.<sup>68</sup>

The difficulty in clinically deciding the size of the OAC may make it troublesome to follow a guideline based on this, but the dentist should be able to make an estimate. These treatment options may be applied after an estimation of the OAC size:



- 2 mm diameter or less: No surgery indicated. Ensure haemostasis. The patient must prevent changes in the air pressure that may dislodge the blood clot (sinus precautions). Antibiotics should be prescribed.<sup>69</sup>
- 2-6 mm diameter: make a figure-of-eight suture over the tooth socket (if this is sufficient to obtain closure). Sinus precautions. Antibiotics should be prescribed and the patient should use a spray to relieve nasal congestion.
- 7 mm diameter or more: Using a flap procedure should be considered. The patient should be informed postoperatively about necessary sinus precautions, and the dentist should prescribe antibiotics and recommend the use of a nasal decongestant spray.<sup>67</sup>

Phenoxymethylpenicillin is the first choice of antibiotics. The duration of antibiotics and the use of a nasal decongestant should be 7-10 days. Sinus precautions should be maintained the first 10-12 days.<sup>68</sup> Tetracyclines may be used in cases of allergy to penicillin.

### **Timing of treatment**

To prevent the formation of a permanent fistula and chronic sinusitis, the closure should be done within 24 to 48 hours.<sup>65</sup> The sinus should be healthy at the time of closure. In addition to sinus precautions and use of antibiotics, the patient may come to the dental office for daily irrigation of the sinus with sterile saline through the alveolus, until the solution is clear and pus-free.

### **Surgical technique**

There are several flap methods. The Rehrmann's technique is a buccal flap procedure for closure of alveolar fistula. The procedure should be relatively simple to perform, and the broad base of the flap assures good blood supply.<sup>70</sup> A mucoperiosteal flap is raised to the depth of the labial vestibule, and parallel incisions in the periosteum at the base of the flap may be made to increase flap mobility. The buccal bone surface of the alveolus may be reduced in height to allow proper approximation of the flap. The flap should be sutured to the palatal mucosa.<sup>69</sup> Complications of the procedure may be a decrease of the buccal vestibular sulcus.<sup>65, 70</sup>

## **5. Results and discussion**

### **5.1 The literature review**

In this study, some surgical procedures for the general dental practitioner are described. Attempt has been made to select techniques and procedures supported by evidence, but there is in general a lack of high-quality studies to compare the different surgical methods. Several of the techniques and treatment strategies are based on clinical experience due to ethical limitations in making such studies. For some procedures there are divergent opinions of the choice of surgical technique. Regarding the superior labial frenum, a frenectomy procedure where the palatally attached fibres of the frenum are excised may be more likely to produce aberrations of the interdental tissues. Other procedures, like the Z-plasty technique, avoid this problem, but some fibres will remain interproximally. However, there seems to be no consensus regarding what technique is optimal. The techniques illustrated in this guide are chosen based on available evidence and arguments in the literature for the applicability.

The use of antibiotics is a difficult subject. There is a clear agreement that the use of antibiotics should be reduced, but also that they should be employed when necessary to benefit patient health. In cases of apical abscesses it has been suggested to prescribe antibiotics only for three days and then make a new assessment of the patient, to prevent unnecessary contribution to resistance. If the patient shows no more signs of systemic involvement, the medicaments are discontinued.<sup>63</sup> In this guide, traditional courses are recommended, until a national consensus has been obtained, but in this area changes may be expected. In an attempt not to contribute to an increase in resistance, this guide attempts focusing on using antibiotics only when necessary and, besides some special specific recommendations, the use of a small-spectred type of antibiotic is promoted.

### **5.2 The role of the general practitioner**

One opinion especially noticeable in British literature is that certain biopsies should always be undertaken in a hospital setting. This may be biopsies from tissue that is believed to be

cancerous, premalignant lesions or lesions of widespread mucosal disease.<sup>35, 39</sup> In evidence-based clinical recommendations made in July 2005, the statement is that a clinician who suspects potential malignancy of the oral mucosa may want to perform a biopsy immediately by him- or herself, or refer the patient to undertake an evaluation and possibly a biopsy by a medical or dental clinician with more experience.<sup>38</sup>

Dentists have different ambitions and different levels of competency. Due to the geographic imbalance and relatively low level of specialists in oral surgery in Norway, it is reasonable that the local general practitioner interfere more often than in countries with more widely spread specialist services. A decision on behalf of the general practitioner for what procedures to do or not to do, will not be taken here, but in our opinion the surgery may as well be done by the general practitioner if he or she is competent to provide an optimal surgical outcome for the patient and, regarding biopsies, make a good tissue sample for the pathologist and follow up the test results. This can be advantageous for the patient, who may be saved for travelling far to reach a specialist, and in some cases it may even contribute to reduce doctor's delay in the diagnosis of cancer. A clinical picture that strongly indicates cancer, should, however, be referred immediately.

The dentist should be alert to clinical situations in which the patient should get to a hospital as soon as possible. Odontogenic infections may be serious and life threatening, and patients with breathing difficulties, severe problems swallowing or with severely compromised immune defences should be managed by hospital care. Drainage, if accomplishable, should be done as soon as possible, and may be performed immediately at the dental office if the hospital is not near by.

### **5.3 The manual**

A preliminary guide for soft-tissue surgery is developed. Due to a limited period of time to produce this guide, it should be considered as a preliminary version. Not every surgical procedure was possible to clinically observe and document with photographs, and some of the techniques shown in the manual may differ to some extent from the techniques described in

the review. The manual is planned to be completed when the remaining procedures are encountered.

Some headings, elementary for soft tissue surgery, has not been included, for example suturing techniques and instrument selection. It may be that the interrupted suture is chosen in surgical situations where a mattress suture would be more appropriate, and a review to recapitulate different techniques would be a chapter for the future complete manual.

The written information in the developed manual is based on the background review, but some details are modified to make it more practical and useful in daily dental practice.

## 6. Acknowledgements

Geir Støre

Hans Thomas Brox

Paula Frid

Endre Romstad

Kirsti Årøen Lein

Eero Kerosuo

Elin Hadler-Olsen

Eva Edblad

University Dental Clinic, UiT

Mbachi Msomphora

Ken Jensen

Mari Lein

Hege Bjørkedal

## 7. References

1. NOU 2005:11. Det offentlige engasjement på tannhelsefeltet
2. Nagell TA. Lenge å vente på kirurgi. *Nor Tannlegeforen Tid* 2010; 120: 245-6.
3. Stortingsmelding nr. 35. Tilgjengelighet, kompetanse og sosial utjevning. Fremtidas tannhelsetjenester. Oslo: Helse- og omsorgsdepartementet; 2006–2007. p 52-3.
4. Norsk samkatalog for bøker: <http://www.nb.no/baser/sambok/> (lest 28.03.10)
5. Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *J Am Dent Assoc* 2008; 139: 3S-24S.
6. Retningslinjer for antibiotikaproylakse mot endokarditt, utarbeidet av Norsk cardiologisk selskap. *Nor Tannlegeforen Tid* 2008; 118: 313.
7. Blomgren J, Dahlèn G, Donhammar U, Heimdahl A, Struwe J, Wahlin YB, et al. Få indikationer för antibiotikaproylax. *Tandlakartidningen*. 2009; 101: 4.
8. Sancho-Puchades M, Herráez-Vilas JM, Berini-Aytés L, Gay-Escoda C. Antibiotic prophylaxis to prevent local infection in Oral Surgery: use or abuse? *Med Oral Patol Oral Cir Bucal*. 2009; 14: E28-33.
9. Peterson LJ. Principles of management and prevention of odontogenic infections. In: Peterson LJ, Ellis E, Hupp JR, Tucker MR, editors. *Contemporary Oral and Maxillofacial Surgery*. 4 ed: St.louis: Mosby; 2003. p.344-366.
10. Neppelberg E, Herlofson BB. Antikoagulantia og platehemmere i tannlegepraksis. *Nor Tannlegeforen Tid* 2008; 118: 656–9.
11. Jeske AH, Suchko GD. Lack of a scientific basis for routine discontinuation of oral anticoagulation therapy before dental treatment. *J Am Dent Assoc*. 2003; 134: 1492-7.
12. Jung C, Inder WJ. Management of adrenal insufficiency during the stress of medical illness and surgery. *Med J Aust*. 2008; 188: 409-13.
13. Marik PE, Varon J. Requirement of perioperative stress doses of corticosteroids: a systematic review of the literature. *Arch Surg*. 2008; 143: 1222-6.
14. Felleskatalogen: <http://www.felleskatalogen.no/> (lest 22.01.11)

15. Gibson N, Ferguson JW. Steroid cover for dental patients on long-term steroid medication: proposed clinical guidelines based upon a critical review of the literature. *Br Dent J*. 2004; 197: 681-5.
16. Shetty V, Schwartz HC. Wound healing and perioperative care. *Oral Maxillofac Surg Clin North Am*. 2006; 18: 107-113
17. Løkken P, Skjelbred P, Skoglund LA. Tannbehandling av pasienter som medisineres med bisfosfonater. *Nor Tannlegeforen Tid* 2007; 117: 588 – 94.
18. Assael LA. Oral bisphosphonates as a cause of bisphosphonate-related osteonecrosis of the jaws: clinical findings, assessment of risks, and preventive strategies. *J Oral Maxillofac Surg*. 2009; 67: 35-43.
19. Patel V, et al. Bisphosphonate osteonecrosis of the jaw-a literature review of UK policies versus international policies on bisphosphonates, risk factors and prevention. *Br J Oral Maxillofac Surg* (2010), [Epub ahead of print]
20. Marx R. Oral & intravenous bisphosphonate-induced osteonecrosis of the jaws: History, etiology, prevention and treatment. Chicago: Quintessence Publishing Co, Inc; 2007.
21. Bodner S. Psychologic considerations in the management of oral surgical patients. *Oral Maxillofac Surg Clin North Am*. 2006; 18: 59-72
22. Muglali M, Komerik N. Factors related to patients' anxiety before and after oral surgery. *J Oral Maxillofac Surg*. 2008; 66: 870-7.
23. Moore PA, Hersh EV. Local anesthetics: pharmacology and toxicity. *Dent Clin North Am*. 2010; 54: 587-99.
24. Caceres MT, Ludovice AC, Brito FS, Darrieux FC, Neves RS, Scanavacca MI, et al. Effect of local anesthetics with and without vasoconstrictor agent in patients with ventricular arrhythmias. *Arq Bras Cardiol*. 2008; 91: 128-33
25. Kosutic D, Uglesic V, Perkovic D, Persic Z, Solman L, Lupi-Ferandin S, et al. Preoperative antiseptics in clean/contaminated maxillofacial and oral surgery: prospective randomized study. *Int J Oral Maxillofac Surg*. 2009; 38: 160-5.
26. Christensen GJ. Soft-tissue cutting with laser versus electrosurgery. *J Am Dent Assoc*. 2008; 139: 981-4.
27. Bashetty K, Nadig G, Kapoor S. Electrosurgery in aesthetic and restorative dentistry: A literature review and case reports. *J Conserv Dent*. 2009; 12: 139-44.
28. Silverstein LH, Kurtzman GM, Shatz PC. Suturing for optimal soft-tissue management. *J Oral Implantol*. 2009; 35: 82-90.
29. Ellis E. Principles of differential diagnosis and biopsy. In: Peterson LJ, Ellis E, Hupp JR, Tucker MR, editors. *Contemporary Oral and Maxillofacial Surgery*. 4 ed: St.louis: Mosby; 2003. p. 458-478.

30. Mota-Ramirez A, Silvestre FJ, Simo JM. Oral biopsy in dental practice. *Med Oral Patol Oral Cir Bucal*. 2007; 12: E504-10.
31. Leknes KN. Suturmateriale ved oralkirurgiske inngrep. *Nor Tannlegeforen Tid* 2005; 115: 828-33
32. Siervo S. *Suturing techniques in oral surgery*. Quintessenza Edizioni S.r.l.; 2008.
33. Fletcher MC, Spera JF. Pre-emptive and postoperative analgesia for dentoalveolar surgery. *Oral Maxillofacial Surg Clin North Am*. 2002;14: 137-51.
34. Ong CKS, Seymour RA, Lirk P, Merry AF. Combining paracetamol (acetaminophen) with nonsteroidal antiinflammatory drugs: a qualitative systematic review of analgesic efficacy for acute postoperative pain. *Anesth Analg*. 2010; 110: 1170-9.
35. Pedlar J, Frame JW. *Oral and Maxillofacial Surgery An objective-based textbook*. 2nd ed: Churchill Livingstone Elsevier; 2007.
36. Koppang HS, Barkvoll P. Biopsi i odontologisk praksis. I: Holnstrup P, red. *Nordisk Odontologisk Arbog*. 2005. København: Munksgaard; 2005. p. 109-120.
37. Sexton J. Surgical pathology of the oral cavity. *Clin Dermatol*. 2000; 18: 601-11.
38. Rethman MP, Carpenter W, Cohen EE, Epstein J, Evans CA, Flaitz CM, et al. Evidence-based clinical recommendations regarding screening for oral squamous cell carcinomas. *J Am Dent Assoc*. 2010; 141: 509-20.
39. Oliver RJ, Sloan P, Pemberton MN. Oral biopsies: methods and applications. *Br Dent J*. 2004; 196: 329-33.
40. Melrose RJ, Handlers JP, Kerpel S, Summerlin DJ, Tomich CJ. The use of biopsy in dental practice. The position of the American Academy of Oral and Maxillofacial Pathology. *Gen Dent*. 2007; 55: 457-61.
41. Seoane J, Varela-Centelles P, Ramirez JR, Romero MA, De La Cruz A. Artefacts produced by suture traction during incisional biopsy of oral lesions. *Clin Otolaryngol Allied Sci*. 2002; 27: 549-53.
42. Camacho-Alonso F, Lopez-Jornet P. "Study of pain and swelling after oral mucosal biopsy". *Br J Oral Maxillofac Surg*. 2008; 46: 301-3.
43. Baurmash HD. Mucoceles and ranulas. *J Oral Maxillofac Surg*. 2003; 61: 369-78.
44. Esmeili T, Lozada-Nur F, Epstein J. Common benign oral soft tissue masses. *Dent Clin North Am*. 2005; 49: 223-40.
45. Mustapha IZ, Boucree SA, Jr. Mucocele of the upper lip: case report of an uncommon presentation and its differential diagnosis. *J Can Dent Assoc*. 2004; 70: 318-21.



46. Minguez-Martinez I, Bonet-Coloma C, Ata-Ali-Mahmud J, Carrillo-Garcia C, Penarrocha-Diago M. Clinical characteristics, treatment, and evolution of 89 mucoceles in children. *J Oral Maxillofac Surg.* 2010; 68: 2468-71.
47. McGurk M. Management of the ranula. *J Oral Maxillofac Surg.* 2007; 65: 115-6.
48. Baurmash HD. Marsupialization for treatment of oral ranula: a second look at the procedure. *J Oral Maxillofac Surg.* 1992; 50: 1274-9.
49. Jainkittivong A, Aneksuk V, Langlais RP. Oral mucosal lesions in denture wearers. *Gerodontology.* 2010; 27: 26-32.
50. Tamarit-Borras M, Delgado-Molina E, Berini-Aytes L, Gay-Escoda C. Removal of hyperplastic lesions of the oral cavity. A retrospective study of 128 cases. *Med Oral Patol Oral Cir Bucal.* 2005; 10: 151-62.
51. Ochs MW, Tucker MR. Preprosthetic surgery. In: Peterson LJ, Ellis E, Hupp JR, Tucker MR, editors. *Contemporary Oral and Maxillofacial Surgery.* 4 ed: St.louis: Mosby; 2003. p.248-303.
52. Edwards JG. The diastema, the frenum, the frenectomy: a clinical study. *Am J Orthod.* 1977; 71: 489-508.
53. Gkantidis N, Kolokitha OE, Topouzelis N. Management of maxillary midline diastema with emphasis on etiology. *J Clin Pediatr Dent.* 2008; 32: 265-72.
54. Wennstrom JL. Mucogingival therapy. *Ann Periodontol.* 1996; 1: 671-701.
55. Koora K, Muthu MS, Rathna PV. Spontaneous closure of midline diastema following frenectomy. *J Indian Soc Pedod Prev Dent.* 2007; 25: 23-6.
56. Kaban L, Troulis M. *Pediatric Oral and Maxillofacial Surgery.* Saunders; 2004.
57. Suter VG, Bornstein MM. Ankyloglossia: facts and myths in diagnosis and treatment. *J Periodontol.* 2009; 80: 1204-19.
58. Segal LM, Stephenson R, Dawes M, Feldman P. Prevalence, diagnosis, and treatment of ankyloglossia: methodologic review. *Can Fam Physician.* 2007; 53: 1027-33.
59. Oredsson J, Tornngren A. [Frenotomy in children with ankyloglossia and breast-feeding problems. A simple method seems to render good results]. *Lakartidningen.* 2010; 107: 676-8.
60. Clinical practice guideline on treatment of acute apical abscess (AAA) in adults. *Evid Based Dent.* 2004; 5: 8
61. Matthews DC, Sutherland S, Basrani B. Emergency management of acute apical abscesses in the permanent dentition: a systematic review of the literature. *J Can Dent Assoc.* 2003; 69: 660.

62. Quality guidelines for endodontic treatment: consensus report of the European Society of Endodontology. *Int Endod J.* 2006; 39: 921-30.
63. Ellison SJ. The role of phenoxymethylpenicillin, amoxicillin, metronidazole and clindamycin in the management of acute dentoalveolar abscesses--a review. *Br Dent J.* 2009; 206: 357-62.
64. Skaug N, Berge TI, Bårdsen A. Akutte infeksjoner. *Nor Tannlegeforen Tid* 2005; 115: 30-7.
65. Visscher SH, van-Minnen B, Bos RR. Closure of Oroantral Communications: A Review of the Literature. *J Oral Maxillofac Surg.* 2010; 68: 1384-91.
66. Del Rey-Santamaria M, Valmaseda-Castellon E, Berini Aytés L, Gay-Escoda C. Risk of oroantral communications. *Med Oral Patol Oral Cir Bucal.* 2006; 11: E334-8
67. Peterson LJ, Prevention and management of surgical complications. In: Peterson LJ, Ellis E, Hupp JR, Tucker MR, editors. *Contemporary Oral and Maxillofacial Surgery.* 4 ed: St.louis: Mosby; 2003. p.232-233.
68. Bågenholm T, Hellem S, Tornes K. Akutte skader og komplikasjoner ved behandlingsprosedyrer i munnhulen. *Nor Tannlegeforen Tid.* 2005; 115: 38-47.
69. Schow SR. Odontogenic diseases of the maxillary sinus. In: Peterson LJ, Ellis E, Hupp JR, Tucker MR, editors. *Contemporary Oral and Maxillofacial Surgery.* 4 ed: St.louis: Mosby; 2003. p.425-432
70. Awang MN. Closure of oroantral fistula. *Int J Oral Maxillofac Surg.* 1988; 17: 110-5.