Post-traumatic ankylosis of the temporomandibular joint in the dog – a case report

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Abstract

Temporomandibular ankylosis, even though considered to be of a relatively rare emergence, can be encountered in day-to-day clinical practice. Most cases follow a typical, if not identical anamnesis pattern. The background of mechanical difficulties manifestation is associated with some trauma. The animals usually suffer a severe blow to the head, leading to a gradual development of the defect, which unfortunately most owners are not aware of, or claim not to be. This case report describes a typical incidence of post traumatic ankylosis of the temporomandibular joint (TMJ). The patient suffered a blow to the head at the age of 4 months, the clinical aftermath of which was a gradual difficulty in opening the mouth. A CT examination revealed the extent of damage in the region of the zygomatic arch, affecting also the corresponding TMJ. For this particular case, a surgical intervention was the only course of treatment, meaning the resection of arcus zygomaticus and the TMJ. The procedure was scheduled to be performed 14 days post the CT examination. Due to the fact that the changes were located only on the lateral surface of the TMJ, the plan was to resect and remove the affected area only, with the medial part of the TMJ left intact and in position. The joint capsule was then sutured. This approach proved to be very beneficial and effective in the outcome of the surgery and in aiding in the overall comfort of the patient.

Temporomandibular resection, arcus zygomaticus trauma, orofacial surgery, dysphagy

The term true ankylosis describes a situation where the bony fusion is located within the temporomandibular joint (TMJ); pseudo-ankylosis is due to osteophyte formation resulting in a bony bridge between the coronoid process of the mandible and the zygomatic arch. Fault in the normal mobility range of the joint can come about more commonly as an outcome of trauma but the list of differentials could also include an adverse result of secondary inflammatory processes or even neoplastic changes in this region (Lantz 2005). Classification can be based on type or stage.

Based on stage, we can divide ankylosis into three levels (Chossegros et al. 1997), with level 1 having the ankylotic bone limited to the condylar process, level 2 having the ankylotic bone extending to the sigmoid notch, and level 3 having the ankylotic bone extending to the coronoid process.

Based on type, we can categorise the disease into four levels, gradually increasing in severity. Level 1 has a considerable amount of fibrous adhesions surrounding the joint. Level 2 is an increase in bony fusion on the outermost surface of the articular surface but without the involvement of the medial region of the joint. Level 3 is the presence of a bone connection between the mandible and the temporal bone. The last and most severe level 4 is the total alteration of the joint by the replacement with a solid, bony mass (Sporniak-Tutak 2011).

As previously mentioned, the most common causes of true ankylosis of the TMJ or pseudo-ankylosis include bone trauma in the vicinity of the area (Yew et al. 2015). Due to

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the extended time period over which the fault develops and manifests into a clinical image which an "inexperienced" owner can recognise, we receive the patients when they already suffer from type 4 ankylosis of TMJ.

Following injury, the degree and range of joint mobility are gradually reduced in result of a bone insult, bone bruising and/or a change in the composition of the capsule surrounding the joint to fibrous tissue. As previously mentioned, the most common cause of TMJ ankylosis includes bone trauma (Yew et al. 2015) in the vicinity of the area, osteoproliferative changes, or even neoplasia arising from otitis media (Çetinkaya 2012). Less frequently encountered causes could include an iatrogenic fault by surgical intervention in the region.

The affected individual cannot open the mouth in its physiological range, a course of action which logically does not come about overnight, leading to the extended length of the anamnesis. Evident swelling is also noted in the TMJ area, and when the patient allows us to go over the threshold of pain paired with manipulating the area, crepitation can also possibly be detected. Due to long-lasting issues arising from the inability to maintain normal diet, weight loss and atrophy of the masticatory muscles are observed.

Definitive diagnosis is achieved only by means of diagnostic imaging, with computed tomography (CT) leading the way, which allows us to visualise the affected tissue and precisely locate the point of fusion (CT three dimensional construction) (Gemmill 2008).

The only therapy option is the surgical disruption of the fusion of the joint, by thoroughly resecting the unnatural part of excess bone formation (Gemmill 2008).

From the beginning, great obstacles are encountered, such as ensuring successful tracheal intubation of patients, hindered by the inability to visualise the oral cavity. Endoscopic methods are a popular assistance tool in these cases. Methods used in human medicine/anaesthesiology when faced with similar problems, e.g. nasotracheal intubation, fibre-optic intubation, laryngeal masks etc., are yet to be explored in veterinary medicine.

Between November 1st, 2016 and August 1st, 2017, six patients with the discussed diagnosis were treated in our practice alone. Four of them were canine and two feline; in all cases, the leading factor was trauma to the head. One of the dogs was chosen for this particular case report.

Case presentation

Case history

At the age of 4 months, the mixed breed female dog suffered a head injury. Ability to open mouth was gradually decreasing, there was evident pain in everyday activities, masseter muscle atrophy. The dog was sustained by liquid diet only.

CT examination

CT examination of the head was performed, both with and without the use of the contrast medium iobitridol (Xenetix® 350, 700 mg/kg, Guerbet, Roissy CDG Paris, France). Slight asymmetry in the mandibular region connected to the maxilla. Lateral dislocation was noted on the right side, as well as an osteoproliferative lesion of the processus temporalis ossis zygomatici dexter and the lateral part of the right mandible in the angulus mandibulae region. The observed osteoproliferative lesions were connected to soft tissue. Processus retroarticularis dexter was not in a clear visual field, poorly bordered and identified. Surrounding soft tissue was without detectable abnormalities (Plate X, Figs 1–4).

Surgical procedure

Surgery followed 14 days after the CT examination. Following the anaesthetic protocol, anaesthesia was performed first by premedication with medetomidine (Domitor 1 mg/ml, Orion Pharma, Espoo, Finland) 0.01 $mg \cdot kg^{-1}$ and butorphanol (Butomidor 10 mg/ml,

Richter Pharma, Wels, Newry, Austria) 0.2 $mg \cdot kg^{-1}$ i.v., induced by propofol (Norofol, Norbrook Lab., Monaghan, Ireland) 2 $mg \cdot kg^{-1}$ i.v. and maintained by isoflurane (Isofluran, Torrex Chiesi, London, United Kingdom) in an oxygen-air system. Postoperative analgesia was ensured by fentanyl (Fentanyl Torrex 50 mcg/ml, Torrex Chiesi, Czech Republic) 0.002–0.005 $mg \cdot kg^{-1} \cdot h^{-1}$ i.v. and carprofen (Rimadyl 50 mg/ml, Pfizer, Louvain-la-Neuve, Belgium) 2 $mg \cdot kg^{-1}$ i.v. for 24 h followed by metamizol (Analgin 500 mg/ml, Biotika, Prague, Czech Republic) 20 $mg \cdot kg^{-1}$ orally three dimes daily.

Pre-anaesthetic medication protocol H1/1 was followed with amoxycillin clavulanate (Synulox, 17.5 mg/kg, Haupt Pharma Latina S.r.l., Borgo San Michele, Italy) at a total dose of 2 ml i.m.

The animal was placed in lateral recumbency. Primary incision was performed on the ventral border of arcus zygomaticus. The scar tissue, periosteum, and bone tissue were cleaned out first. Upon visualisation, the arcus zygomaticus was resected in its whole extent including the adhered part of the processus coronoideus mandibulae. The extent of the required resection reached to the lateral side of the TMJ, with the medial part left intact. The incised area was flushed using sterile Ringer's solution (Baxter, Melsungen, Germany). The joint capsule was closed using two cross sutures with the absorbable monofilament material polydioxanone (PDS 3-0, Ethicon, New Jersey, USA). The same material was used in suturing the subcutis in two layers. The suture pattern used was simple continuous, not only when ensuring a periosteum encapsulation but also in suturing the following two layers of the subcutis.

The suture pattern for the skin was simple interrupted, the suture material used was the nonabsorbable monofilament material nylon (Ethilon 3-0, Ethicon, New Jersey, USA). Immediately after the end of the procedure, the range of motion of opening the mouth was at 50% of the normal, whereas prior to the operation, it was impossible to place an endotracheal tube. The patient was transferred to the intensive care unit where she was allowed to rest and recover, and where appropriate pharmaceutical care could be provided until she was deemed capable to be released into home care.

Post-operative medication protocol

Infusion therapy included Plasmalyte (Baxter, Lessimes, Belgium), famotidin (Quamatel, 1 mg/kg, Geden Richter Plc., Budapest, Hungary) 5 ml i.v., and Solumedrol 420 mg i.v. (Pfizer, Inc. Puurs, Belgium) (Plate XI, Figs 5–6, Plate XII, Figs 7–8, Plate XIII, Figs 9-10, Plate XIV, Figs 11-12, Plate XV, Figs 13-14).

One day after the surgery, the infusion was discontinued and we continued with drug therapy using amoxycillin clavulanate (Synulox, Haupt Pharma Latina S.r.l., Italy) 500 mg 1 tbl × 2 daily, famotidin (Quamatel, Geden Richter Plc., Budapest, Hungary) 5 ml i.v. total, and metamizol (Vetalgin, 50 mg/kg, Kellinworth, NJ, USA) 2 ml i.v. In less than 24 h post-operatively, the clinical, mental and physical status of the animal indicated that she was able to be released into home care.

Discussion

Generally speaking, ankylosis of the TMJ is relatively rare. More often, we come across luxations of the joint, mandibular fractures and/or fractures of adjacent structures. All of the previously mentioned conditions may have the same or similar clinical appearance, i.e. indication of pain upon movement and manipulation of jaw and mouth, inappetence or rather avoiding admittance of food into the oral cavity and inability of opening or rather closing the mouth (Lantz and Cantwell 1986). The most common cause is pseudo-ankylosis due to osteophyte formation resulting in a bony bridge between the coronoid process of the mandible and the zygomatic arch. Masticatory muscles then surround the affected tissue and prohibit the movement of the joint (Gilmour et al. 1992). Additional

emerging causes which could be added to the list are myopathies of masticatory muscles (Evans et al. 2004). Atrophy of this group of muscles leads to a restriction of the animal's ability to open the mouth (Maas and Theyse 2007). This process usually takes quite a long time to evolve and is without indication of pain. Upon radiological examination the TMJ appears intact. Osteomyelitis, also on our list of differentials, could originally arise and further spread from the bulla tympanica. Opening the mouth is therefore accompanied by severe pain, and pathological changes can be viewed and confirmed on a radiograph (Houlton et al. 2006). Craniomandibular osteopathy is typical in small animals, namely in dog breeds such West Highland White Terrier (Padgett et al. 1986). Proliferative changes of bone tissue that go hand in hand with this disease result in ankylosis. Last but not least on our list of differentials are neoplastic changes. Unfortunately, the most common type of neoplastic change is chondrosarcoma arising from the ramus mandibulae. Surgical therapy is indicated as the solution for treating all the possible previously mentioned causes of this disease. In very few cases, ankylotic processes can be attempted to be brought to a halt with the use of corticosteroids (Motta et al. 2007).

When it comes to proper diagnostic imaging techniques, particularly regarding the correct and preferred radiological examination projections of the affected area, many options are available. A radiological examination is of small relative value to the whole process, the use of CT is definitely superior (Verstraete and Lommer 2012). A crucial step not to be missed is the exclusion of neurological reasons for the animal's inability to open the mouth.

Animals undergoing surgery showed no signs of extreme pain afterwards, sometimes no pain at all. In our first case of this year, the patient happily ate food and barked without hindrance. The overall mobility of the jaw improved as time passed, and within 3 months from the operation day, it was as if the deficit had never existed.

Possible complications arising from this procedure could include reappearance of the ankylosis due to inadequate resection of the affected tissue, improper healing of tissue post-operatively, or resection of a part of bone not involved in the problem.

As part of home therapy, the owner is to ensure that the dog uses the mouth for chewing and to follow an exercise protocol involving the opening and closing of the mouth manually (Okumura et al. 1999). Aftercare should include plenty of chewing activity, by feeding large-size kibble and providing chew-toys to prevent re-ankylosis. This seemingly simple task helps minimise the risk of inappropriate growth of the resected tissue. The prognosis is guarded to poor, as the cut bony surfaces are inclined to re-ankylose (Verstraete and Tsugawa 2015). Another possible complication is perioperative damage of nerves. The primary incision is right at the ventral border of arcus zygomaticus. Ventrally in close proximity nervus palpebralis passes. Ventrally to the masseter, nervus buccalis dorsalis is located (Evans and De Lahunta 2013). Amongst other complications, exophthalmos appears high on the list, due to high inflammatory reactions surrounding and including the occular region. Prognosis for these patients ranges between good to dubious. The outcome is very much affected by the original cause and current condition of the presented patient.

Conclusion

At present, the discussed patient is without any clinical deficits. The surgical treatment was successful and without any further complications. The described method of TMJ resection had not been explored before. Usability of this method in patients and the clinical results in comparison to the other methods will be further monitored.

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Fig. 1. Dorsally reformed CT image in the bone window (WW 3000, WL 500) at the level of zygomatic arches. Hypertrophy of the bones forming the right zygomatic arch is clearly seen. Please note the normal appearance of the left zygomatic arch. Patient's left side is on the right side of the image.

Fig. 2. Transversal CT image in the bone window (WW 3000, WL 500) showing an expansive hypertrophic bone reaction at the level of the right mandibular angle propagating towards the ipsilateral zygomatic arch. There is also thickening of the right zygomatic arch. The symmetry of the mandible is unaffected. Patient's left side is on the right side of the image.

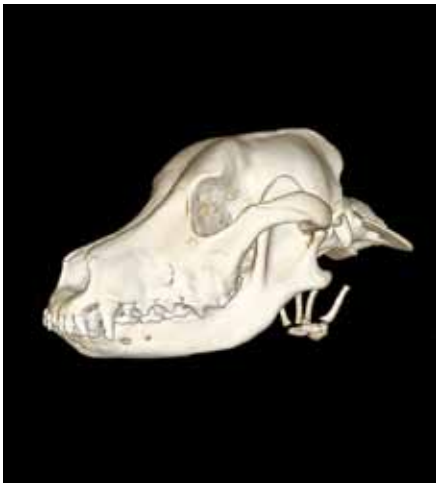

Fig 3. Volume rendered CT image of the skull with a rostro-lateral oblique view of the normal left temporomandibular joint.

Fig. 4. Volume rendered CT image of the skull with a rostro-lateral oblique view of the right temporomandibular joint. Note the hypertrophic irregular bones forming this joint.

Fig. 5. Patient in lateral recumbency with the surgical field ready.

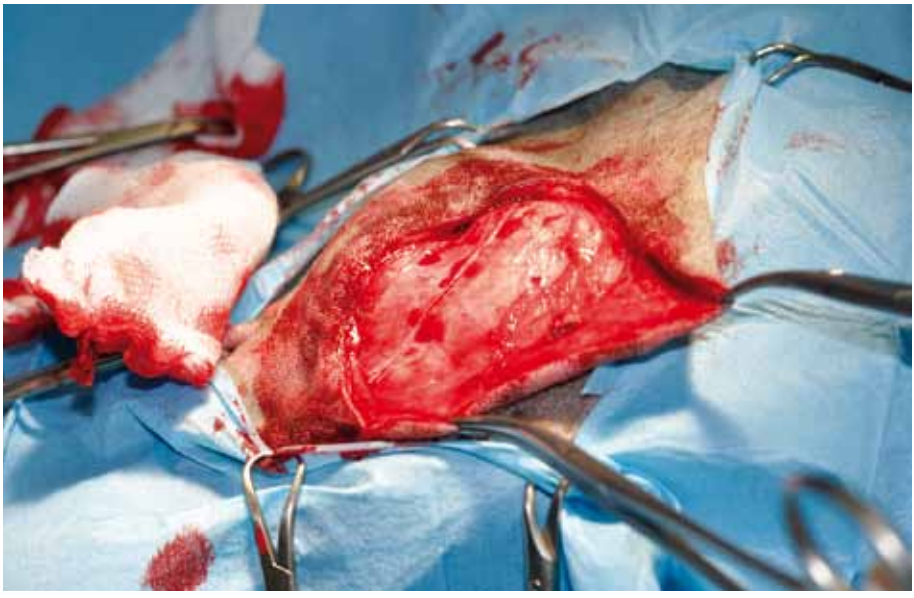

Fig. 6. First incision caudally from a. zygomaticus. The innervation of the affected a. zygomaticus and the longitudinal incision of periosteum can be seen.

Fig. 7. Periosteal preparation. Bone structure of a. zygomaticus has an irregular appearance and configuration.

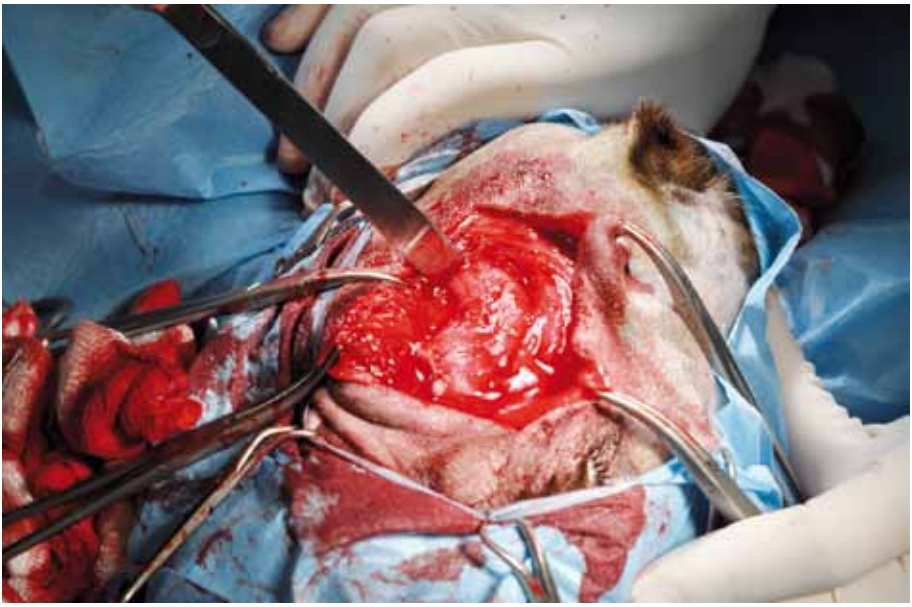

Fig. 8. Resection of a. zygomaticus using man power.

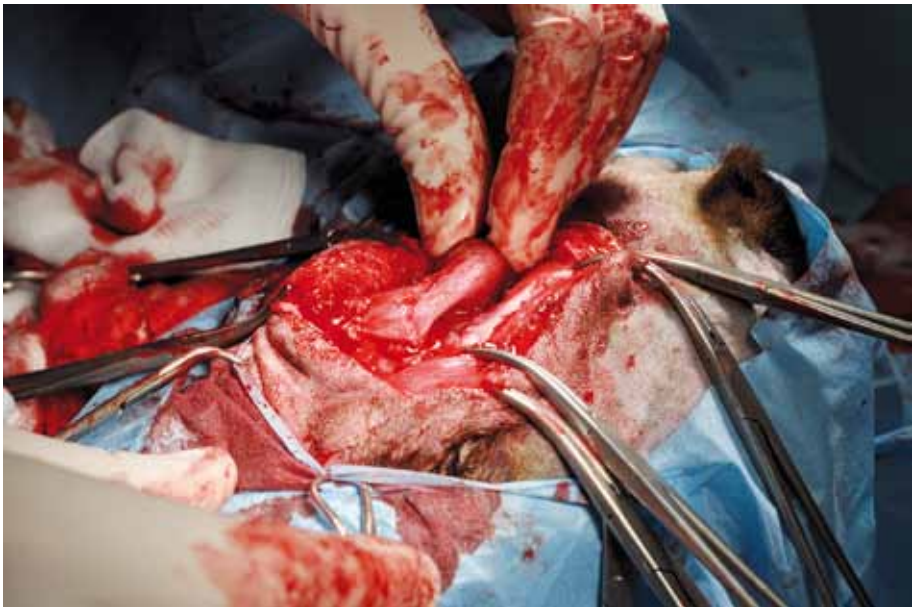

Fig. 9. Resected a. zygomaticus in the correct anatomical position with a visible resection line.

Fig. 10. Resected a. zygomaticus, osteophytes restricting movement of the mandible are observable.

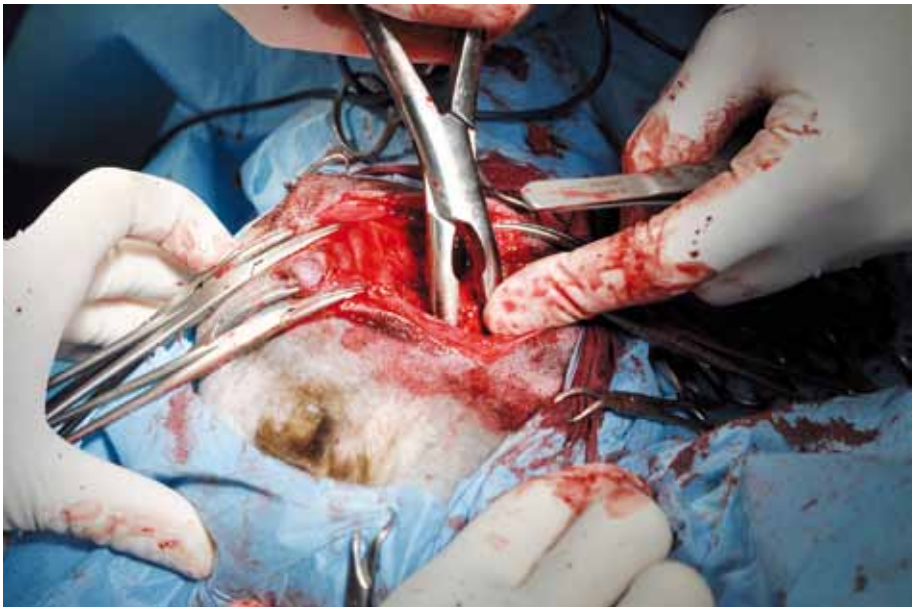

Fig 11. Resection of the base of a. zygomaticus – proc. zygomaticus osis temporalis and the lateral part of the temporomandibular joint condyle.

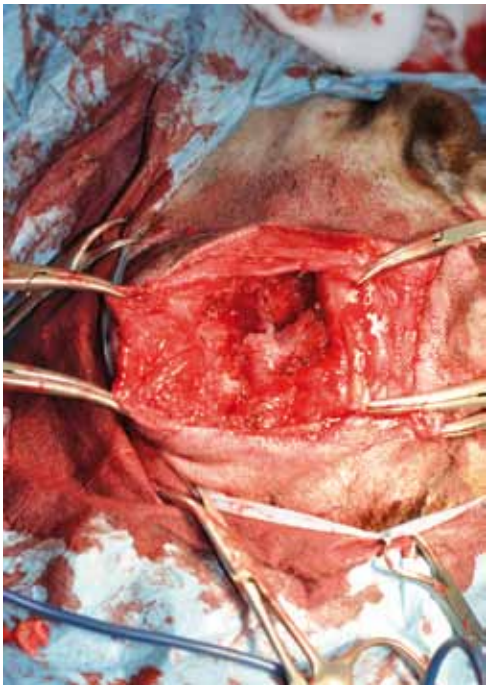

Fig. 12. Final status. Slightly open joint capsule after partial temporomandibular joint condyle resection.

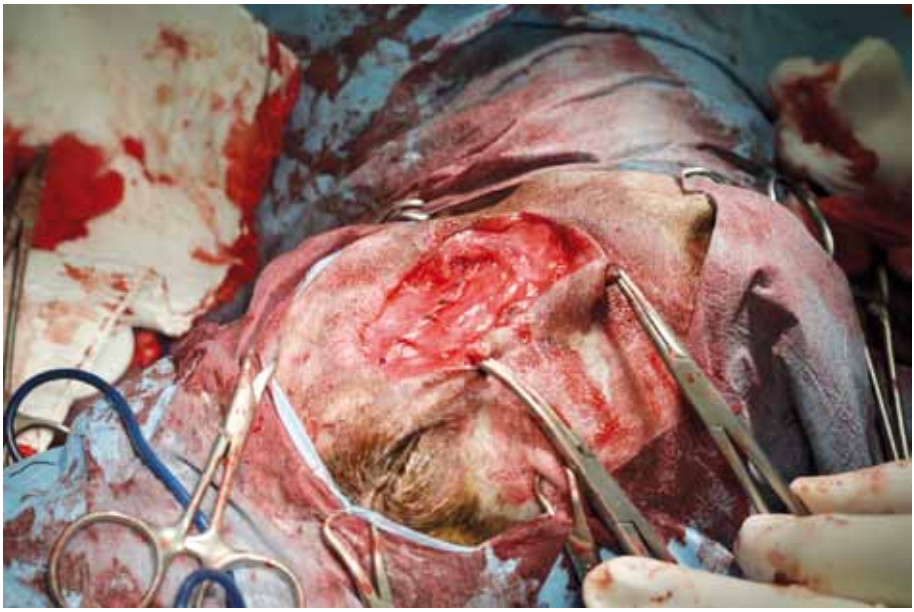

Fig. 13. Closing of the operation wound, suturing of the periosteum over the resected a. zygomaticus.

Fig. 14. Completely sutured operation wound.