# Trigeminal Nerve Injury
# Diagnosis and Management

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# Outline

1. Overview

2. Incidence

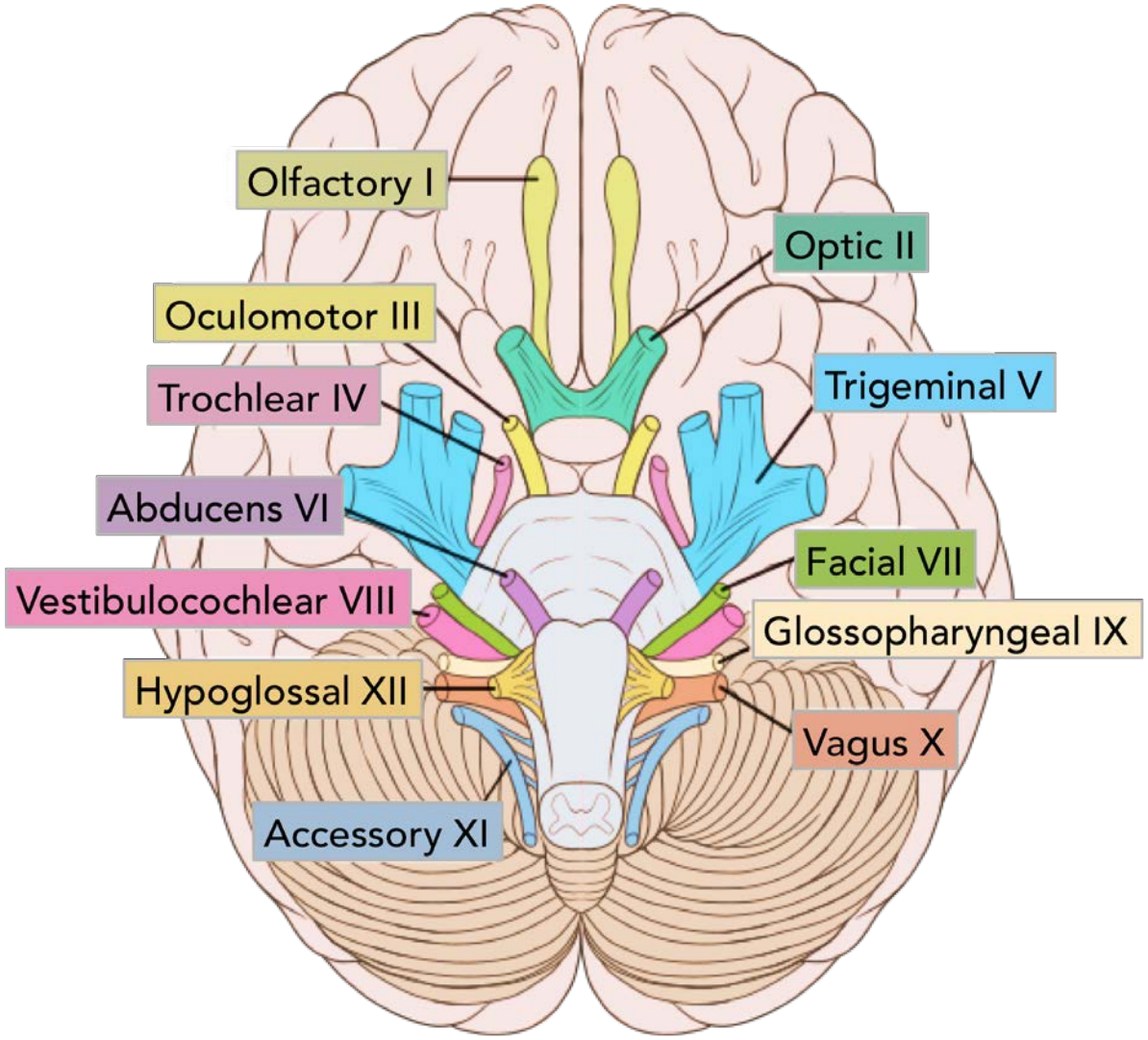
3. Classification

4. Management
   - Current concepts for improving outcomes
   - Anatomy of nerves
   - Case studies by nerve type and injury type

5. Clinical Cases

# Overview

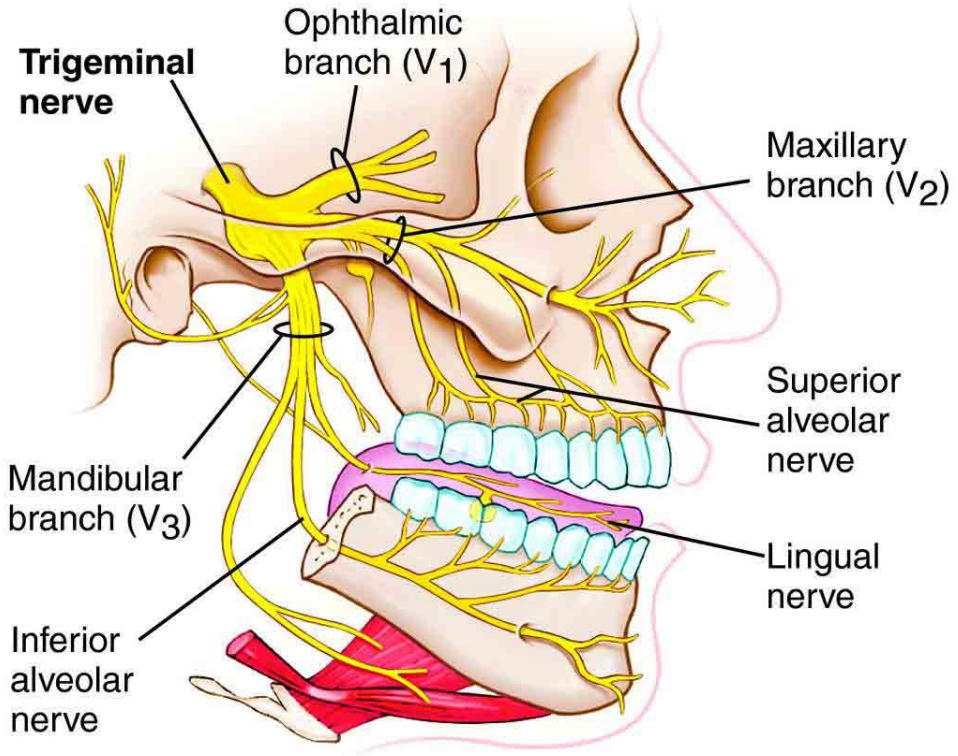
- All cranial nerves can be injured
- Cranial nerves with potential Risk:
  - II, V, VII, X, XI, XII
- Focus on V



# Trigeminal Nerve Injury

Nerves that can be injured:

- V1
  - Supraorbital
- V2
  - Infraorbital
  - Greater palatine
  - Incisal
- V3
  - Inferior alveolar
    - Mental
    - Incisive
  - Lingual



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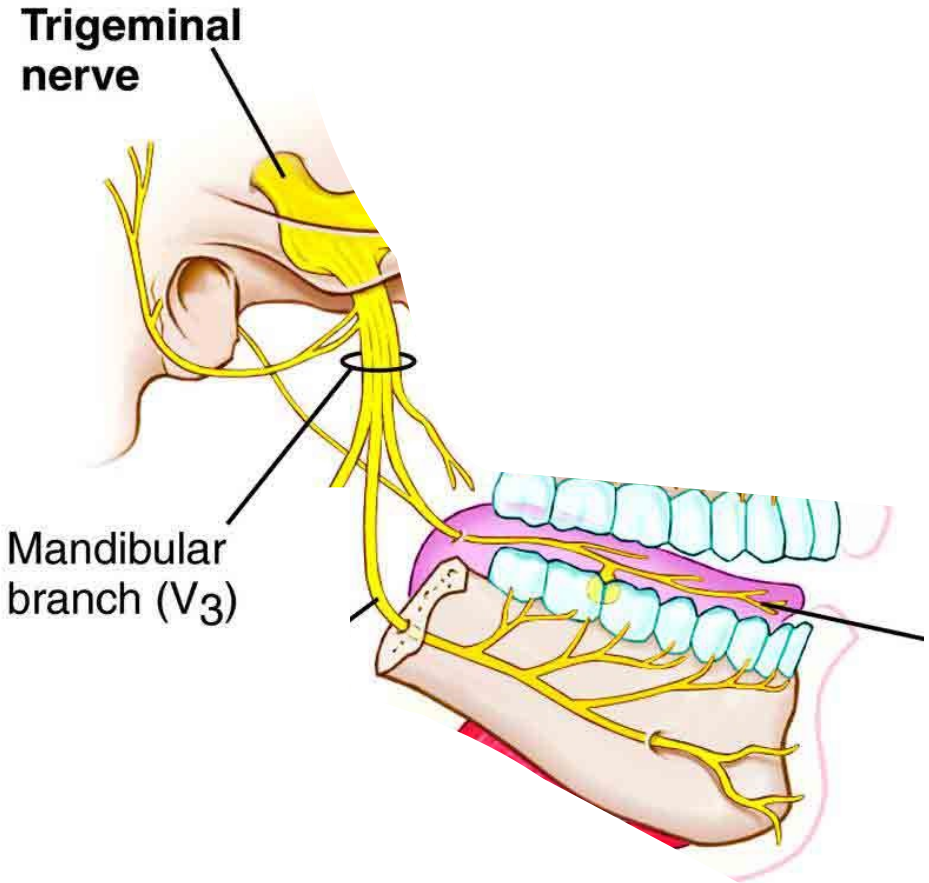

# Trigeminal Nerve Injury

- Iatrogenic or planned resection during ablative surgery
- Potential to impact nearly every social interaction we take for granted
- May cause altered sensation, pain and may interfere with speaking, eating, drinking, tooth brushing, shaving, and smiling

# Outline

1. Overview

2. Incidence & Etiology

3. Classification

4. Management
   - Current concepts for improving outcomes
   - Anatomy of nerves

1. Clinical Cases

# Incidence and Etiology

| ETIOLOGY OF TRIGEMINAL NERVE INJURIES | | |
|---|---|---|
| **Procedure** | **Nerves Affected** | **MOI** |
| Local Anesthetic Injury | Inferior Alveolar Nerve (IAN), LN | Direct needle trauma, toxic effect of anesthetic, bleeding, hematoma |
| M3 Removal | IAN, LN, Long Buccal Nerve (LBN) | Incision, flap retraction, rotating bur, osteotome, compression, suturing, socket medication |
| Orthognathic Surgery | Infraorbital Nerve (IFN), IAN, LN | Drill, osteotome, saw, internal fixation, nerve retraction, nerve compression |
| Ablative Surgery (pathology) | IAN, LN, MN | Unintentional nerve injury, intentional nerve resection |
| Trauma | Supraorbital Nerve(SON), IFN, IAN, Mental Nerve (MN) | Compression, severance, avulsion, internal fixation |
| Preprosthetic Surgery | IAN, LN, MN | Chemical burn, compression, suture, compartment syndrome, rotating bur |
| Endodontic Treatments | IAN, MN | Overinstrumentation, compression, chemical burn |

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# NERVE INJURY CLASSIFICATION

- Provides a means of obtaining a prognosis based on the type of injury, etiological cause and length of time since the injury

- One must also take into consideration subjective data in addressing needs of the patient

# NERVE INJURYCLASSIFICATION

- Seddon (1943)—Separates injuries into three categories:
  - Neuropraxia
  - Axonotmesis
  - Neurotmesis

- Sunderland (1973) expanded upon this idea, subdividing Axonotmesis into three additional grades.

# Classification of Nerve Injury

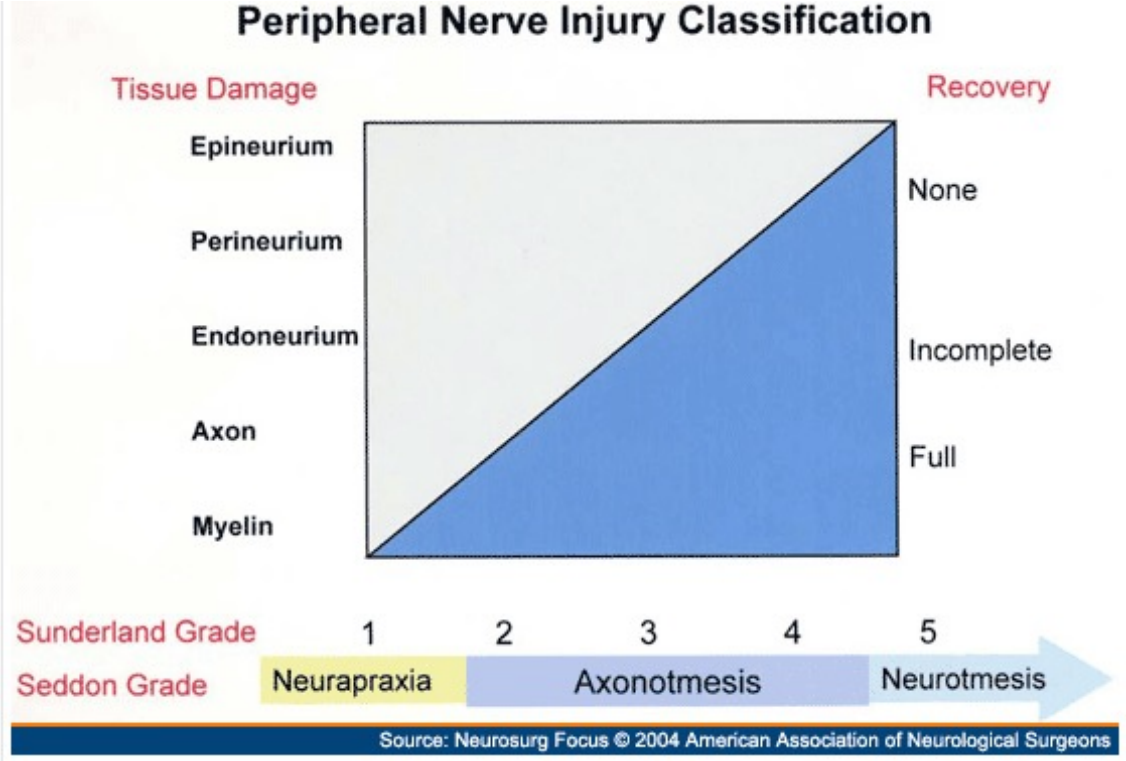
| | Histopathologic Changes | | | | | Tinel Sign | |
|---|---|---|---|---|---|---|---|
| Degree of Injury | Myelin | Axon | Endoneurium | Perineurium | Epineurium | Present | Progresses Distally |
| I Neurapraxia | +/- | | | | | - | - |
| II Axonotmesis | + | + | | | | + | + |
| III | + | + | + | | | + | + |
| IV | + | + | + | + | | + | - |
| V Neurotmesis | + | + | + | + | + | + | - |
| VI | Various fibers and fascicles demonstrate various pathologic changes | | | | | + | +/- |

# NERVE INJURY CLASSIFICATION: RATE OF RECOVERY

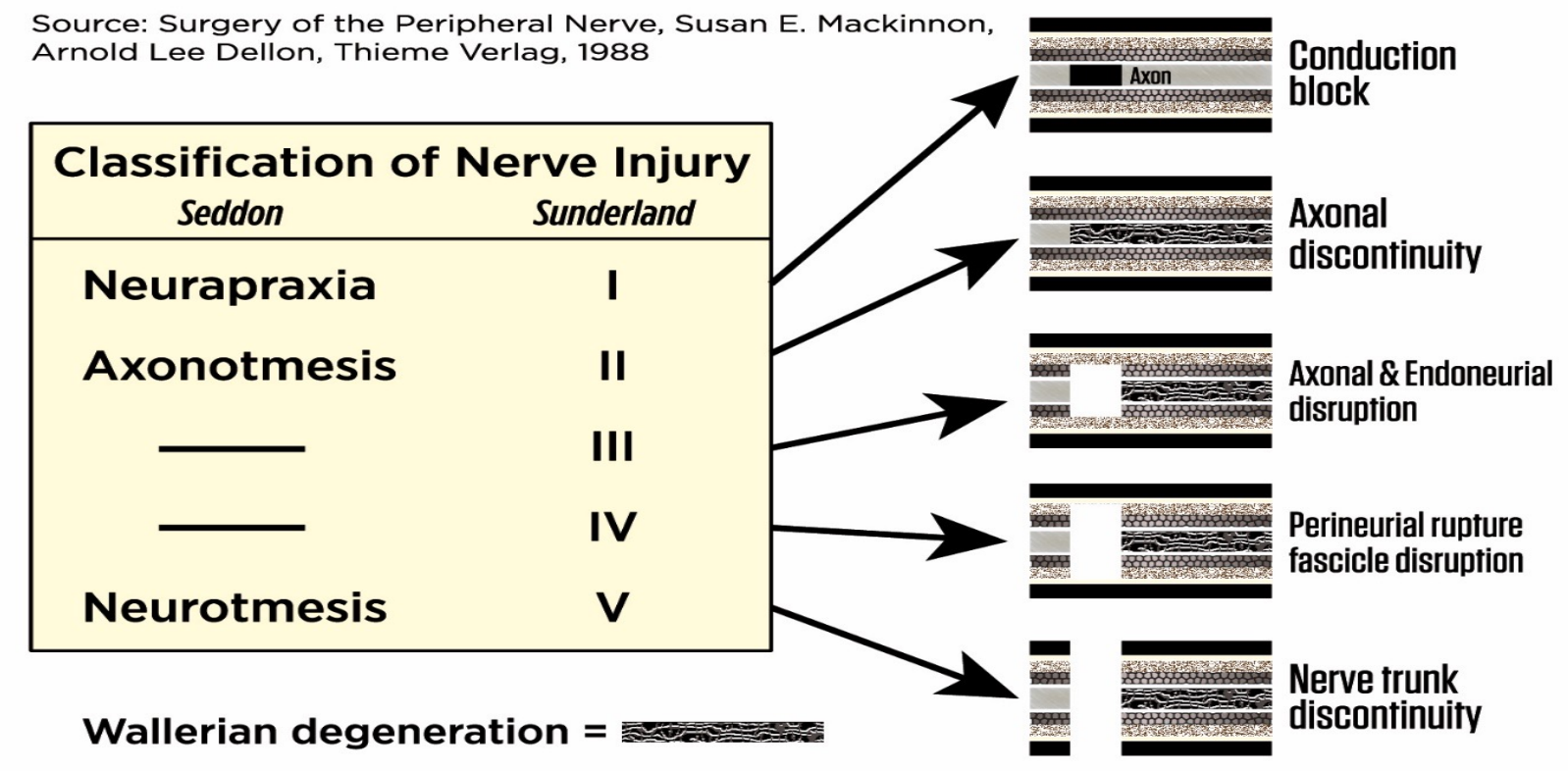
| Sunderland | Recovery Pattern | Rate of Recovery | Need for Surgery |
|---|---|---|---|
| 1st degree | Complete | Fast (days-weeks) | no |
| 2nd degree | Complete | Slow (weeks) | possible |
| 3rd degree | Variable | Slow (weeks-months) | possible |
| 4th degree | Poor | Little/none | yes |
| 5th degree | None | none | yes |

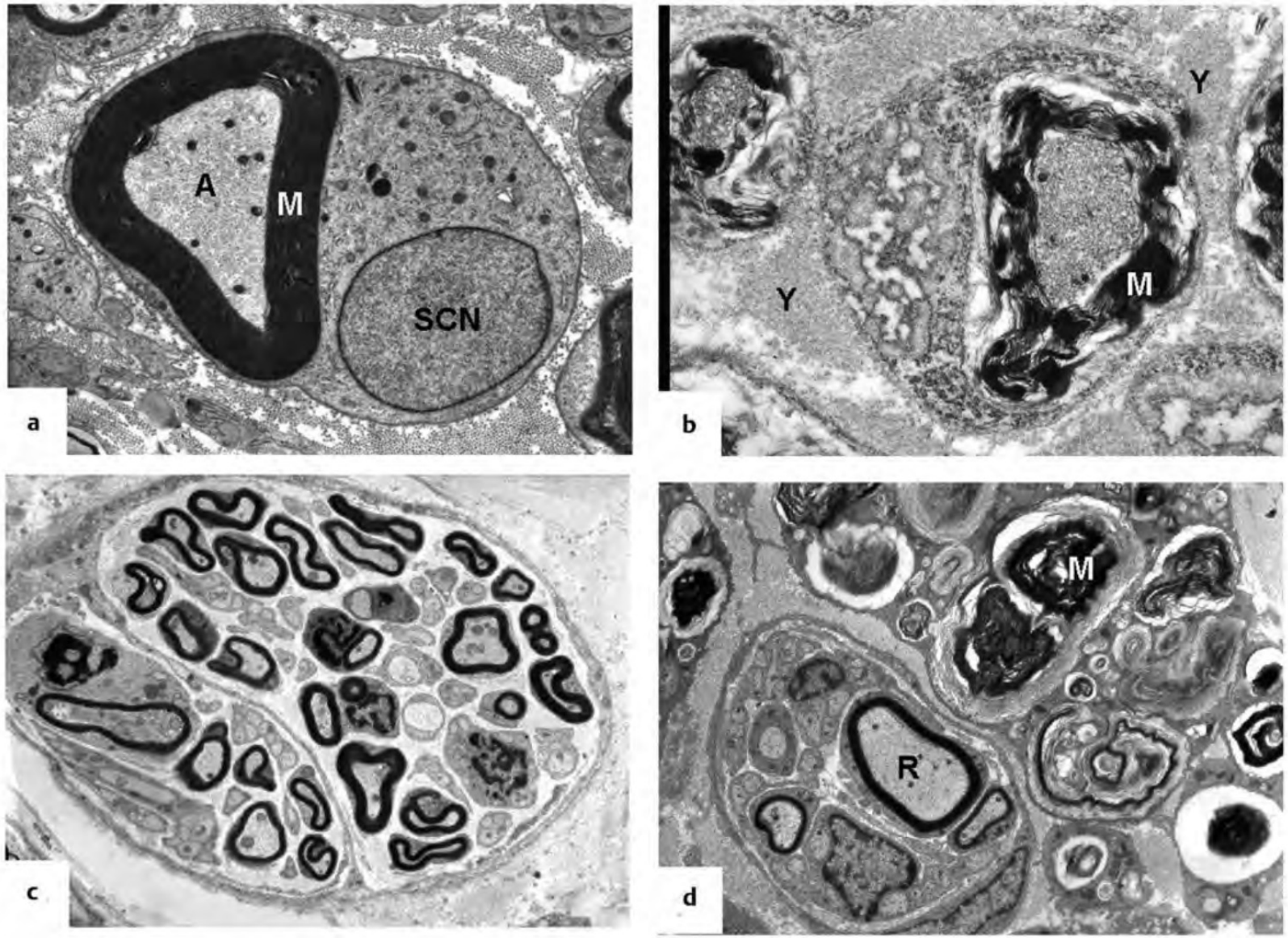
# Why classify injury?

Predict recovery



# MACKINNON DIAGRAM




A
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SCN
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Y
Y
M
b
c
M
R
d


a
b
c
d

# DESPITE BEST OF CARE PRACTICES

- Peripheral trigeminal nerve injuries (CN V) are a known risk of and oral surgical treatments
  - Injuries occur, and in some cases, may be unavoidable
- Recovery occurs in most, but not all patients

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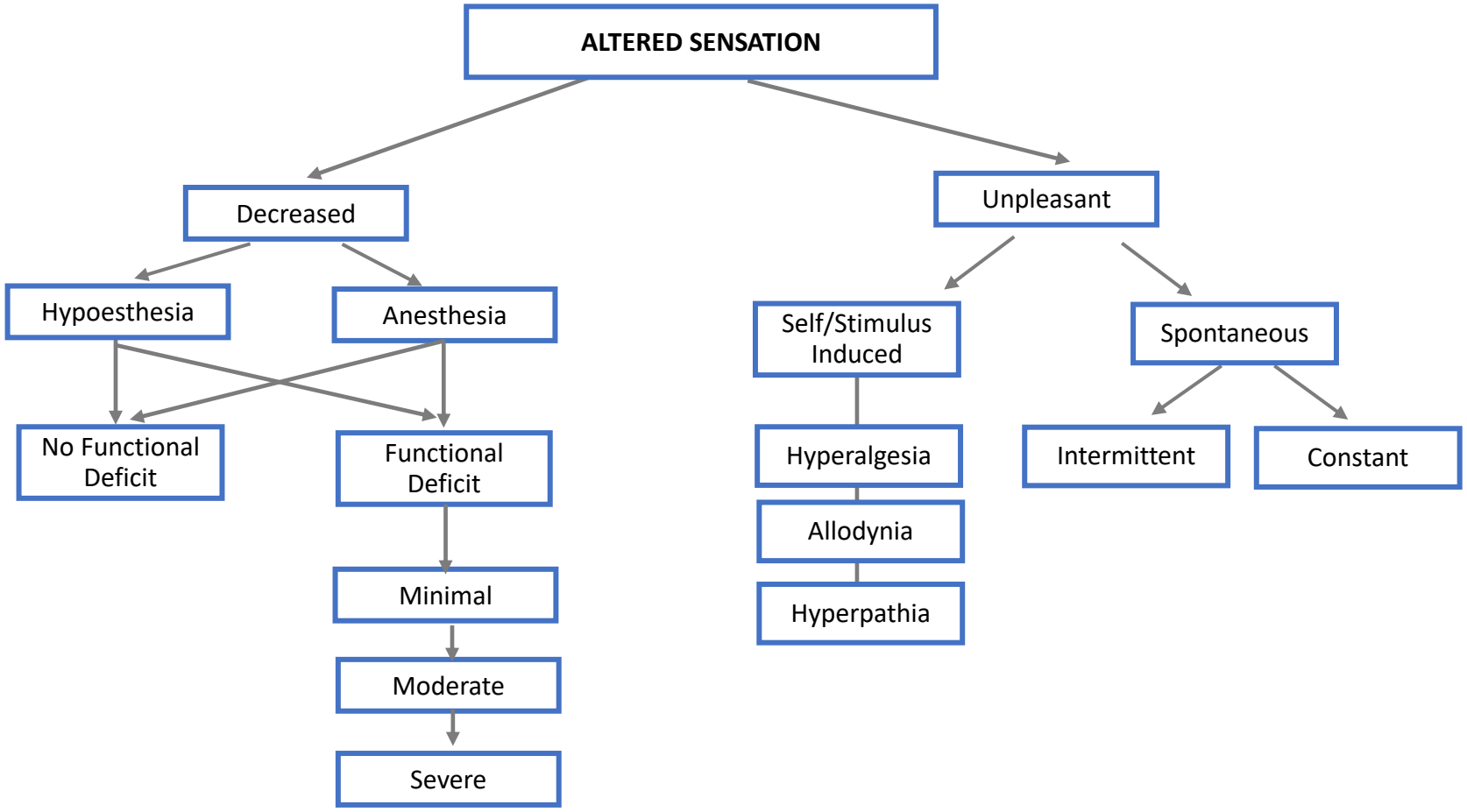
# History

- Etiology
- Onset, Progression
- Any treatment
- Present complaints

# PATIENT INTERVIEW




Ruggiero, S. Proothi, M. Guidelines for Diagnosis and Treatment of Trigeminal Nerve Injuries.

# Examination

- Neurosensory test
- Radiographs – rule out foreign body, roots
- Tinel’s sign
- Atrophic papillae
- Taste abnormality

# Neurosensory Testing

- Level A:
  - Two point discrimination
  - Brush stoke directional perception
- Level B
  - Contact detection (light touch)
- Level C
  - Pain and temperature

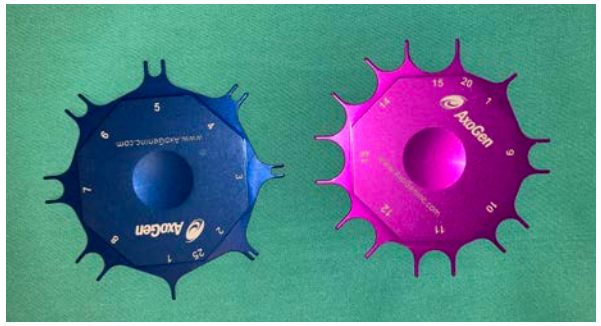
# Level A

## Brush stroke direction

- Right to left/ left to right
- Number correct out of 10 -> normal 80%
- Alternate with control side

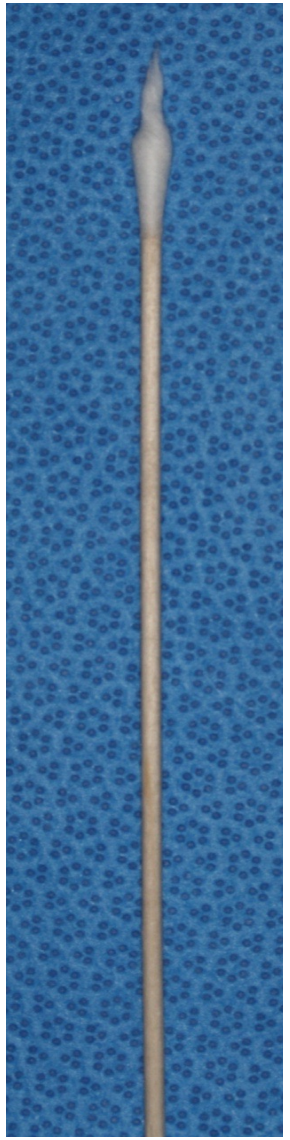
## Two point discrimination

- Closest distance to discern 2 points
- Compare to control side
- Use blunt tips
- Normal:
  - Tongue 2-5 mm
  - Lip 4-5 mm
  - Chin 8-10 mm



# Level B

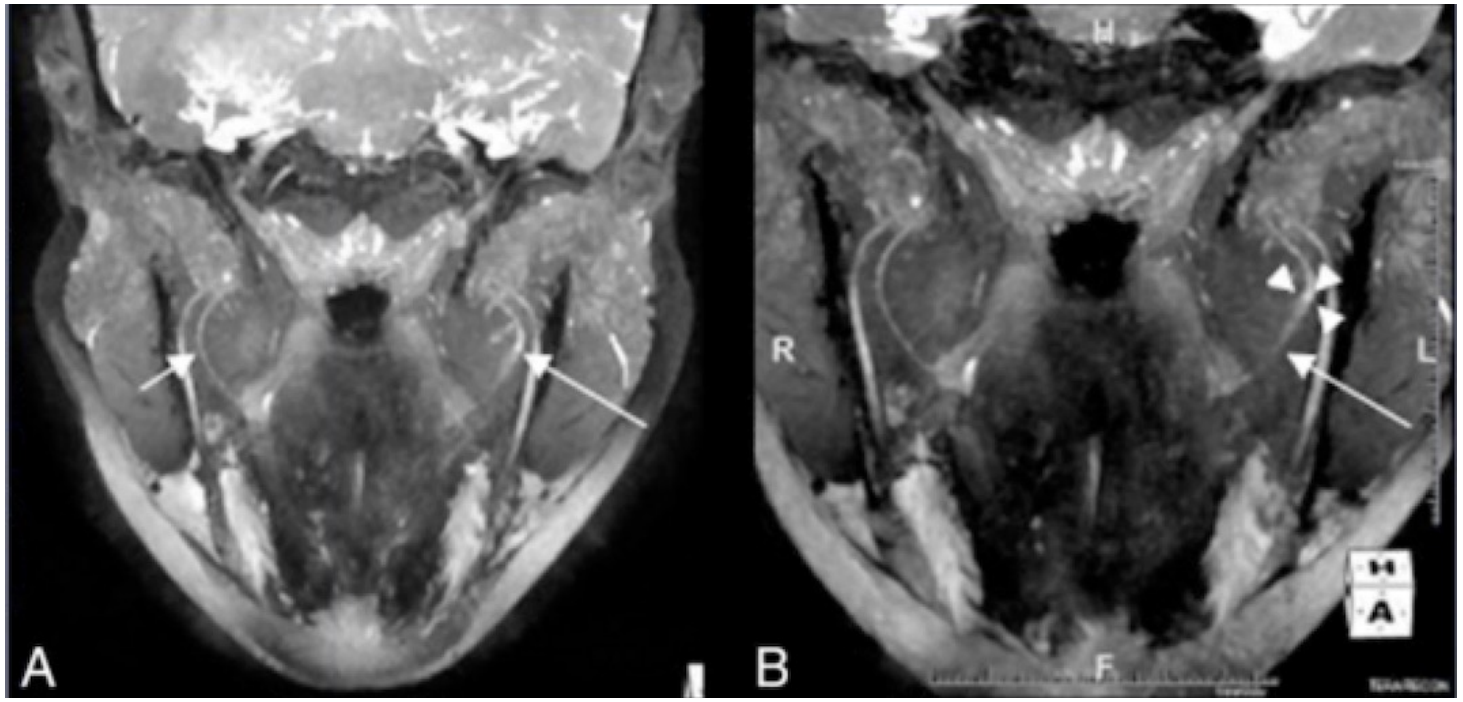
- Contact detection
  - Wisp of cotton tip applicator
  - Von Frey hairs

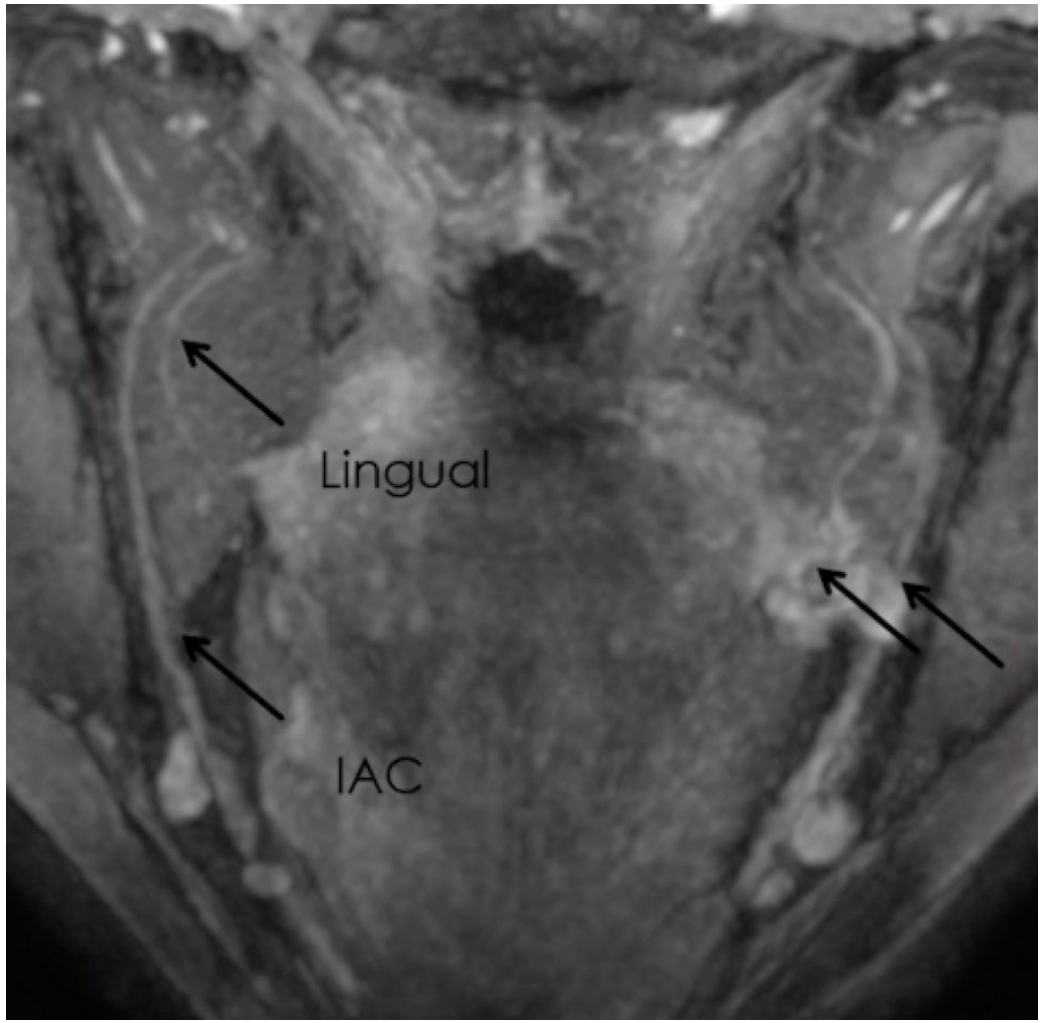


# Level C

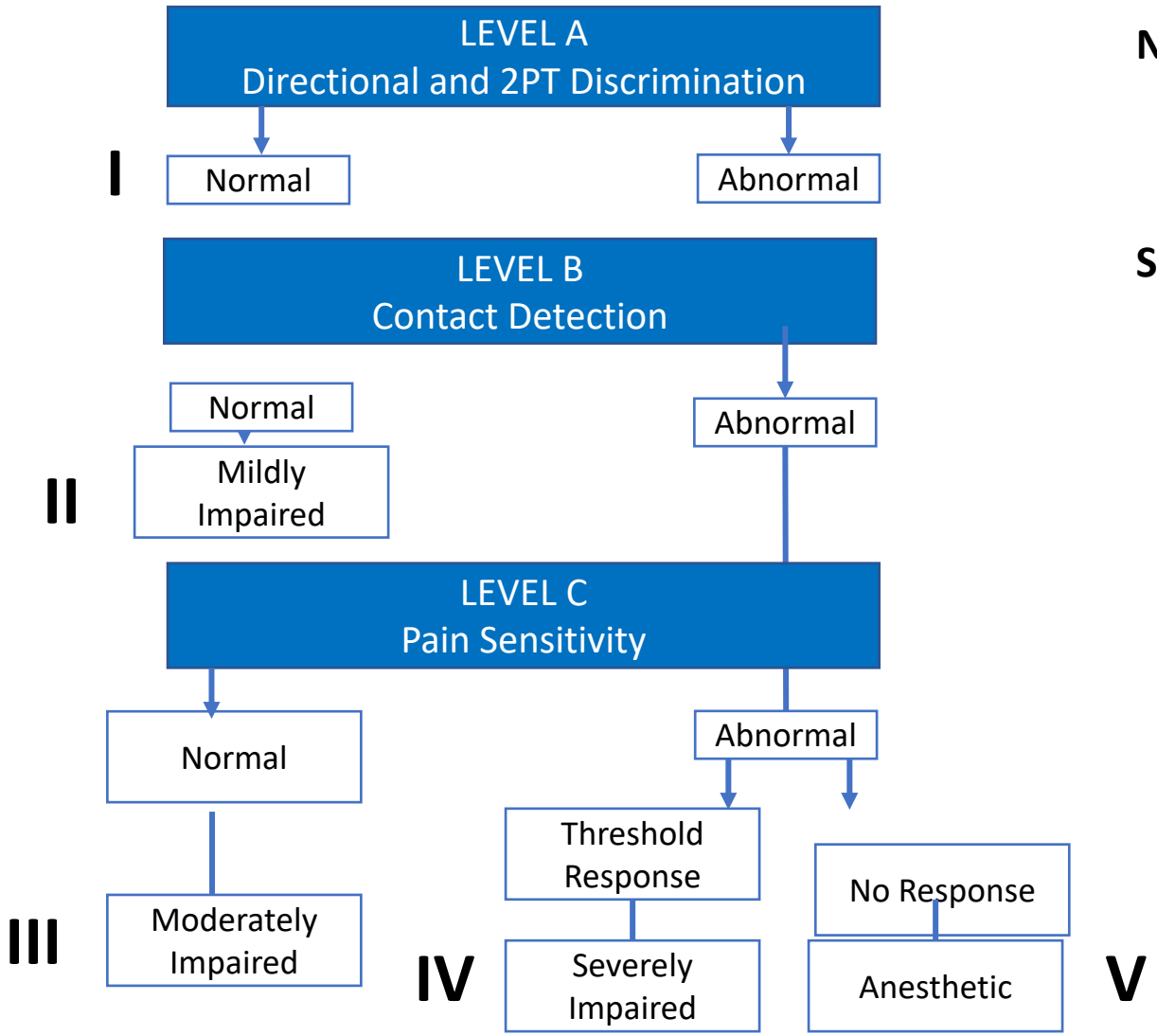
- Temperature
  - Water
  - Cold mirror
- Pain
  - Sharp broken cotton tip applicator
  - 30g needle

# MRN



# CLINICAL NST




**Non-Surgical**

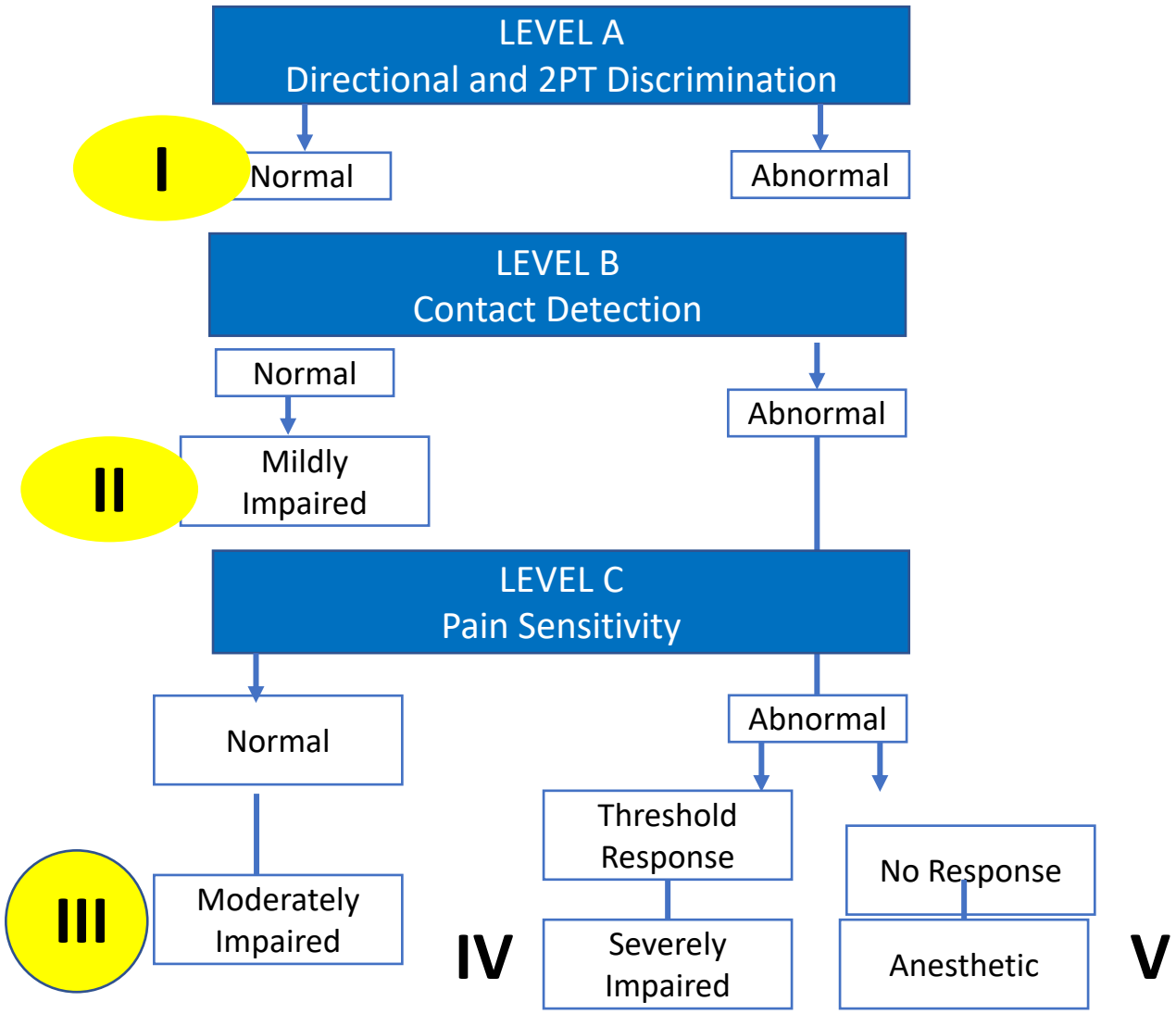
- Class I
- Class II
- Class III

**Surgical**

- Class IV
- Class V

Ruggiero, S. Proothi, M. Guidelines for Diagnosis and Treatment of Trigeminal Nerve Injuries.

# CLINICAL NST

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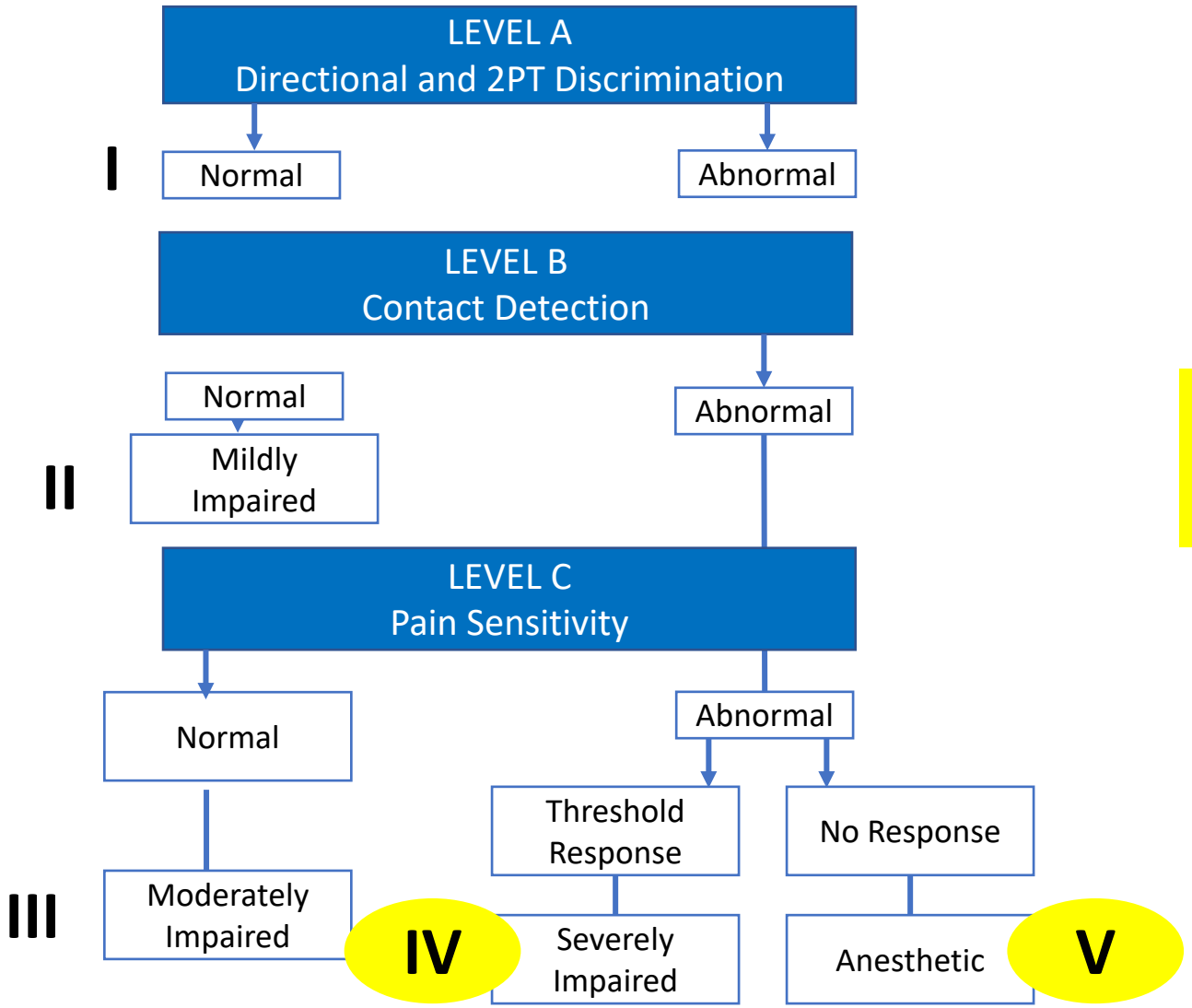


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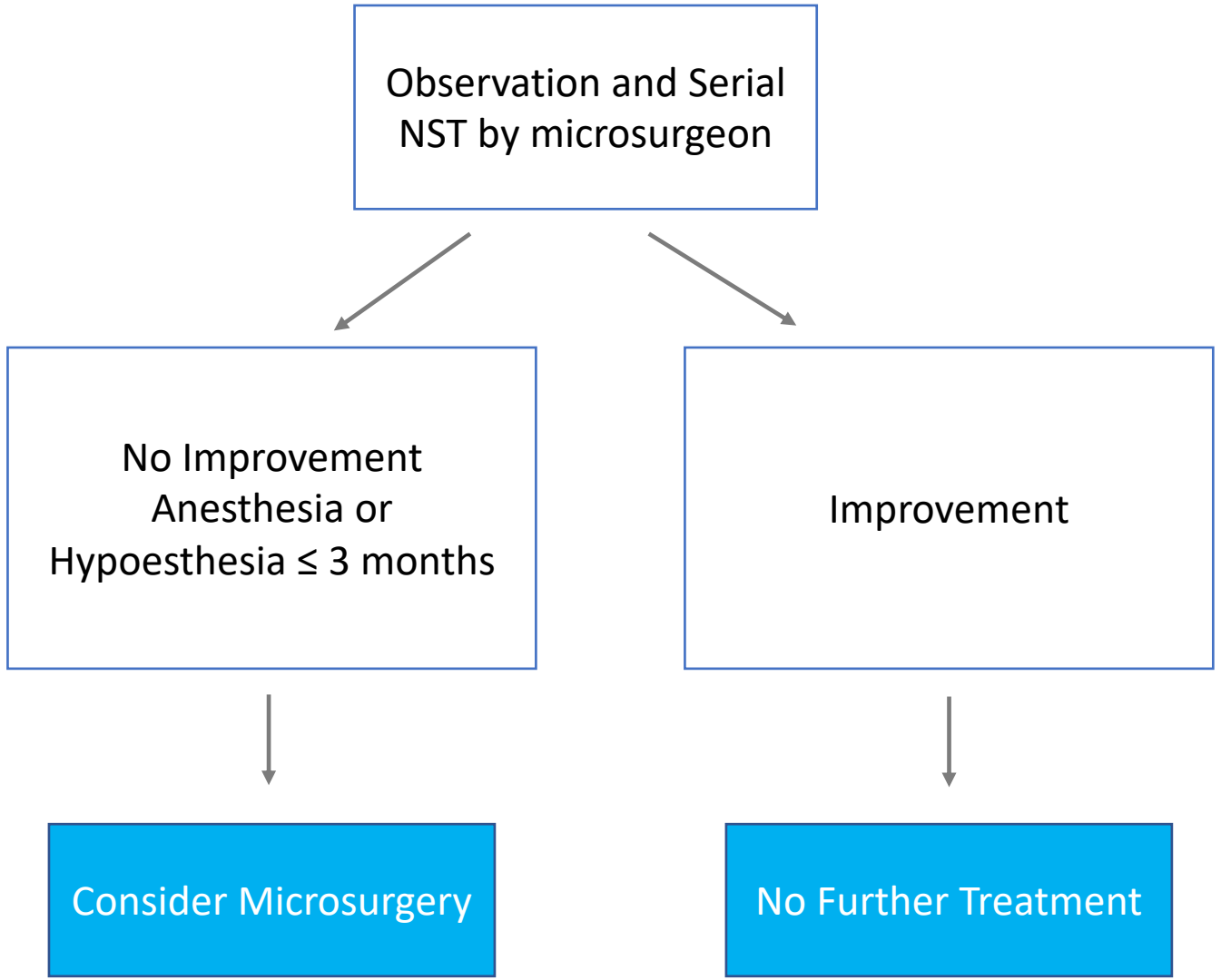
# SURGICAL DECISION ALGORITHM



# Functional Sensory Recovery

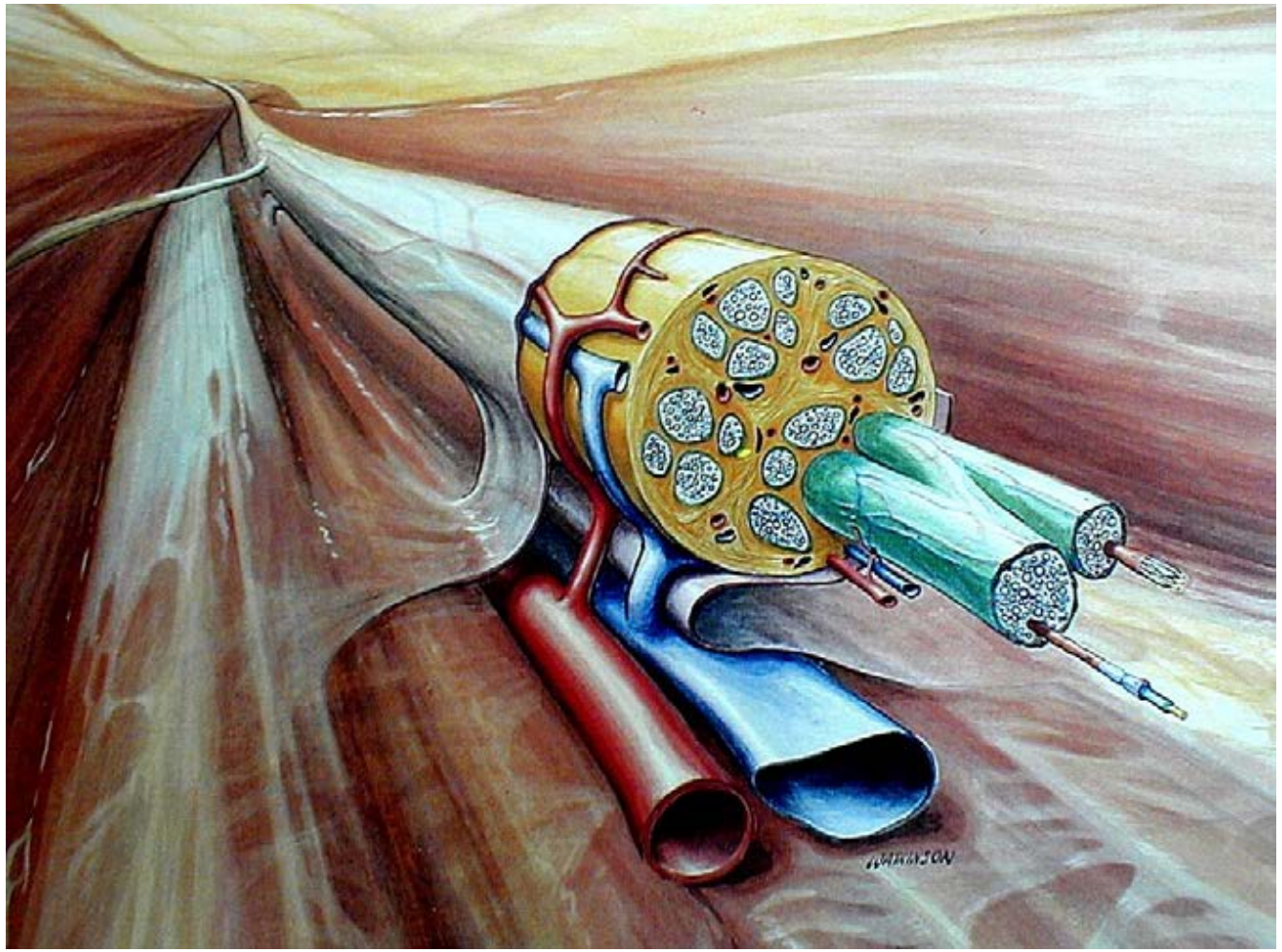
**Table 1**
**Medical Research Council Scale for grading sensory function of peripheral nerves as applied to the trigeminal nerve**

| Grade | Description |
|---|---|
| S0 | No sensation |
| S1 | Deep cutaneous pain in an autonomous zone |
| S2 | Some superficial pain and touch sensation |
| S2+ | Pain and touch sensation with hyperesthesia |
| S3 | Pain and touch sensation without hyperesthesia; static 2pd >15 mm |
| S3+ | Same as S3 with good stimulus localization and static 2pd 7–15 mm |
| S4 | Normal sensation |

# MICRONEUROSURGERY INDICATIONS

- Complete anesthesia (0%)
- < 50% residual sensation
  - Sunderland III, IV, V
- Observed nerve transection
- Early dysesthesia (may indicate neuroma formation)

# Current Concepts for Improving Outcomes in Peripheral Nerve Repair

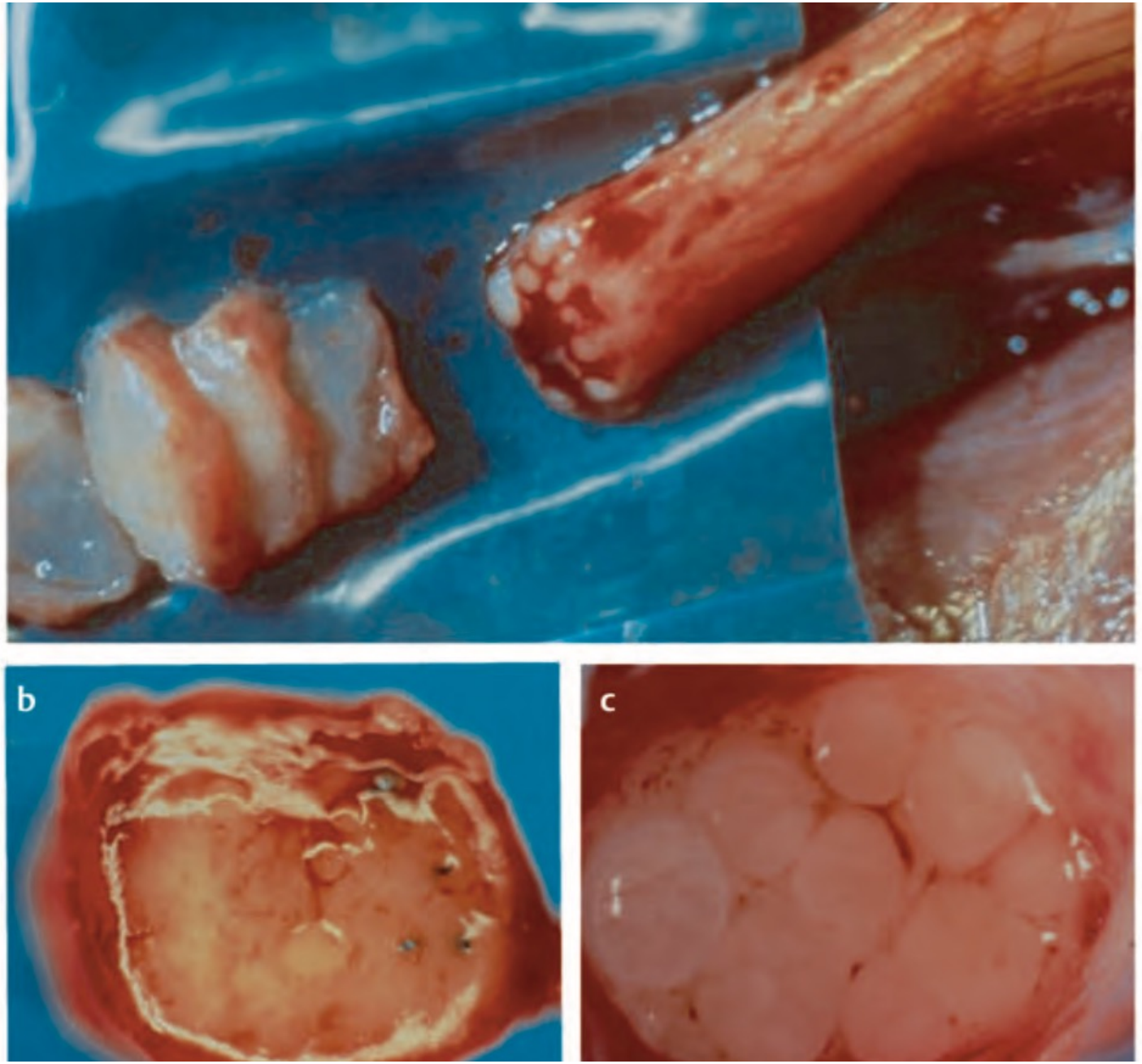


# Clinical Challenges

- Patient Age
- Patient Health Status
- Age of Injury
- Mechanism of Injury
- Extent of Nerve Tissue Damage
- Finding Healthy Nerve Ends
- Tension at the Repair Site
- Bridging the Gap
- Barriers to Control Axonal Escape
- Scarring and Entrapment
- Vascularity of the Nerve and Surrounding Tissue Bed

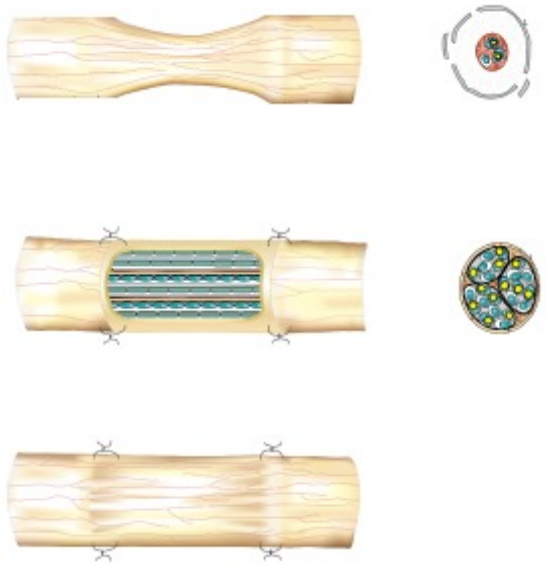
Allografts and Conduits

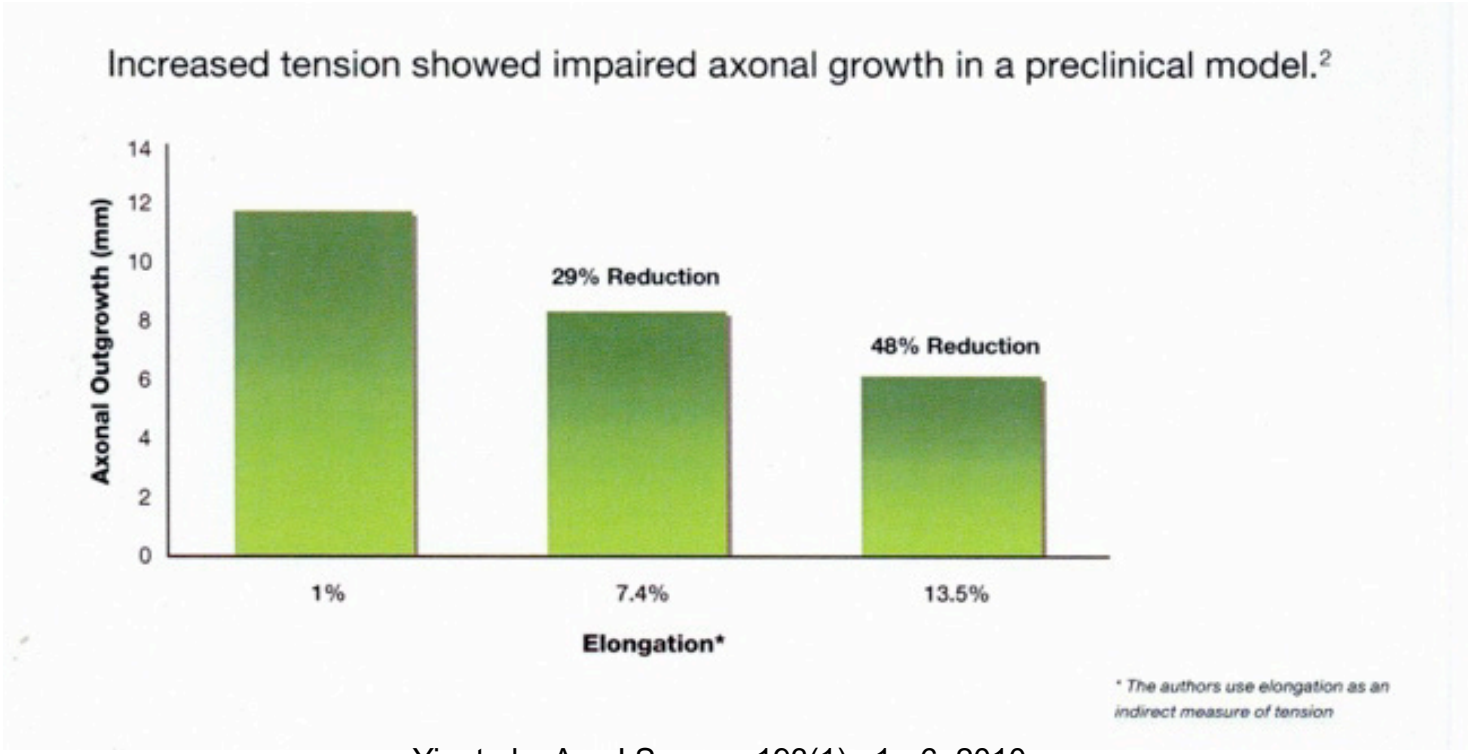
# Viable Nerve Tissue



# Tension at the Repair Site

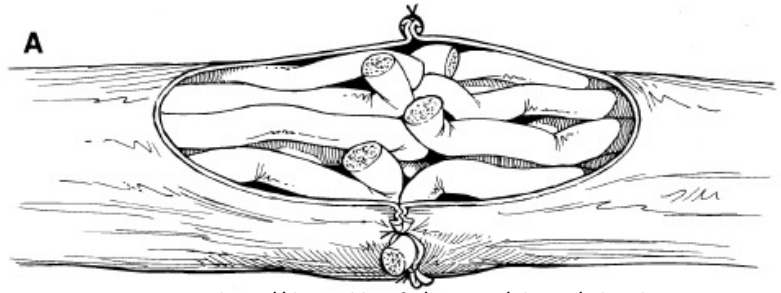
- Tension may compromise the nerve repair and lead to ischemia within the nerve



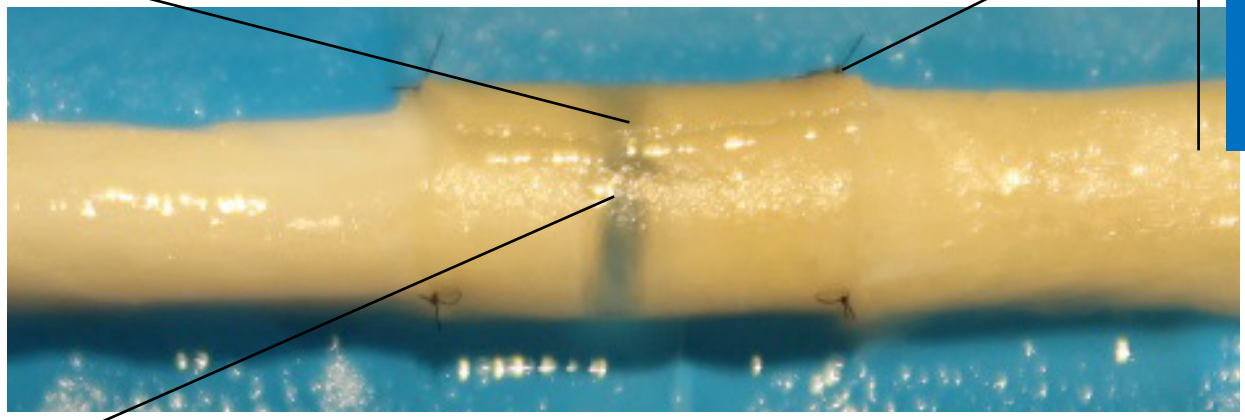



Yi, et al Am J Surgery 193(1):e1-e6, 2010

# Connector Assisted Coaptation: Providing Alignment and Avoiding Tension and the Coaptation




Source: http://doctorlib.info/surgery/plastic/9.html



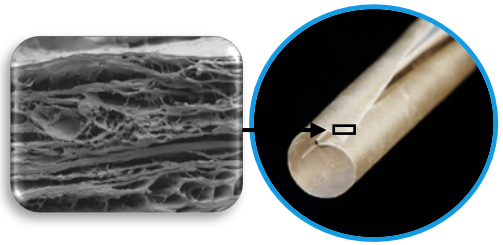
**Barrier to Axonal Escape, Scarring and Inflammatory Infiltration**

**Sutures moved away from Coaptation Site**

**No forced mismatch from overly tight repair**

# Minimally Processed Porcine ECM

AxoGuard® NerveProtector



Protects repair site from surrounding tissue

- Minimizes soft tissue attachments
- Allows for diffusion of nutrients through the material

Allows nerve gliding

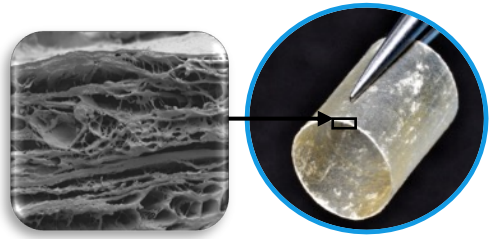
- Minimizes risk of entrapment
- Creates a barrier between repair and surrounding tissue bed

ECM Revascularizes and remodels into patient's own tissue

Easy to use

- Semi-translucent to allow visualization of underlying nerve
- Conforms to nerve

AxoGuard® NerveConnector



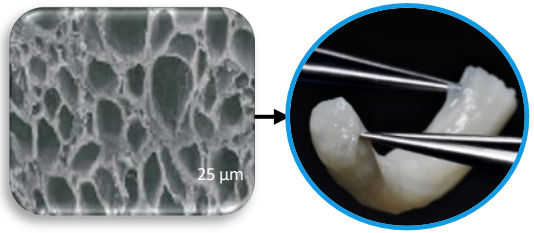
Alternative to direct suture repair

- May reduce surgery time by as much as 40%
- Reduces the risk of forced fascicular mismatch

Alleviates tension at critical zone of regeneration

- Disperses tension across repair site
- Moves suture inflammation away from coaptation face

# Avance Nerve Graft




## Processed human nerve allograft for bridging nerve gaps

### Clinically studied off-the-shelf alternative

- 87% meaningful recovery in sensory, mixed and motor nerve gaps in multi-center study
- Eliminates need for an additional surgical site and risks of donor nerve harvest[7]
- May reduce OR time

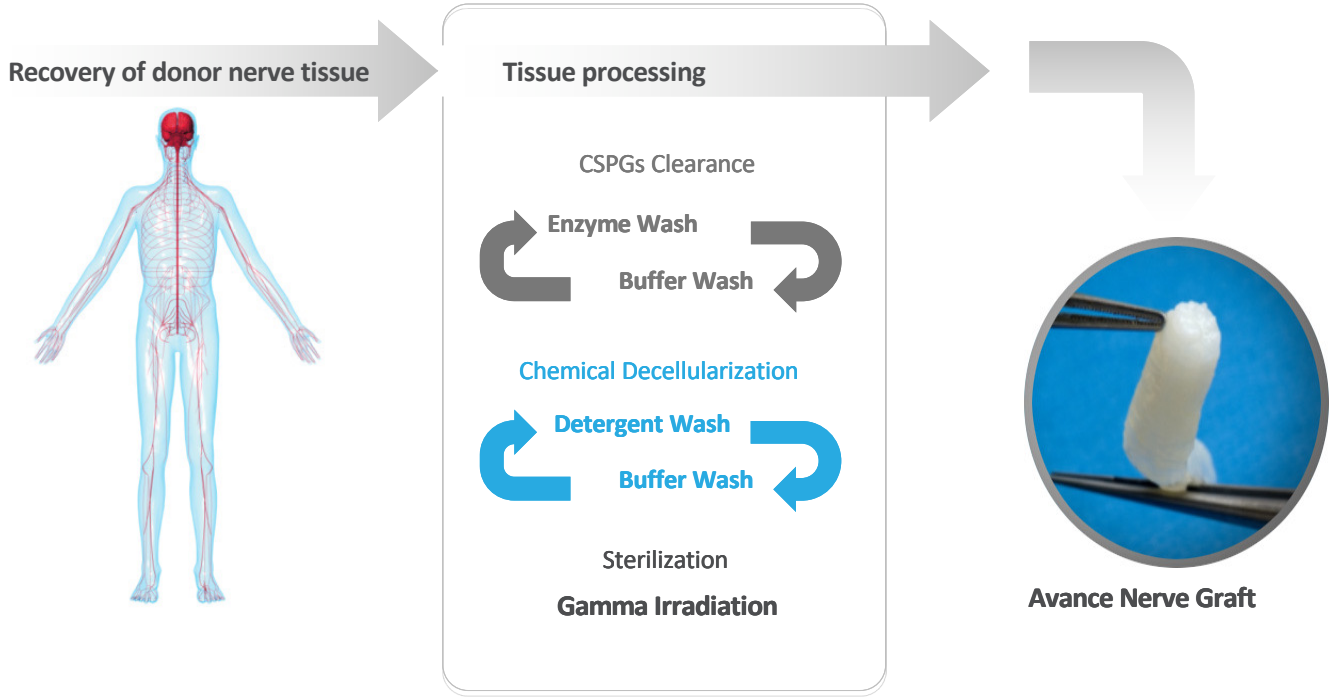
### Structural support for regenerating axons

- Cleansed and decellularized extracellular matrix (ECM)
- Offers the benefits of human peripheral nerve micro-architecture and handling

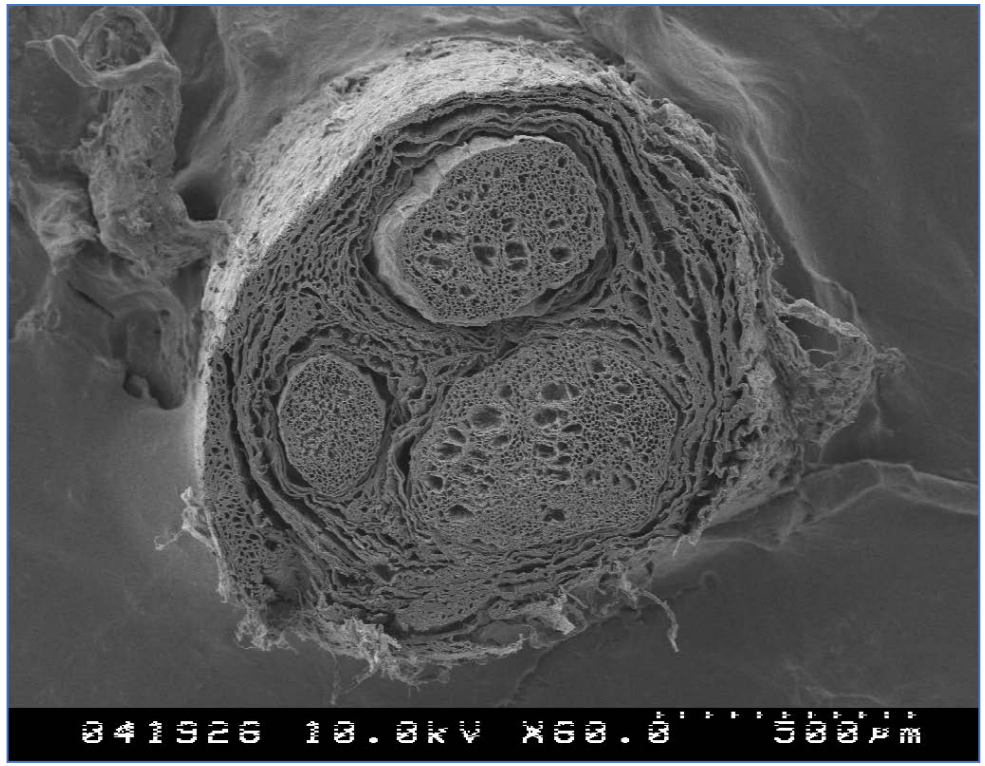
Revascularizes and remodels into patient's own tissue similar to autologous nerve

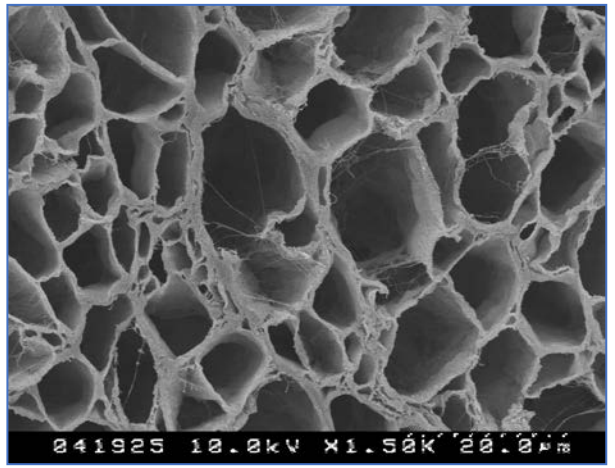
16 Size options in a variety of lengths (up to 70mm) and diameters (up to 5mm)

# Avance Nerve Graft Tissue Processing



# ECM Scaffolding



# Sensory Outcomes After Reconstruction of Lingual and Inferior Alveolar Nerve Discontinuities Using Processed Nerve Allograft—A Case Series

*John R. Zuniga, DMD, MS, PhD**

# Methods / Surgical Technique

Patient Selection:

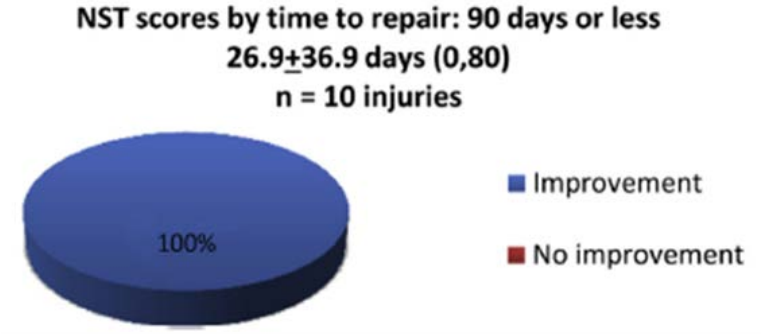
- 2007 to 2013
- Total Population: 26 patients with 28 nerve injuries
- Sunderland IV or V degree of injury prior to reconstruction (axonal transection)
- Outcomes Population: 21 patients with 23 nerve injuries

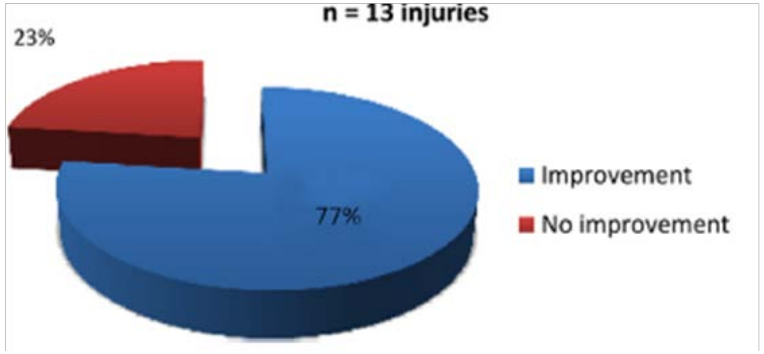
**Table 1. DEMOGRAPHICS OF TOTAL AND OUTCOMES POPULATIONS**

| Variable | Total Population | Outcomes Population |
|---|---|---|
| Gender | | |
| Male | 14 (54) | 11 (52) |
| Female | 12 (46) | 10 (48) |
| Age (yr) | | |
| Mean ± SD | 36.5 ± 18.3 | 33.3 ± 17.0 |
| Range | 9-82 | 9-67 |
| Interval to repair (days) | | |
| Mean ± SD | 152 ± 160 | 148 ± 160 |
| Range | 0-518 | 0-518 |
| Repair within 90 days | 12 (43) | 10 (43) |
| Repair after 90 days | 16 (57) | 13 (57) |
| Etiology | | |
| Third molar | 17 (61) | 13 (57) |
| Implant | 3 (11) | 2 (8.5) |
| Oncologic | 6 (21) | 6 (26) |
| BSSO | 2 (7) | 2 (8.5) |
| Nerve location | | |
| Lingual | 17 (61) | 15 (65) |
| Inferior alveolar | 11 (39) | 8 (35) |
| Gap length (mm) | | |
| Mean ± SD | 32.4 ± 24.1 | 34.2 ± 25.5 |
| Range | 8-70 | 8-70 |

# Results

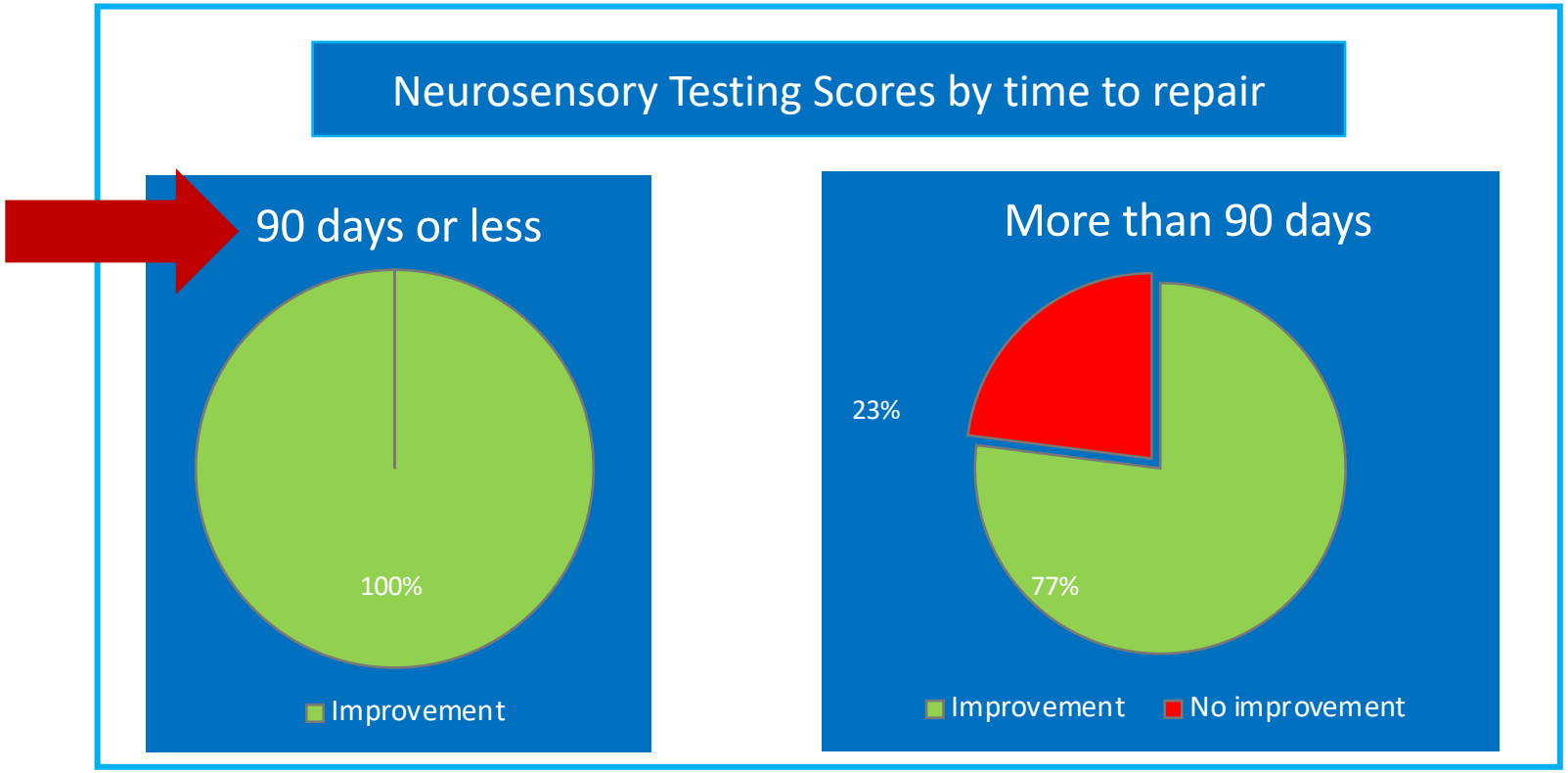
- 87% had improved neurosensory scores with no reported adverse experiences
- 87% for the LNs
- 88% for the IANs
- 100% sensory improvement in injuries repaired within 90 days of the injury
- 77% sensory improvement in injuries repaired after 90 days



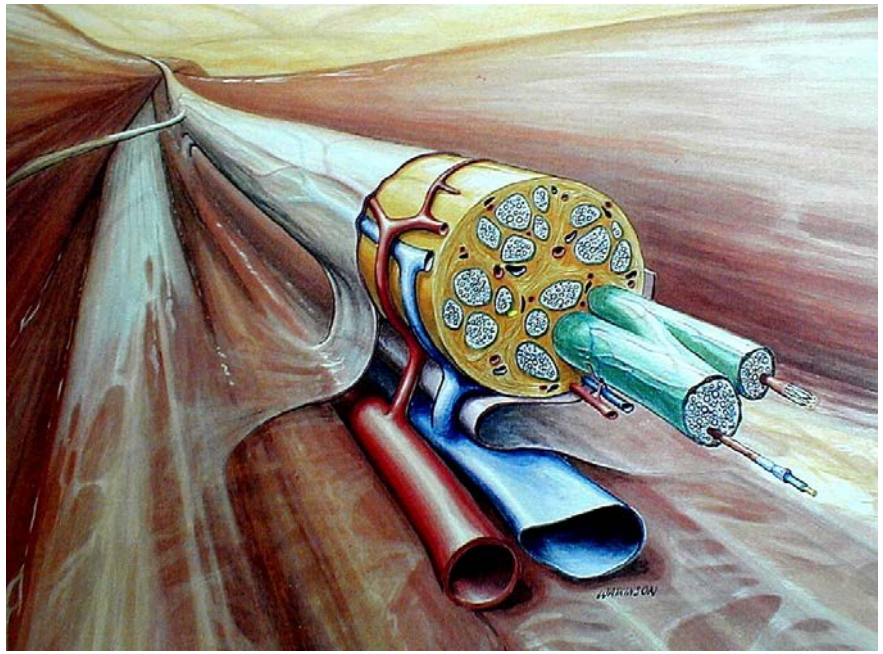
# Sensory Outcomes After Reconstruction of LN and IAN Nerve Discontinuities Using Processed Nerve Allograft. Zuniga, JR Oral Maxillo Fac. 2015 Apr: 734-744

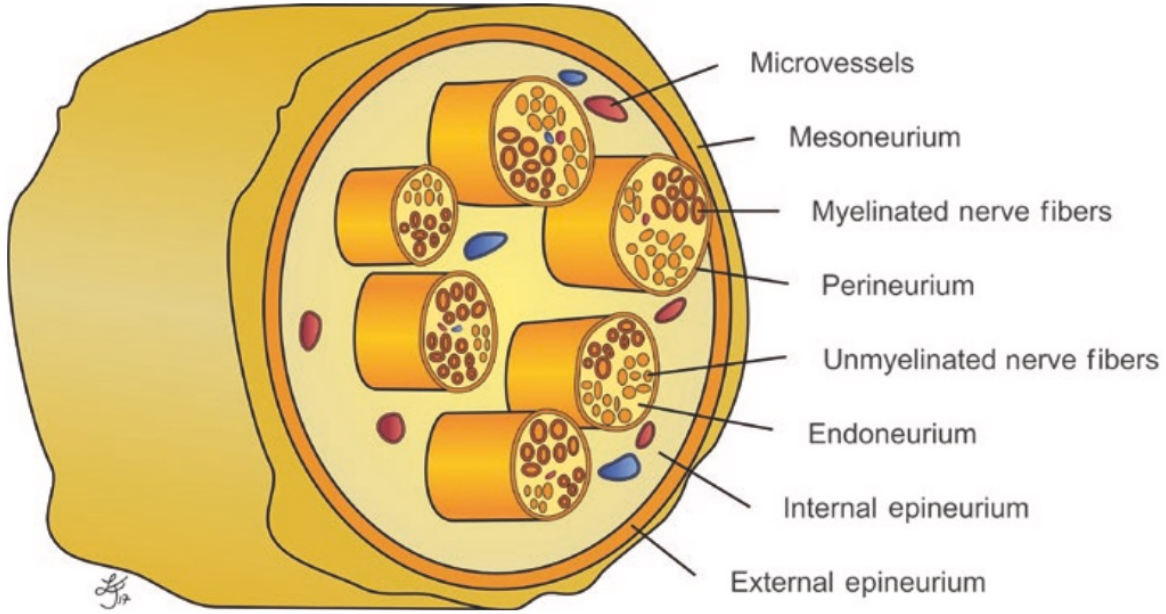
SHORTER DELAY=IMPROVED OUTCOME

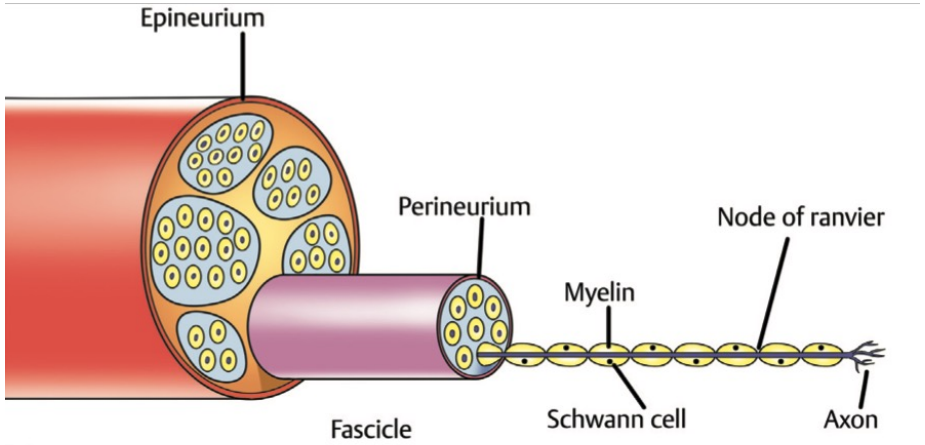


# Conclusion

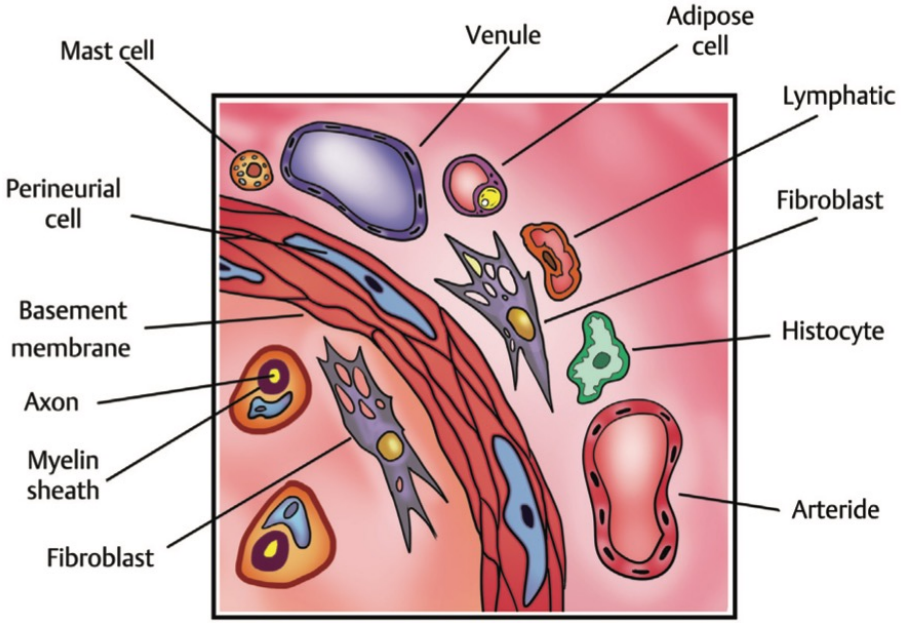
- Outcomes comparable to those using processed nerve allograft for non-trigeminal nerve repairs
- Outcomes similar to trigeminal repair with autograft
- Processed nerve allograft can be safely and effectively used to reconstruct LN and IAN defect up to 70mm
- Benefit of nerve wrapping
  - Seems to have a complementary effect






**(a)** Main trunk




**(b)** Endonerium - Perineurium - Epineurium

# Fiber types

## A alpha (myelin) 12-20 microns 70-120 m/s

- Position/Fine touch

## A beta (myelin) 6-12 microns 35-170m/s

- Proprioception

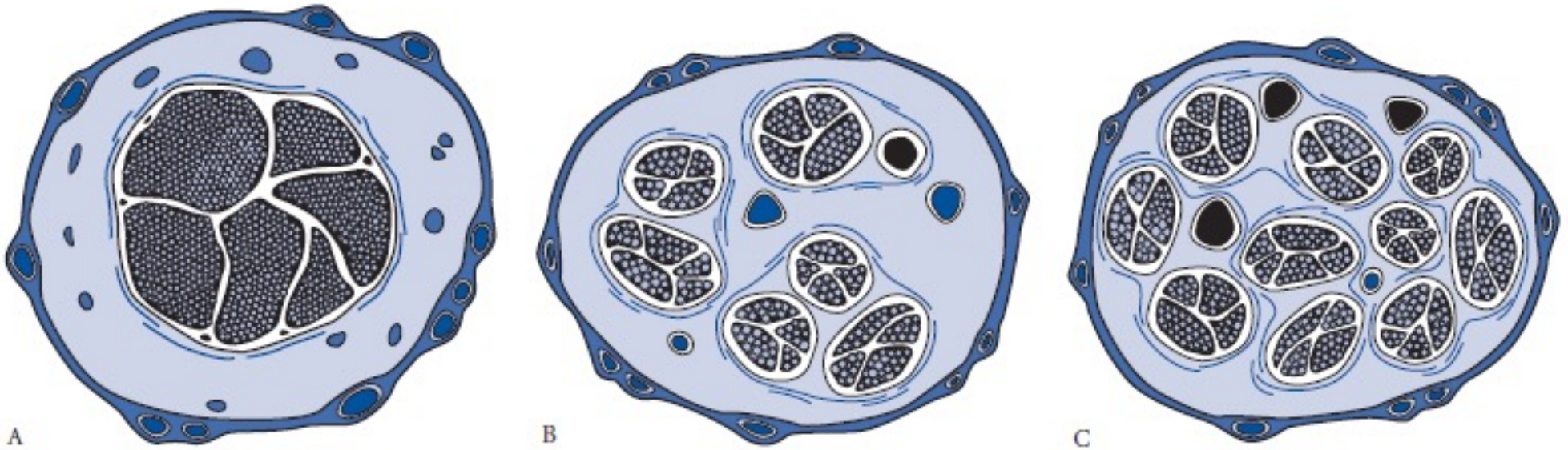
## A delta (thin myelin) 1-6 microns 2.5-3.5m/s

- Superficial pain and temp

## C (unmyelinated) 0.5-1microns 0.7-1.5m/s

- Deep pain and temp

# Fascicular patterns




Monofascicular 1 fascicle

Oligofasicular 2-10 fascicles

Polyfascicular >10 fascicles

# Indications for surgery

- Open injury
- Unobserved injury:
  - Persistent unacceptable diminished sensation
  - Complete loss of sensation
  - Interference with orofacial functions
  - Unremitting pain relieved by local anesthetic block

# Observation

- “Watch and wait”
- Serial NST examinations
- Record results

# Will observation work?

- Most injuries resolve in 3-9 months, but only if improvement began before 3 months
- Deficit >1 month indicates high grade injury with uncertain recovery
- Follow continued improvement, but if it stops-> doesn’t usually start again

# Medications

- All patients
  - Medrol dose pak
  - B complex vitamins (B1, B6, B12)
  - anti-inflammatories

- Dysethestic patient
  - Management of neuropathic pain
  - Antidepressants, anticonvulsants
  - Muscle relaxants, benzodiazepines, gabapentin, pregabalin
  - Topical agents

# Timing of surgery

- Open injuries:
  - At time of injury or as soon as possible

- Closed injuries:
  - IAN – 6 months after injury

  - LN – 3 months after injury

# Surgical options

1. External neurolysis
2. Internal neurolysis
3. Neuroma excision
4. Direct approximation (coaptation)
5. Indirect approximation (grafting)
    - Autogenous
    - Allograft
    - Conduits

# External Neurolysis

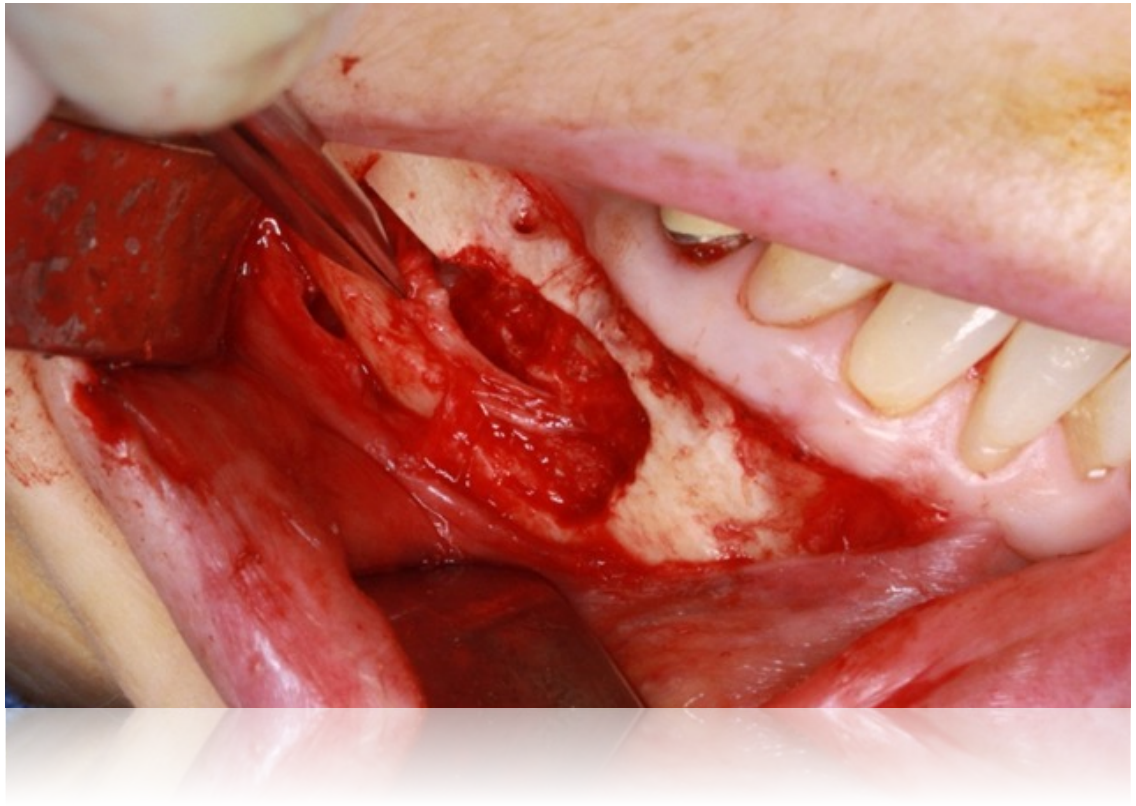
- “freeing up the nerve”

- Definitive tx if:

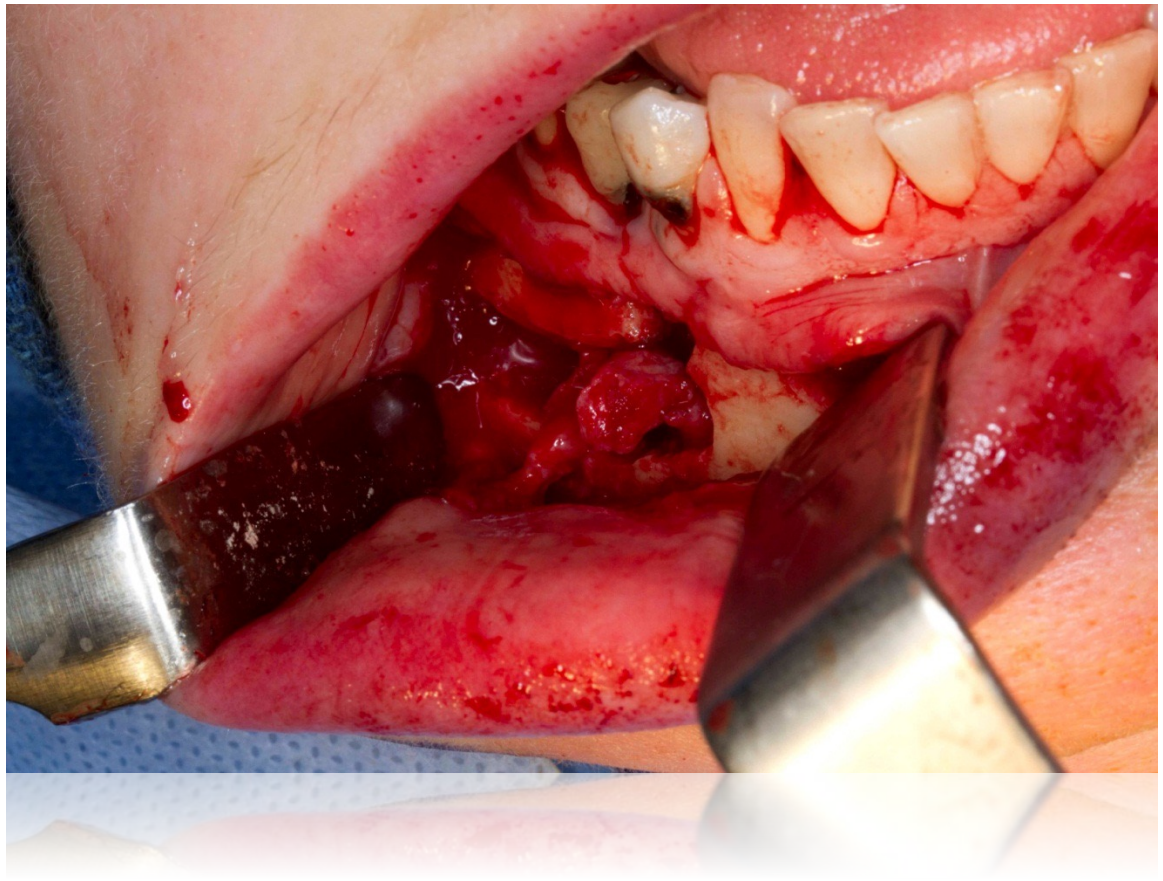
1. compression is <25% of normal diameter

2. paresthesia of short duration (<6mo)

3. No evidence of neuroma formation

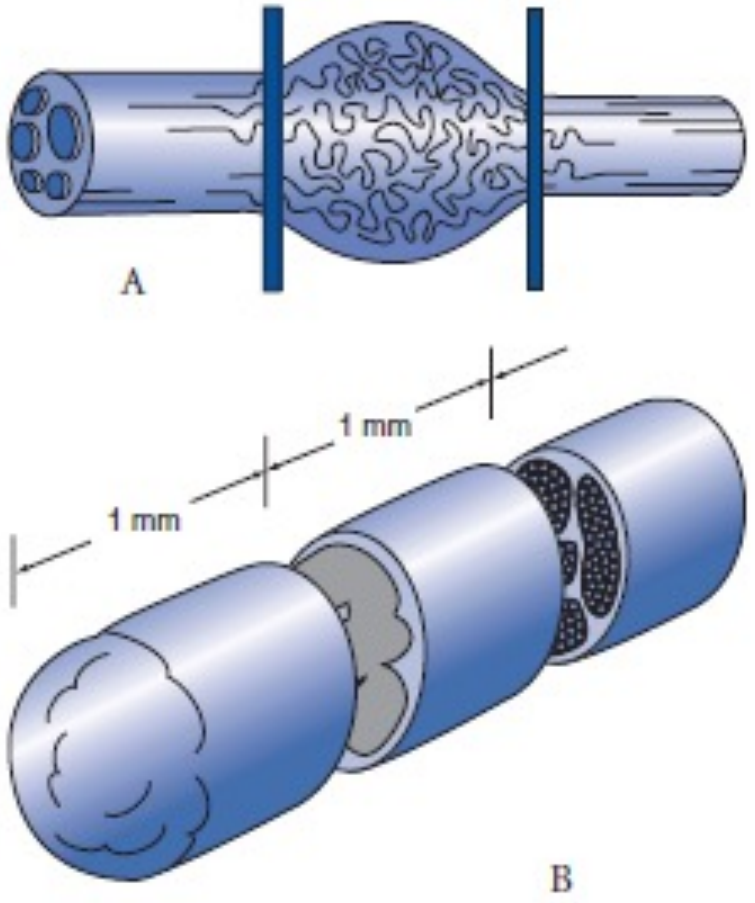


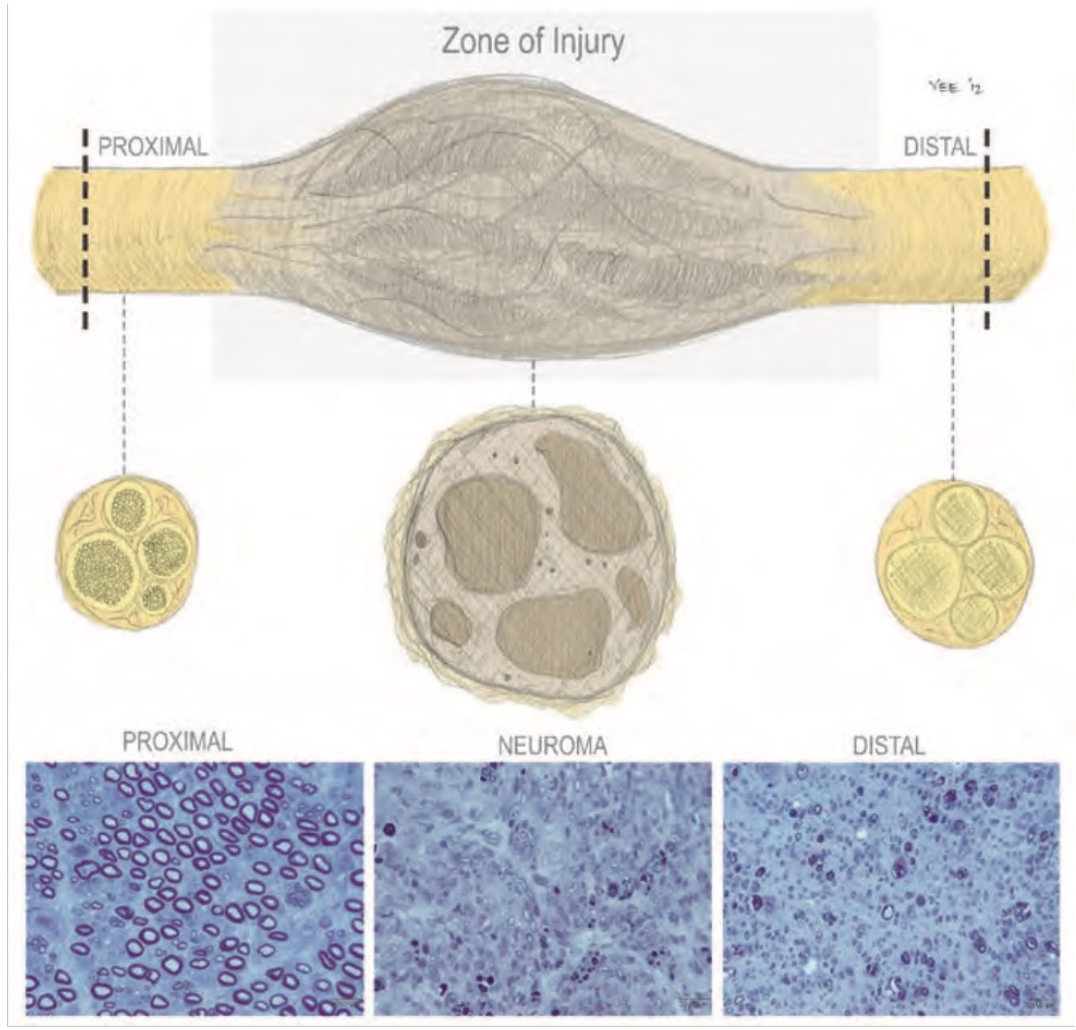
# Neuroma excision



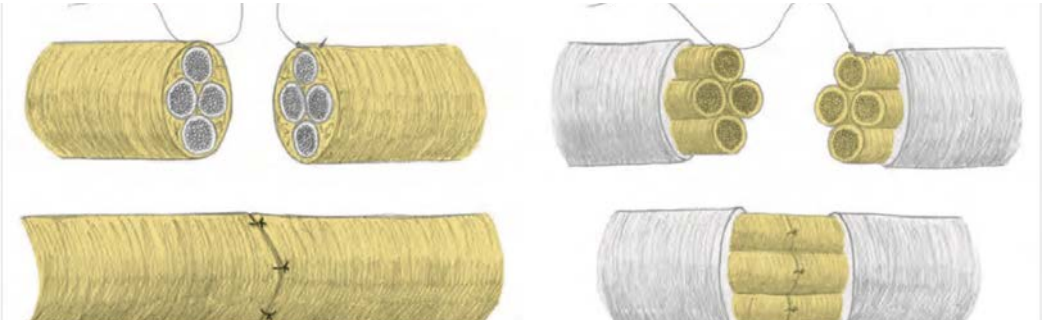
# Nerve stump preparation

- Remove neuroma to glistening white fascicles




Zone of Injury
PROXIMAL
DISTAL
PROXIMAL
NEUROMA
DISTAL

# Direct Approximation



- Tension free closure
- Lingual nerve gaps <1cm
- IAN gaps <5mm

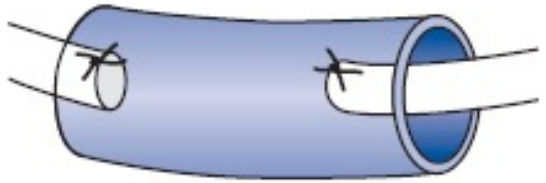

Epineurial Nerve Repair
Fascicular Nerve Repair

# Indirect Approximation

- Grafting:

1. Conduits
   - Vein
   - Gortex
   - Collagen
   - Sheaths
2. **Autogenous**
   - Greater auricular nerve
   - Sural nerve
3. **Allogenic**
   - Cadaver

| Table 41-11 Materials for Entubulation (Conduit) Repair |
|---|
| Autogenous materials |
| Collagen |
| Muscle |
| Fascia |
| Vein |
| Alloplastic materials |
| Polyglycolic acid |
| Polyester |
| Polytetrafluoroethylene (PTFE) |
| Expanded PTFE |
| Silicone, polymeric silicone |



| *Injured Nerve* | *Donor Nerve* | | |
|---|---|---|---|
| | *Sural (2.1 mm)* | *Greater Auricular (1.5 mm)* | *Greater Auricular Cable (3.0 mm)* |
| Inferior alveolar (2.4 mm) | 88% | 63% | 125% |
| Lingual (3.2 mm) | 66% | 47% | 94% |

Adapted from Brammer JP and Epker BN.[68]

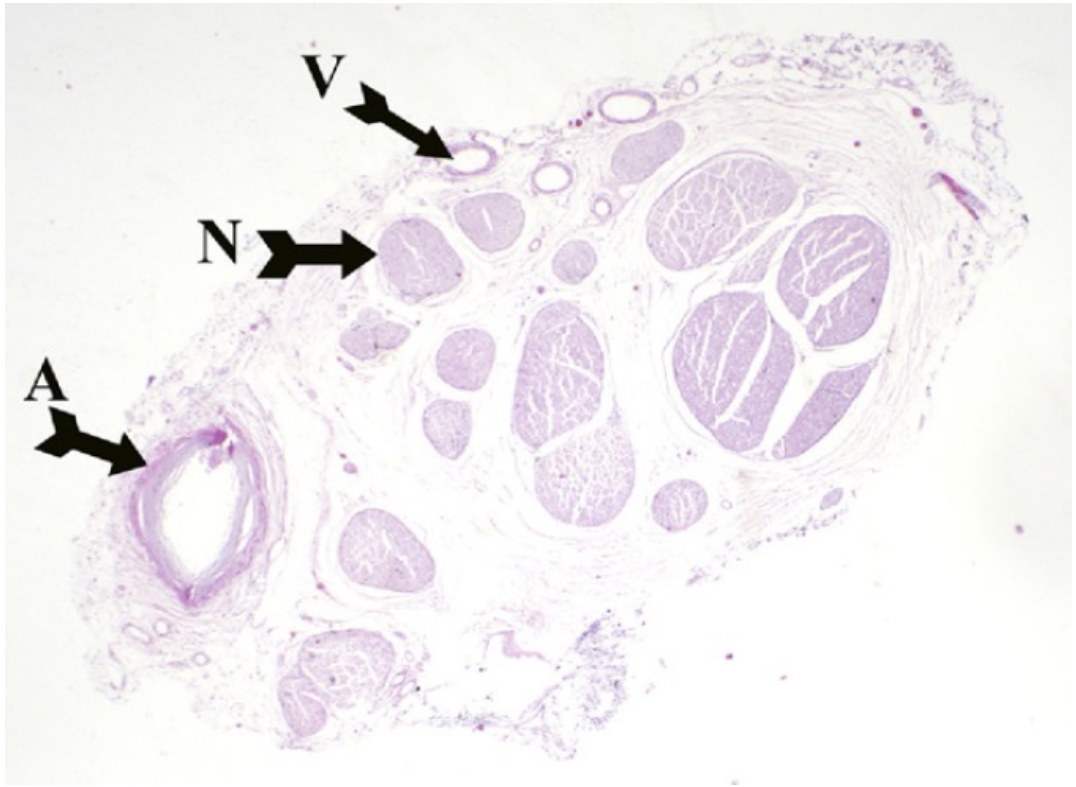
# Inferior alveolar nerve anatomy

- Polyfascicular
- Within bony cavity
- 2.4mm diameter

# The Anatomic Structure of the Inferior Alveolar Neurovascular Bundle in the Third Molar Region

*M. Anthony Pogrel, DDS, MD, FRCS,**
*David Dorfman, DDS, MD,† and Heshaam Fallah, DDS, MD‡*

- Vein lies superior to nerve
- Often multiple veins
- Artery lingual aspect of canal



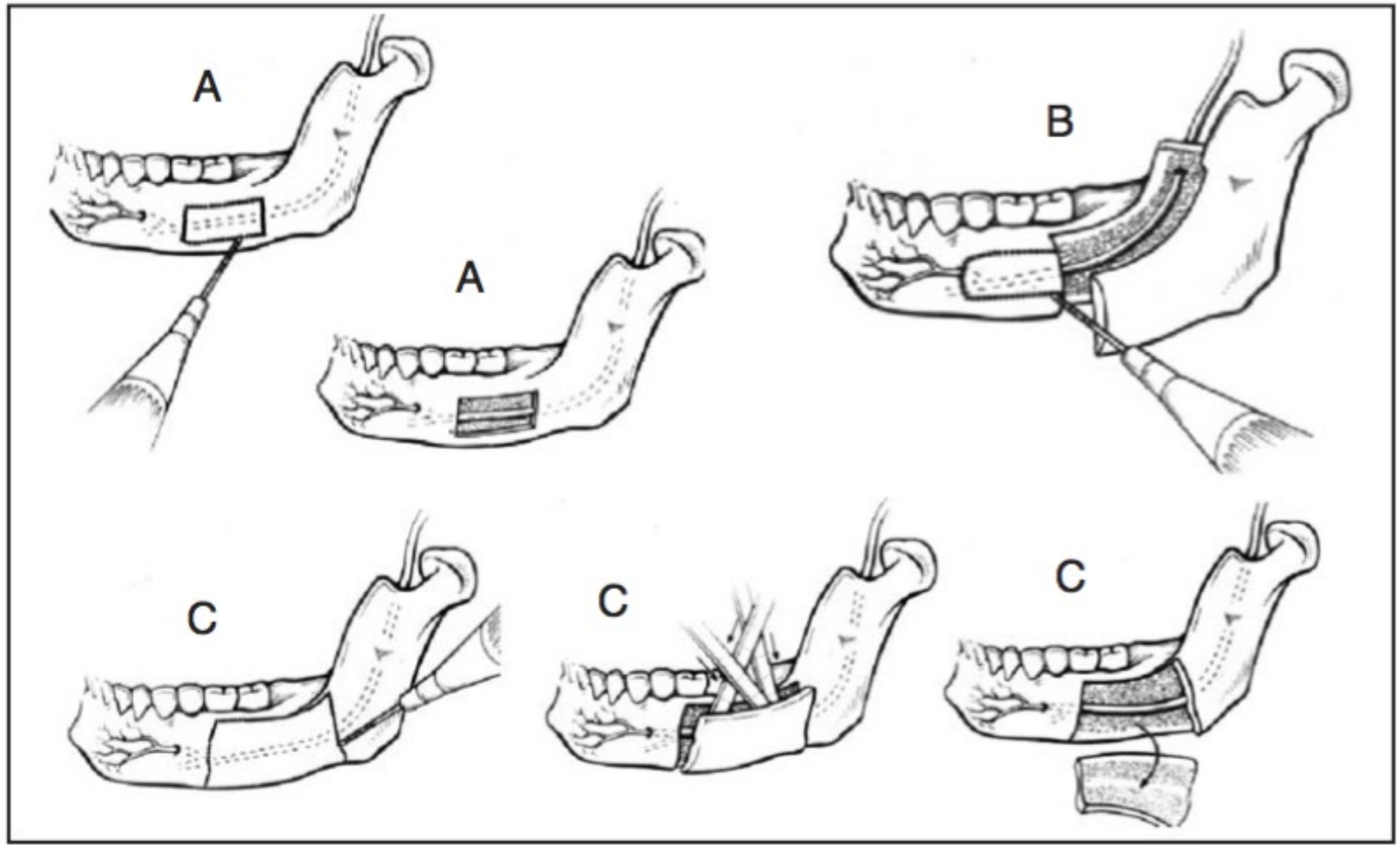
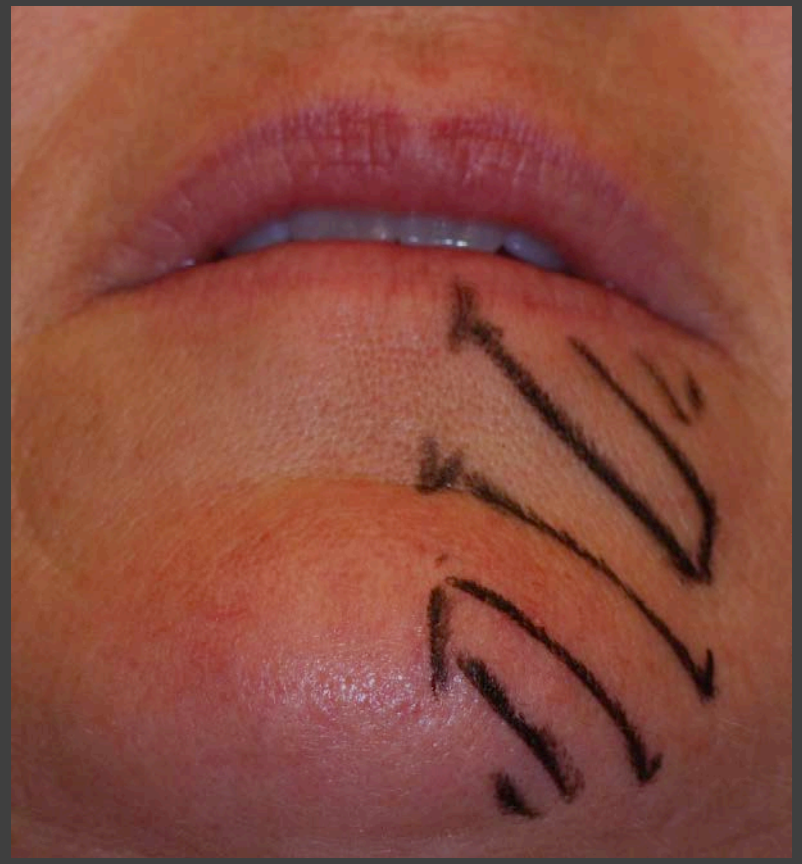
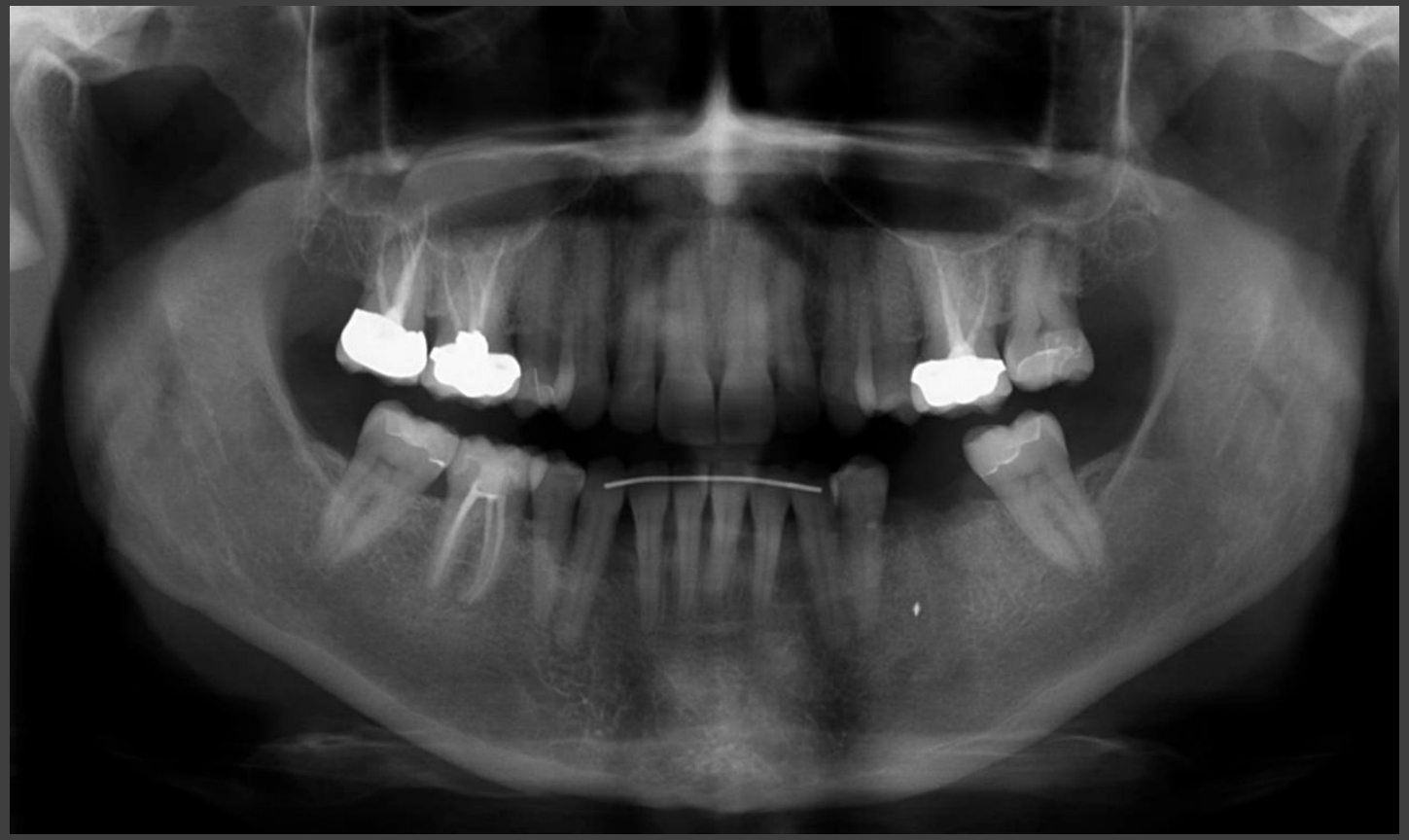
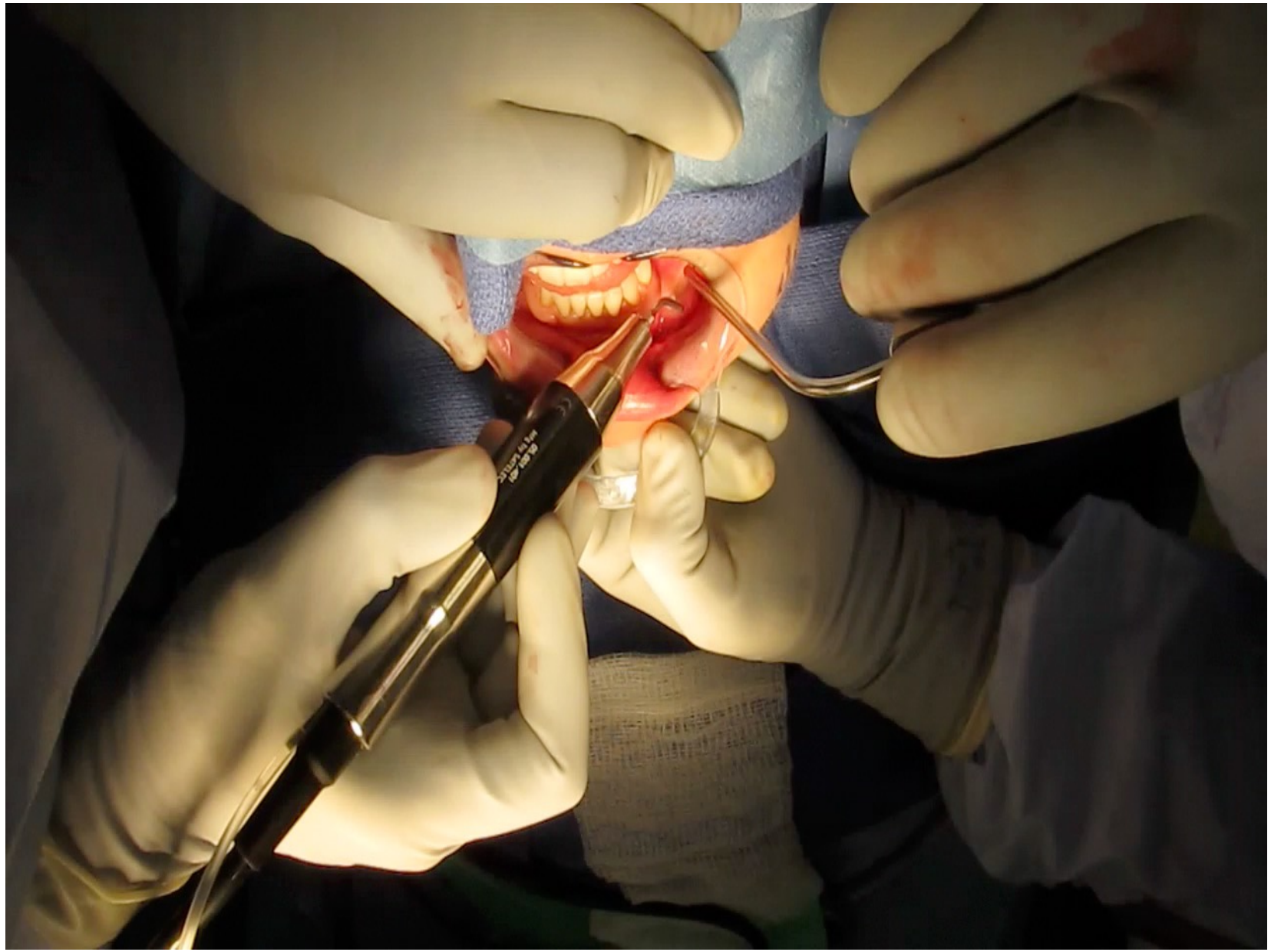
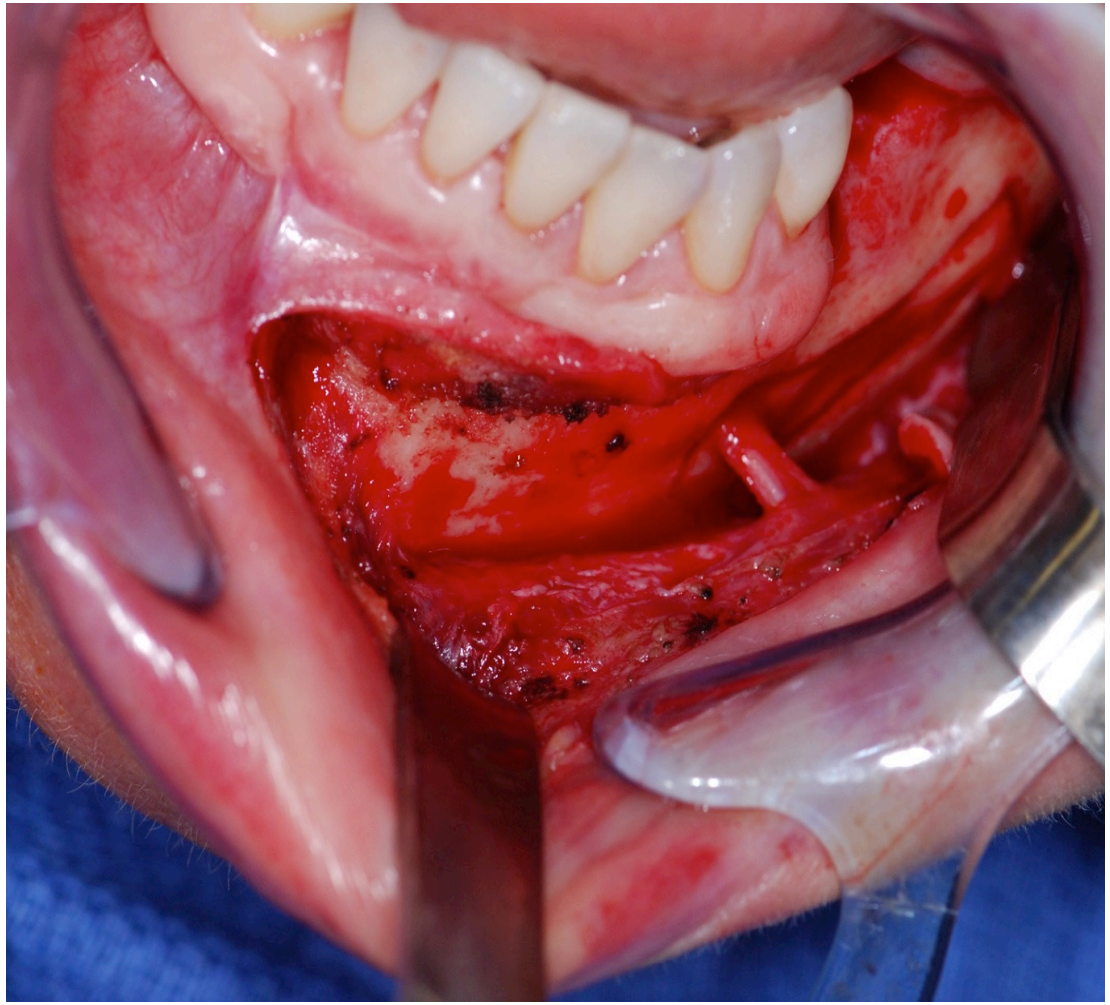


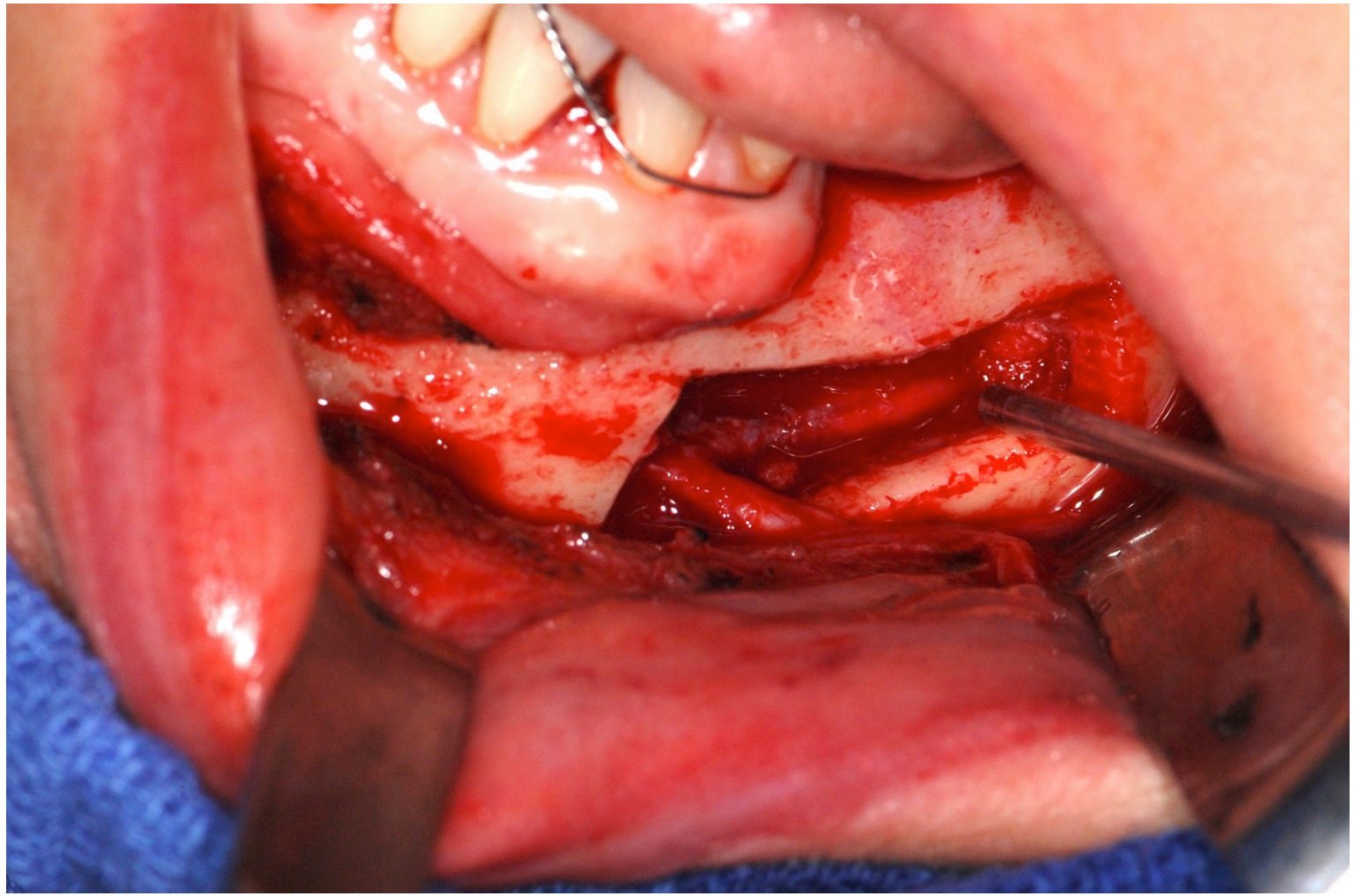

Fig 4.—Exposure techniques for the IAN. A. Lateral corticotomy. B. Sagittal split ramus osteotomy. C. Modified buccal corticotomy.

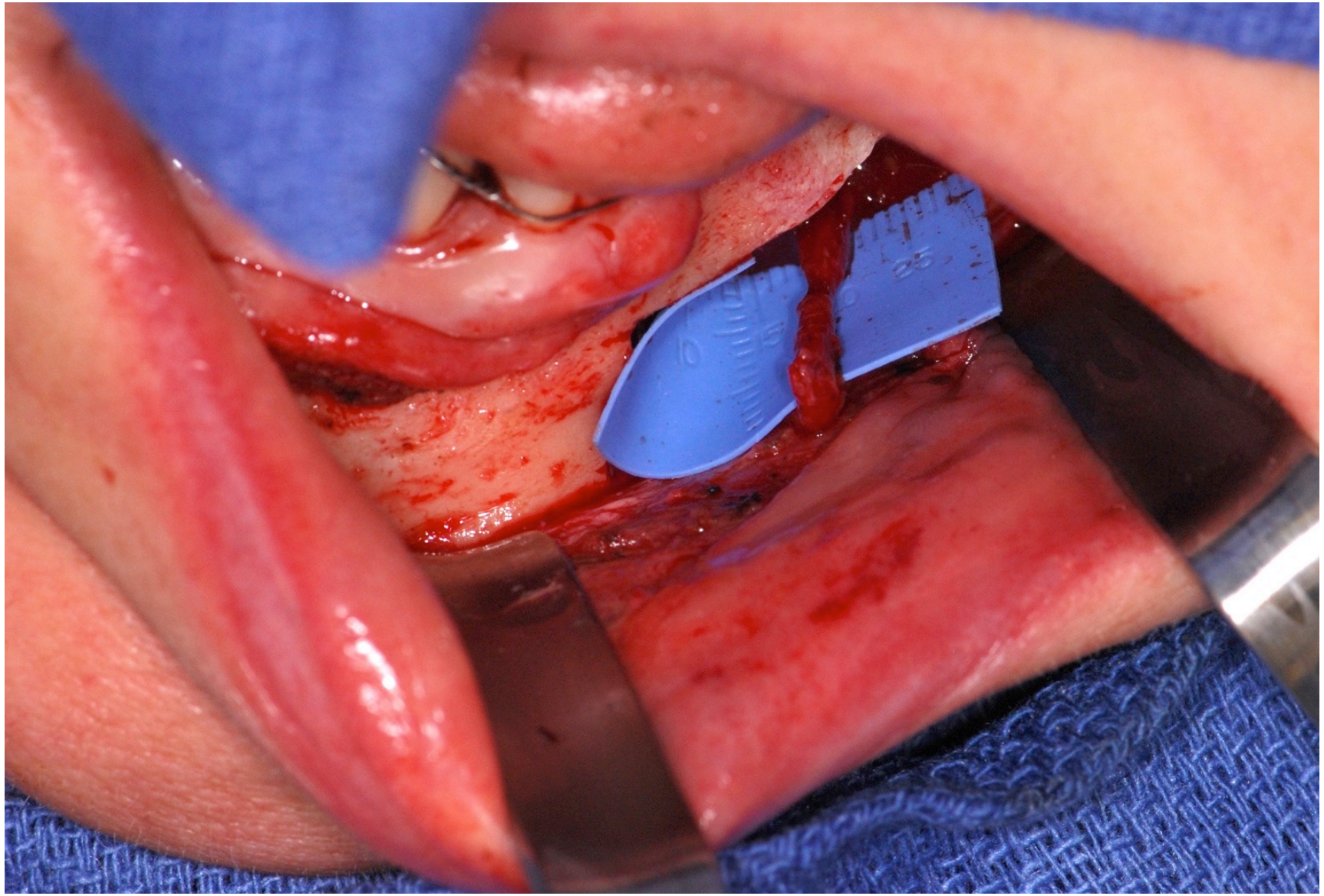


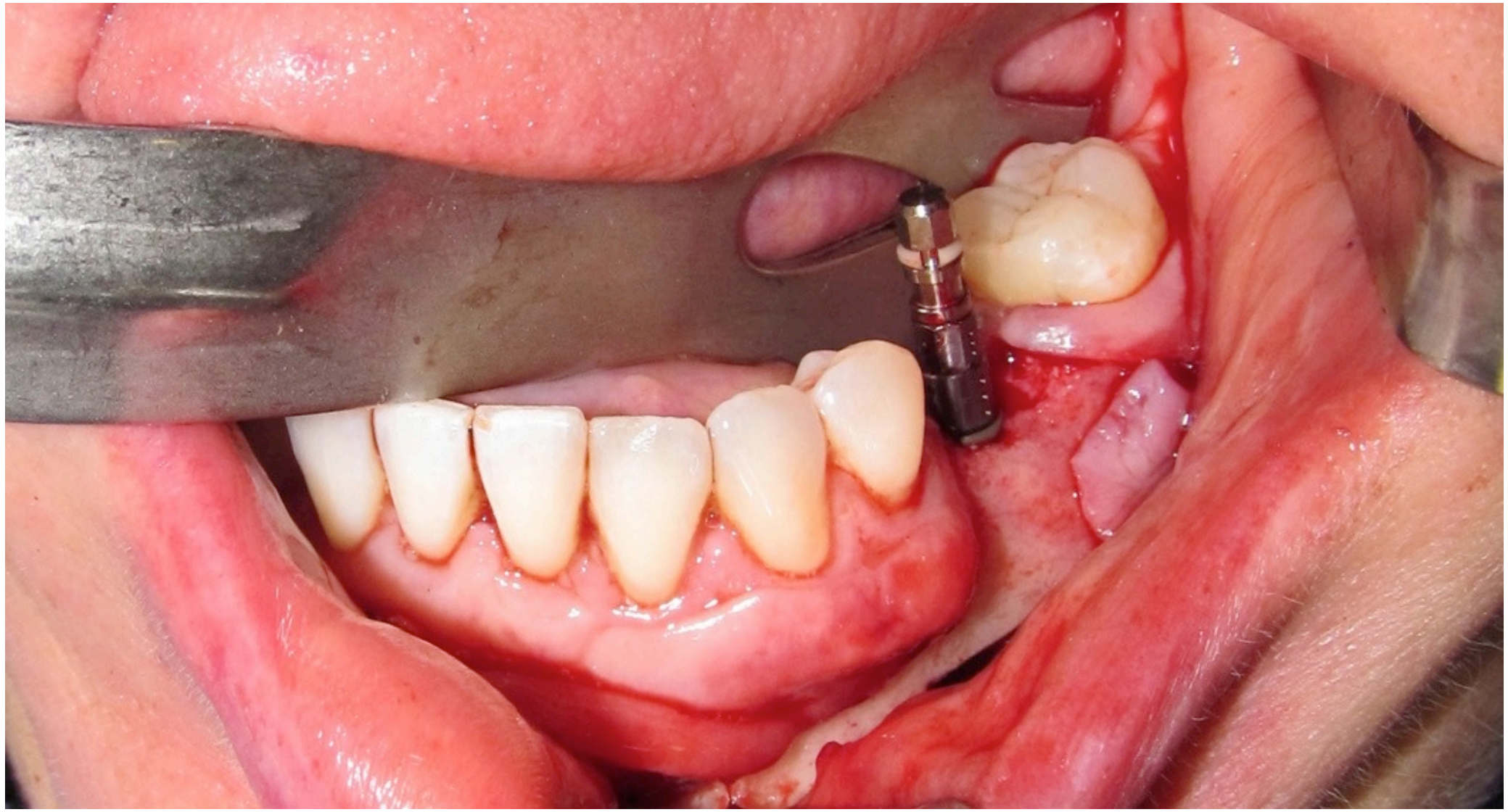


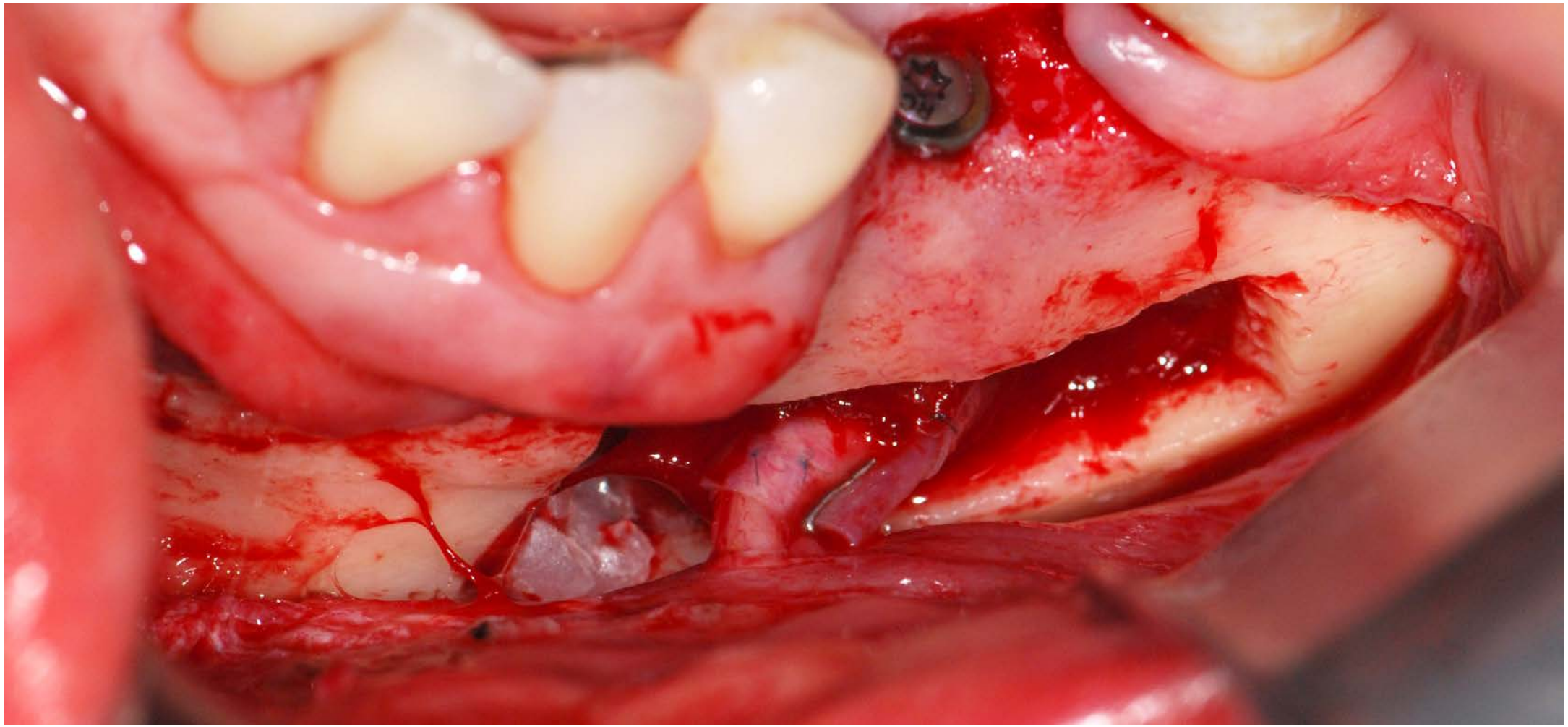


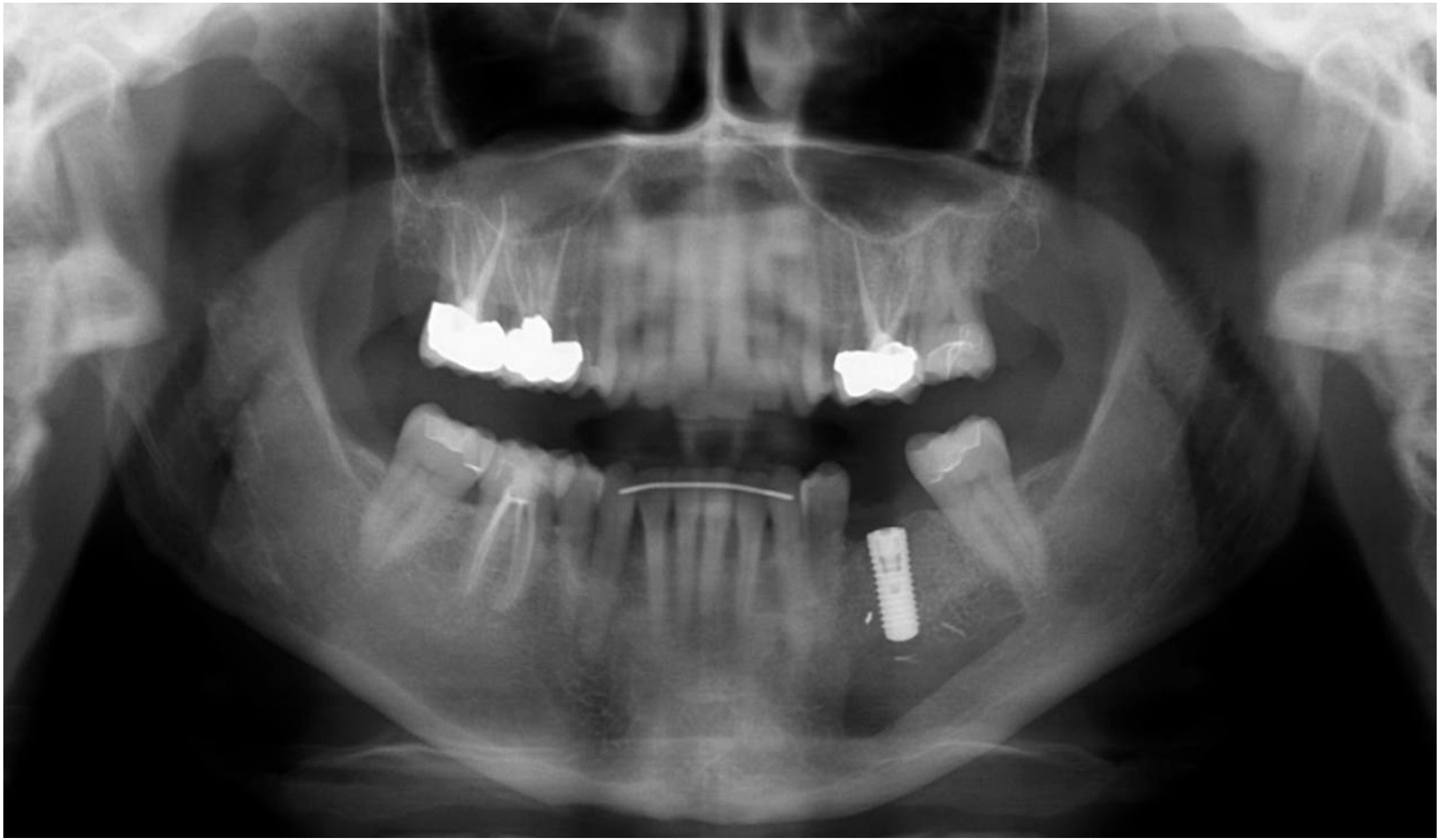


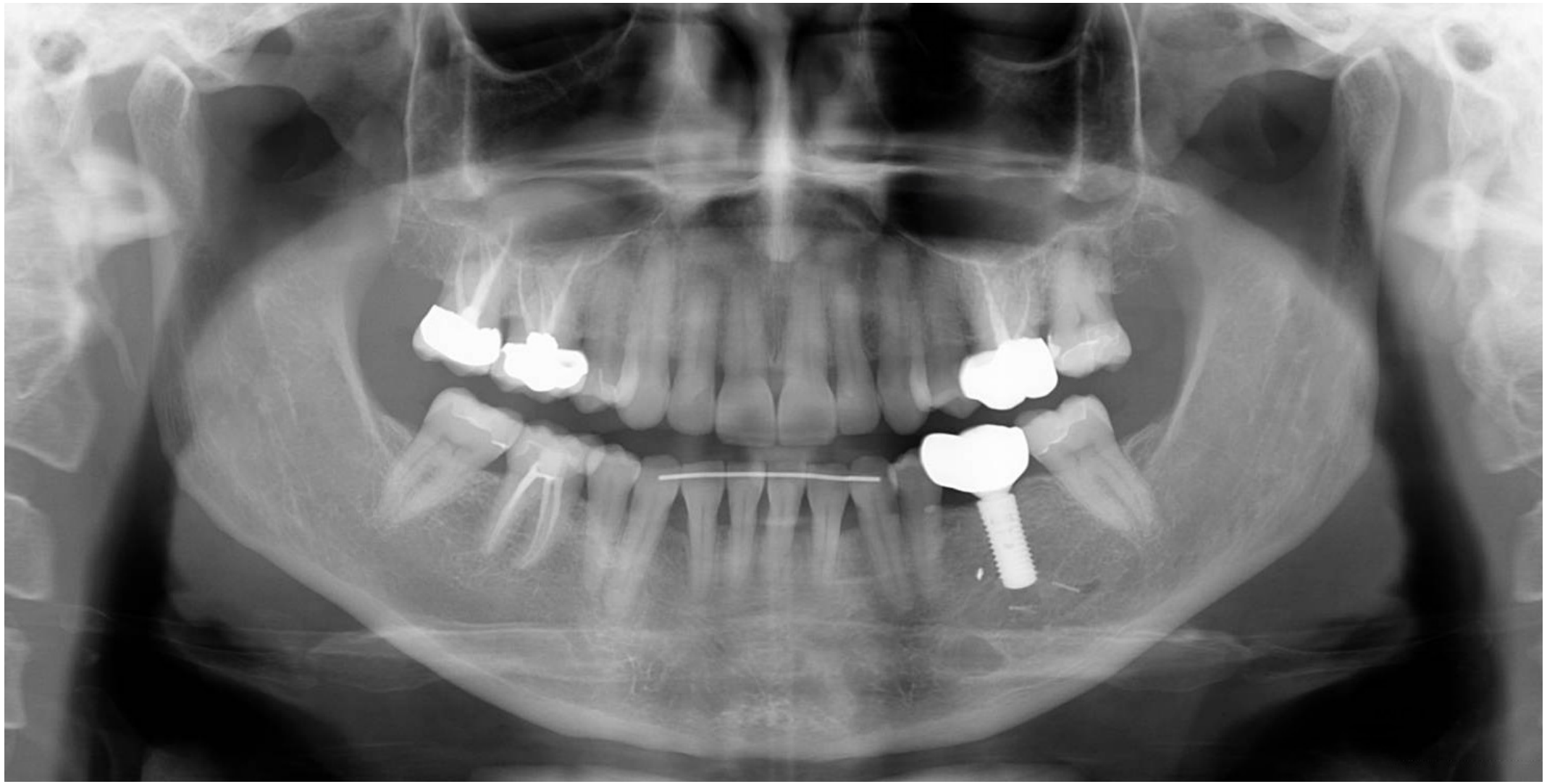






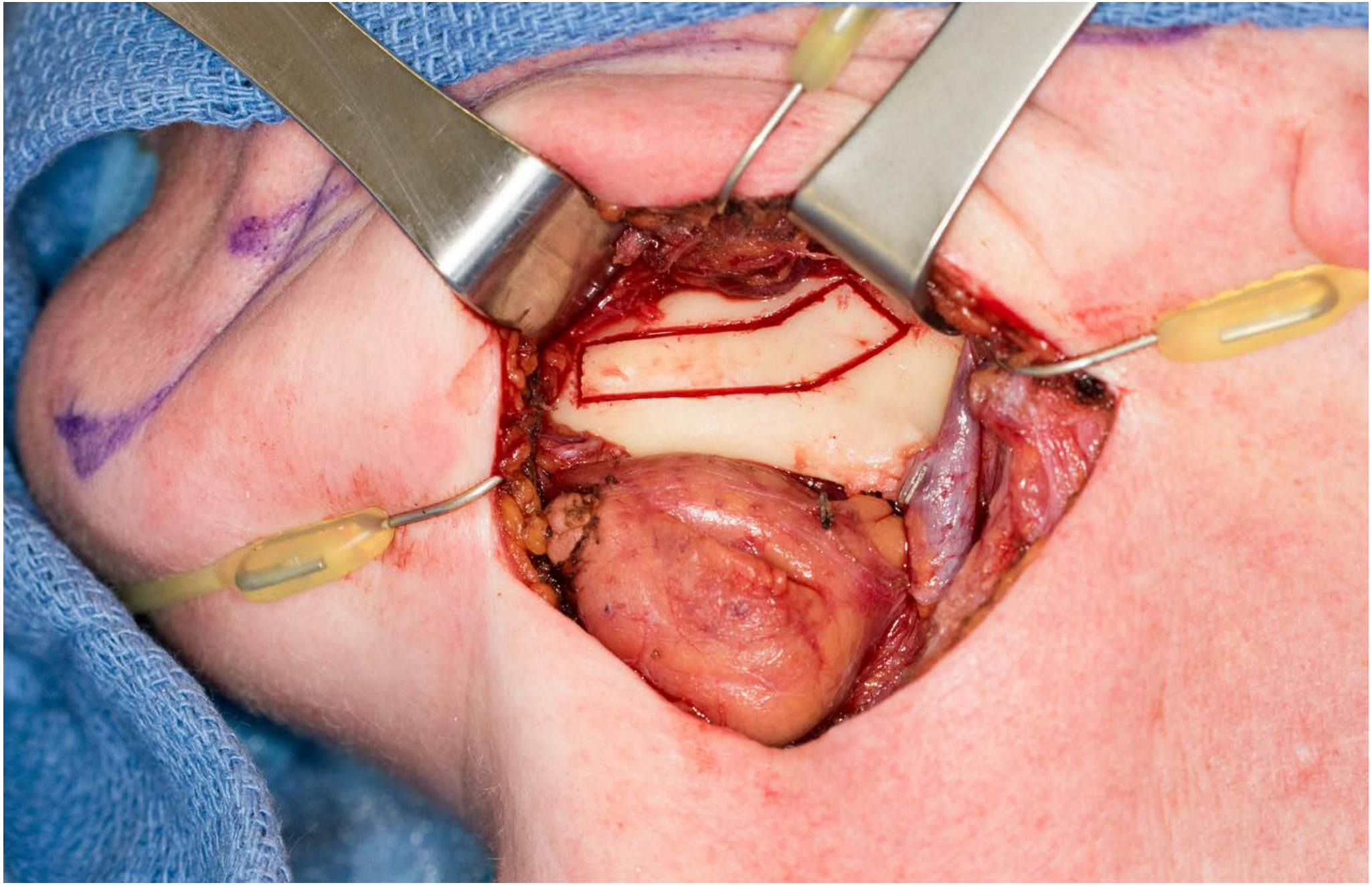


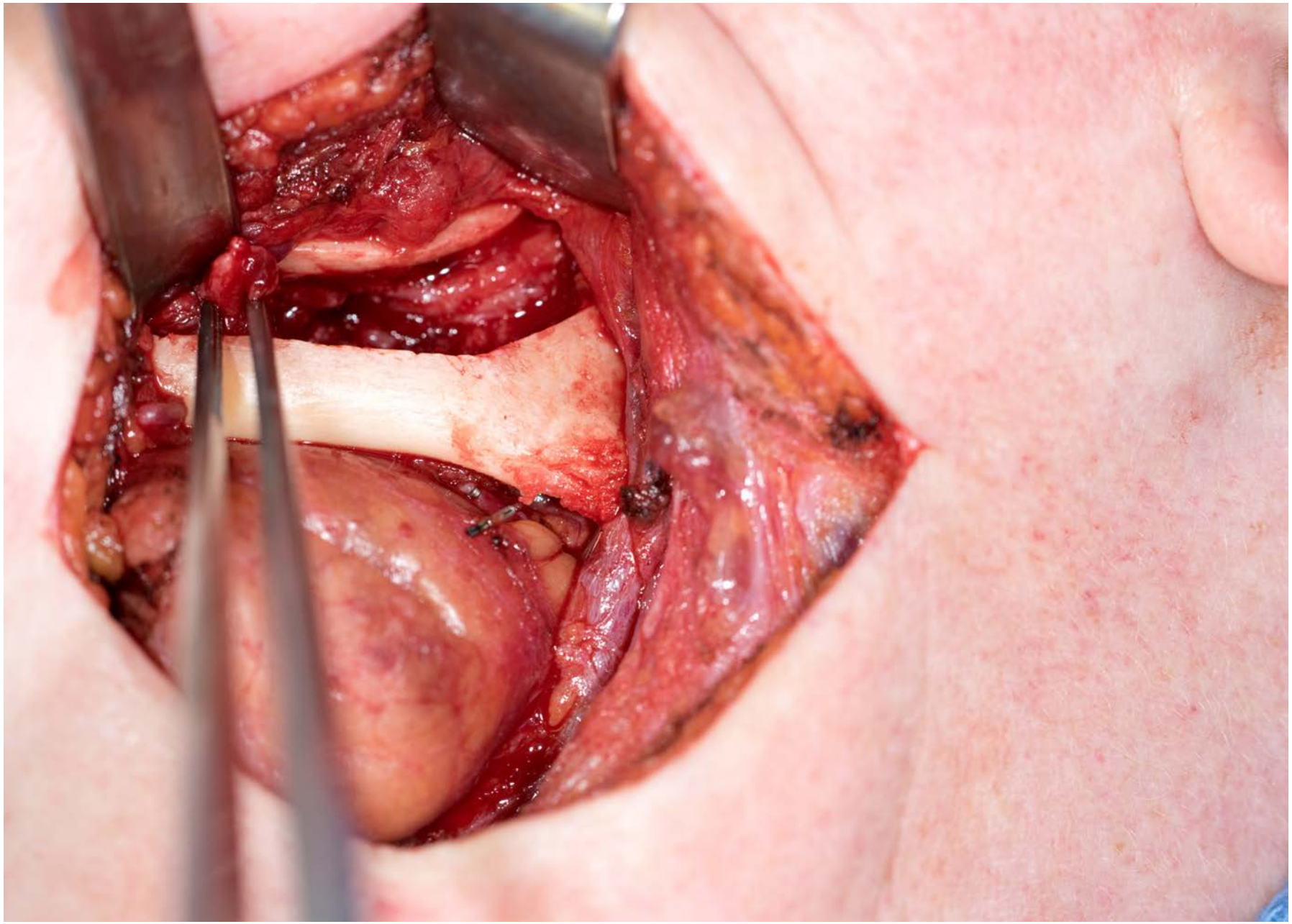




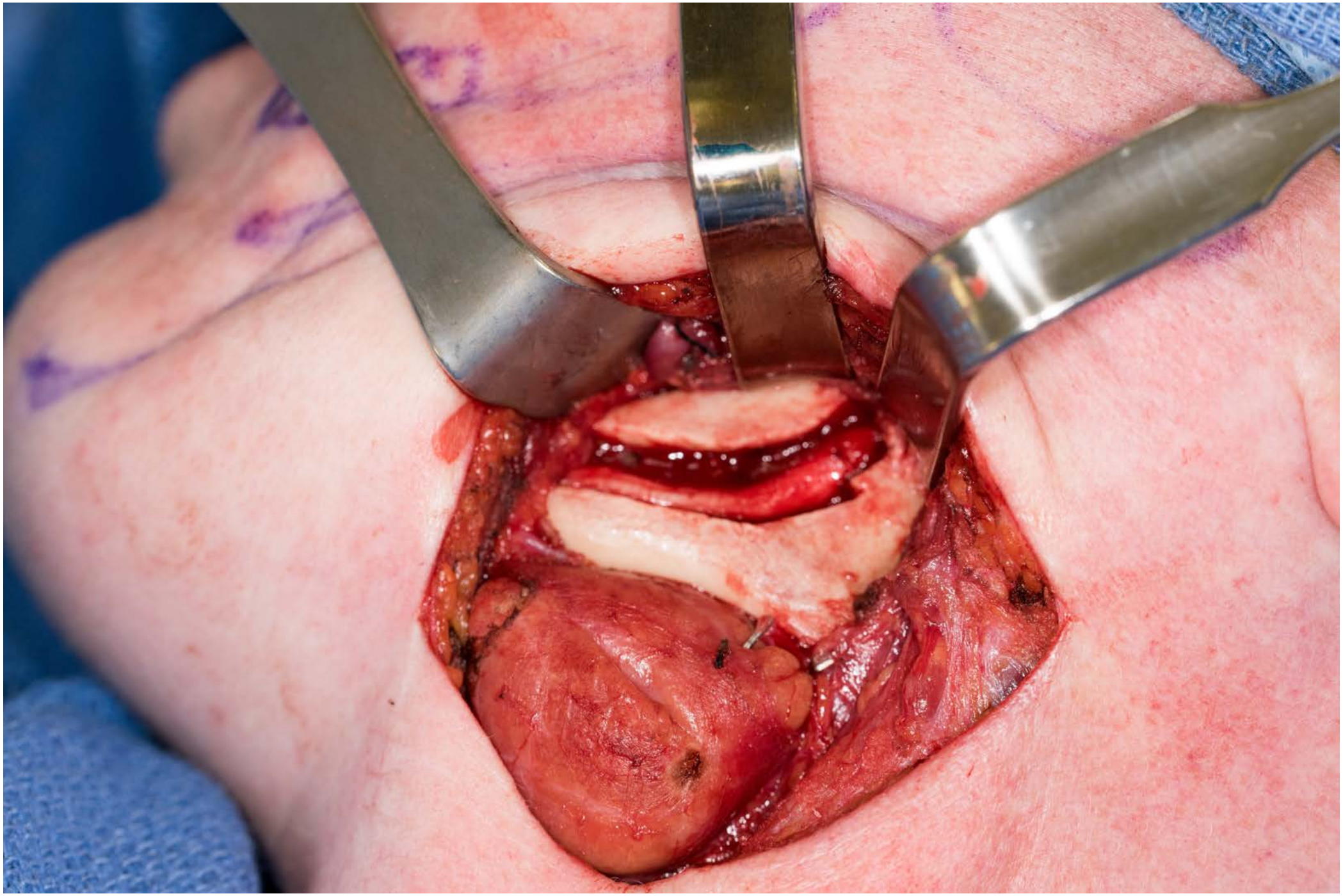
# 2 years postoperative NST

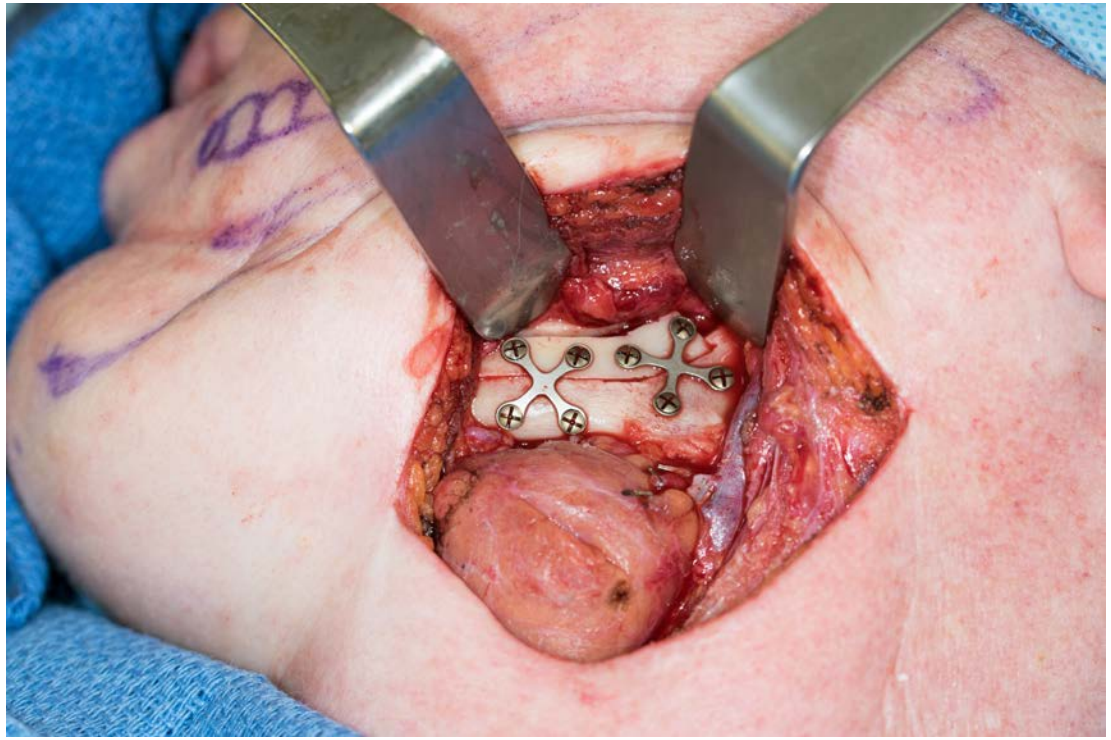
| | Right | Left |
|---|---|---|
| Light touch | intact | Directional intact (tingling sensation, but intact) |
| Coarse touch | intact | intact |
| Pain | intact | Good pain sensation |
| Two point discrimination | 10mm | 11mm |

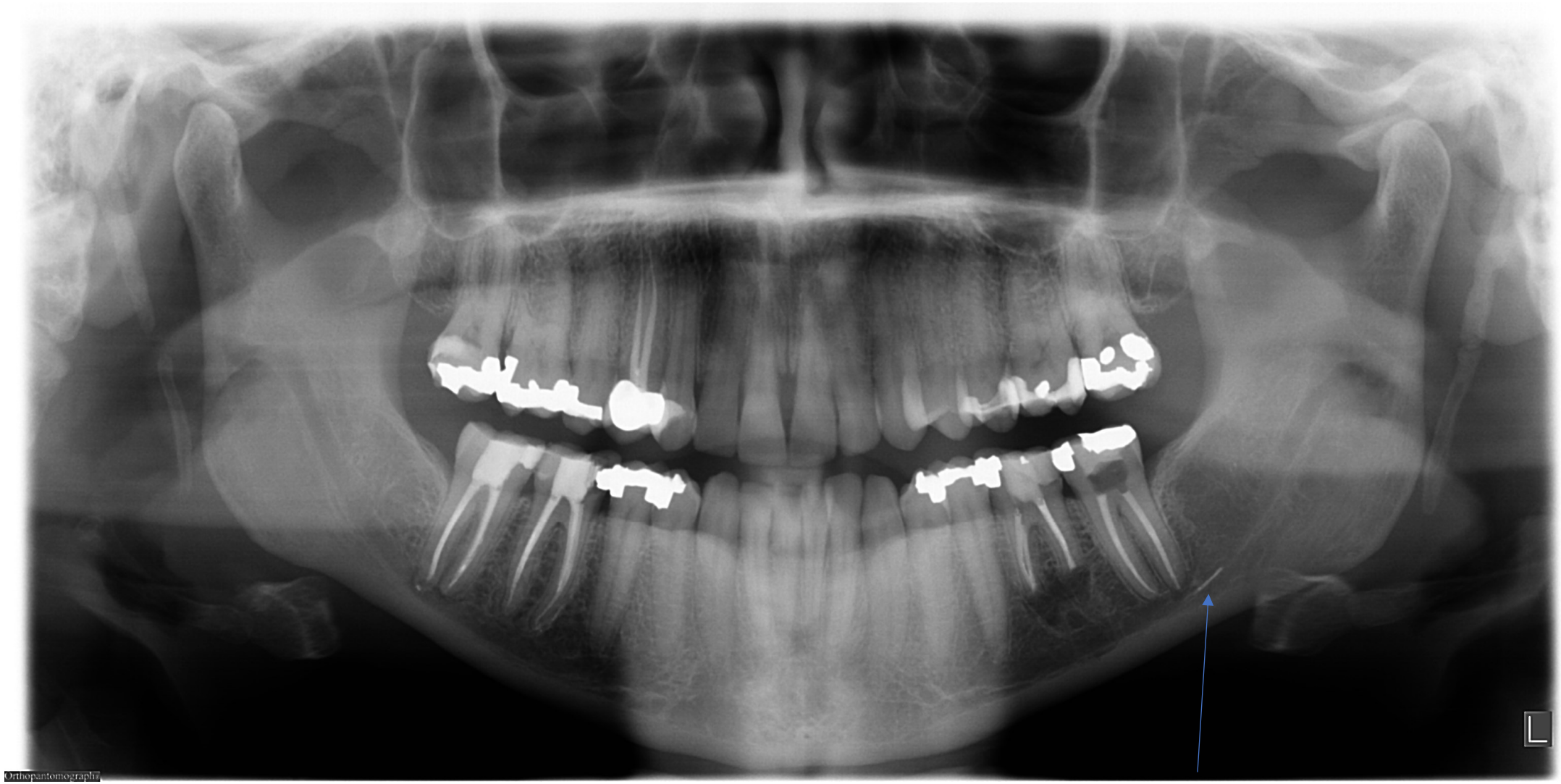




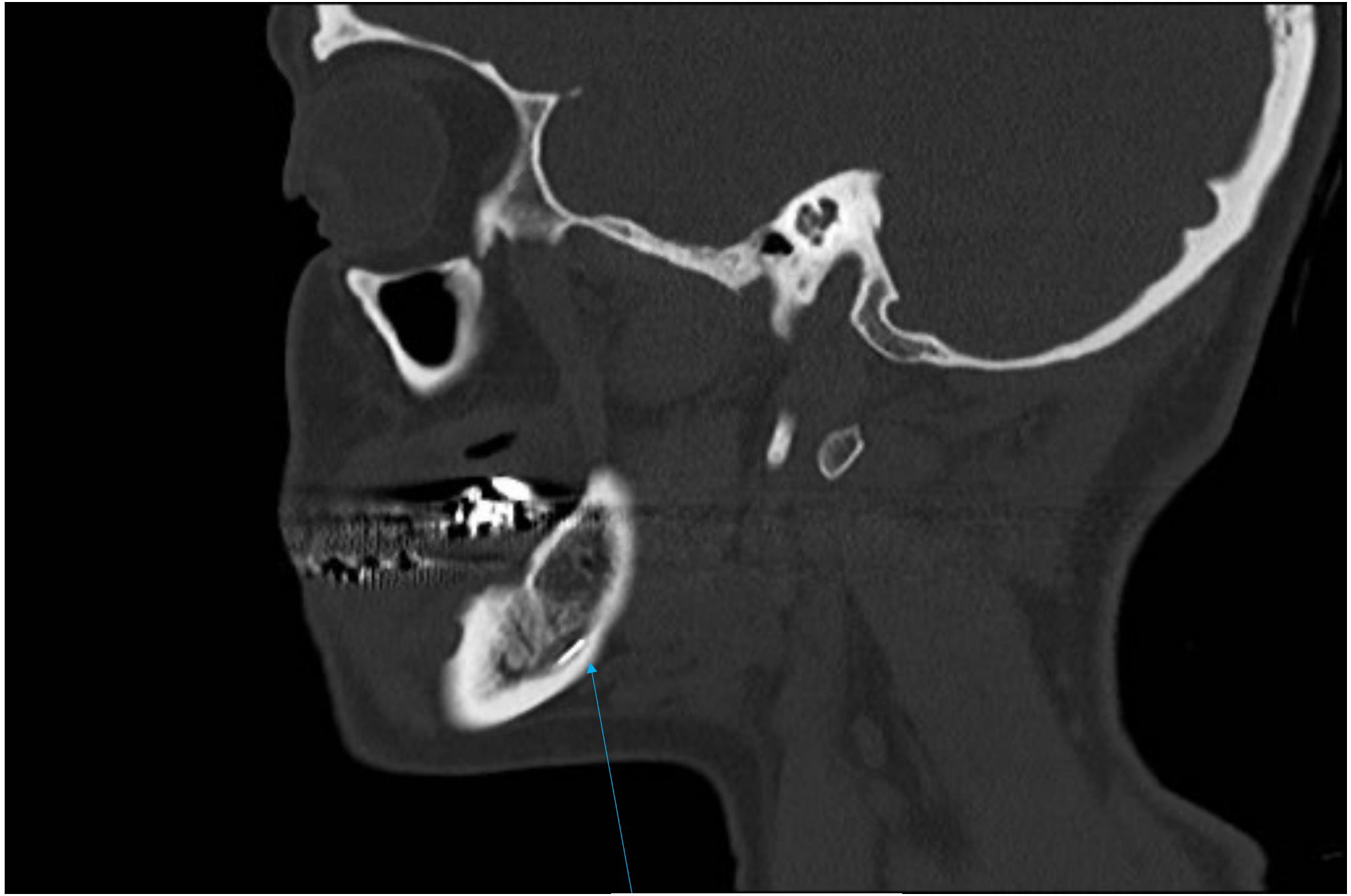

10
2



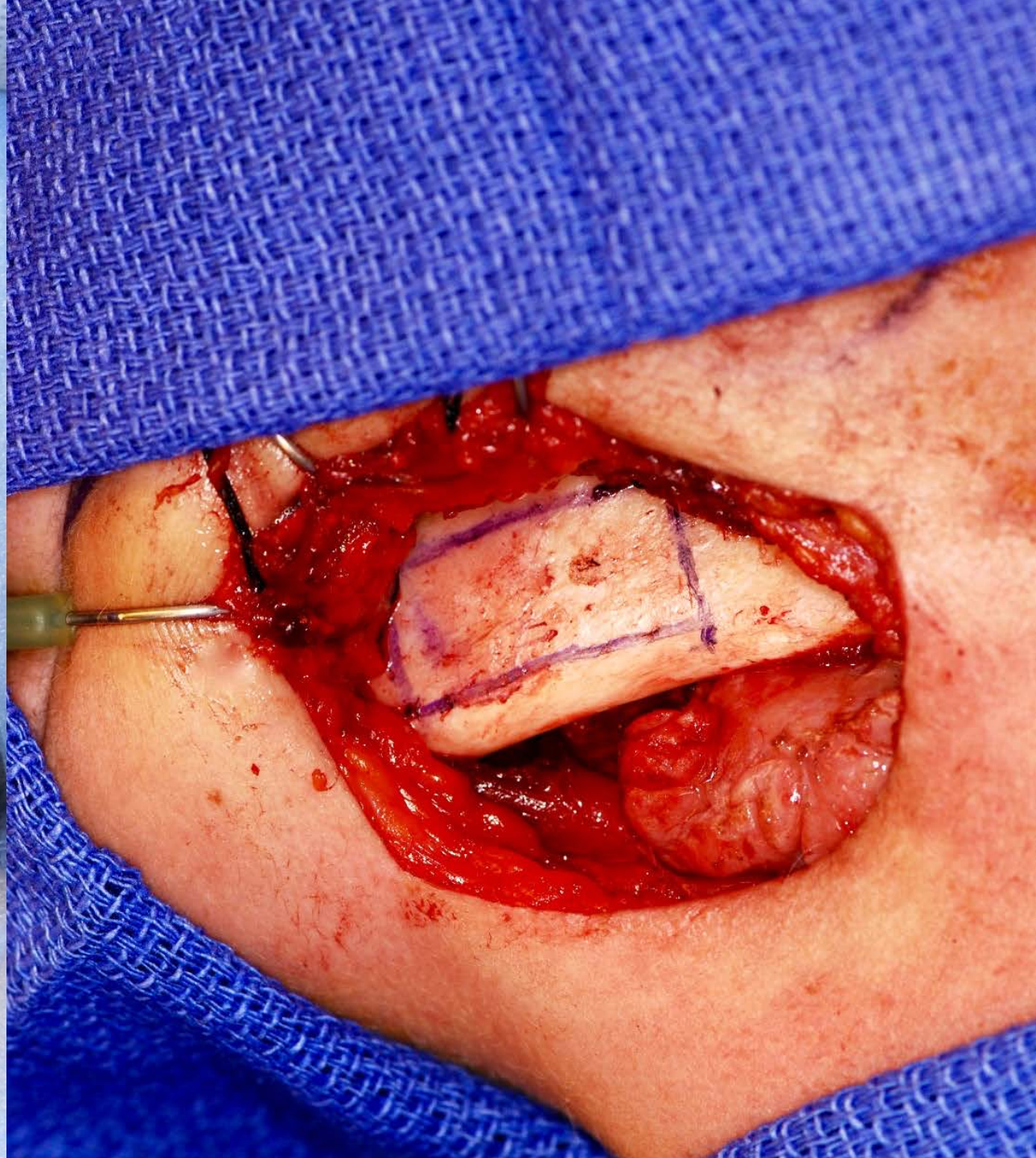


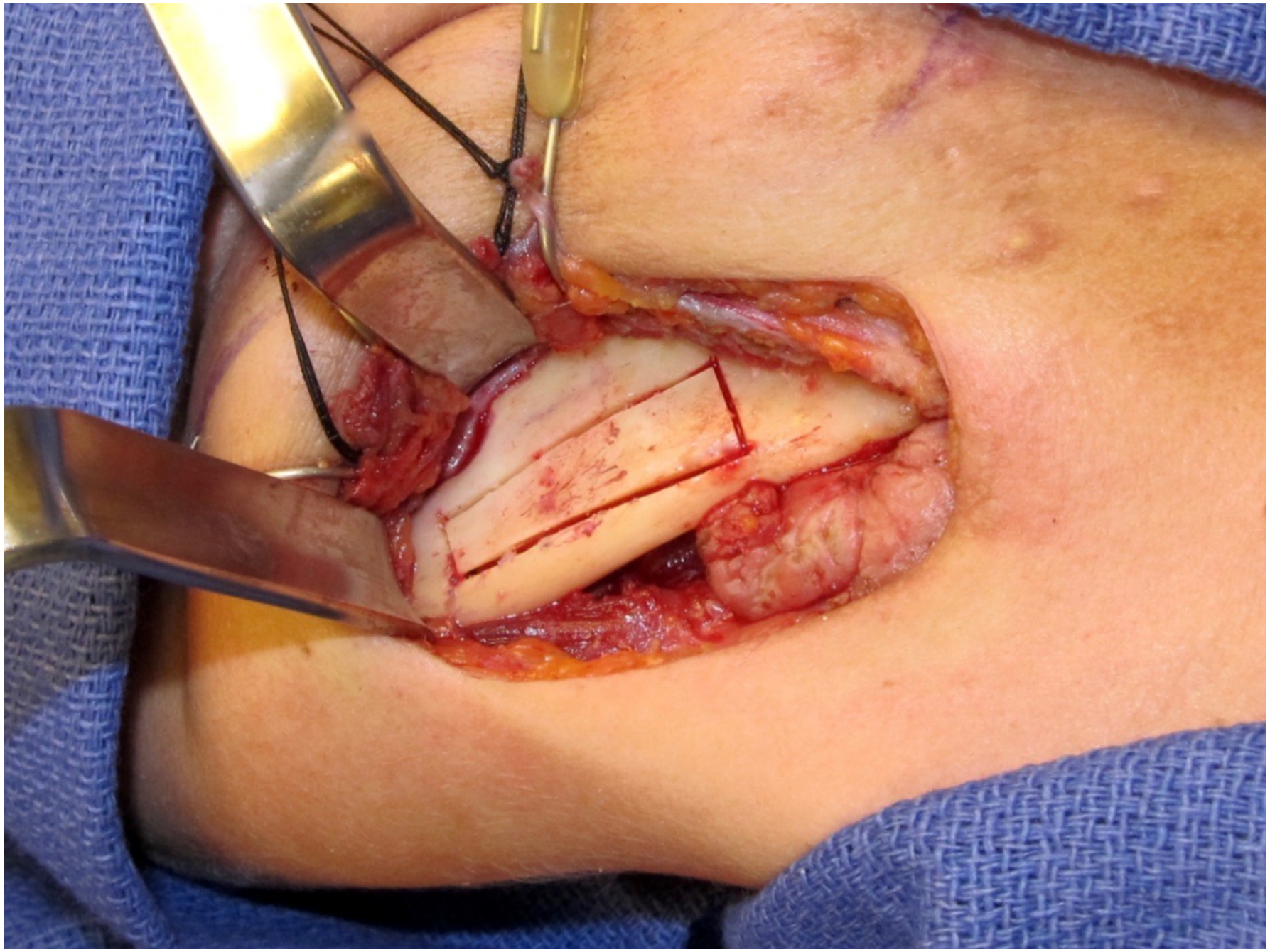


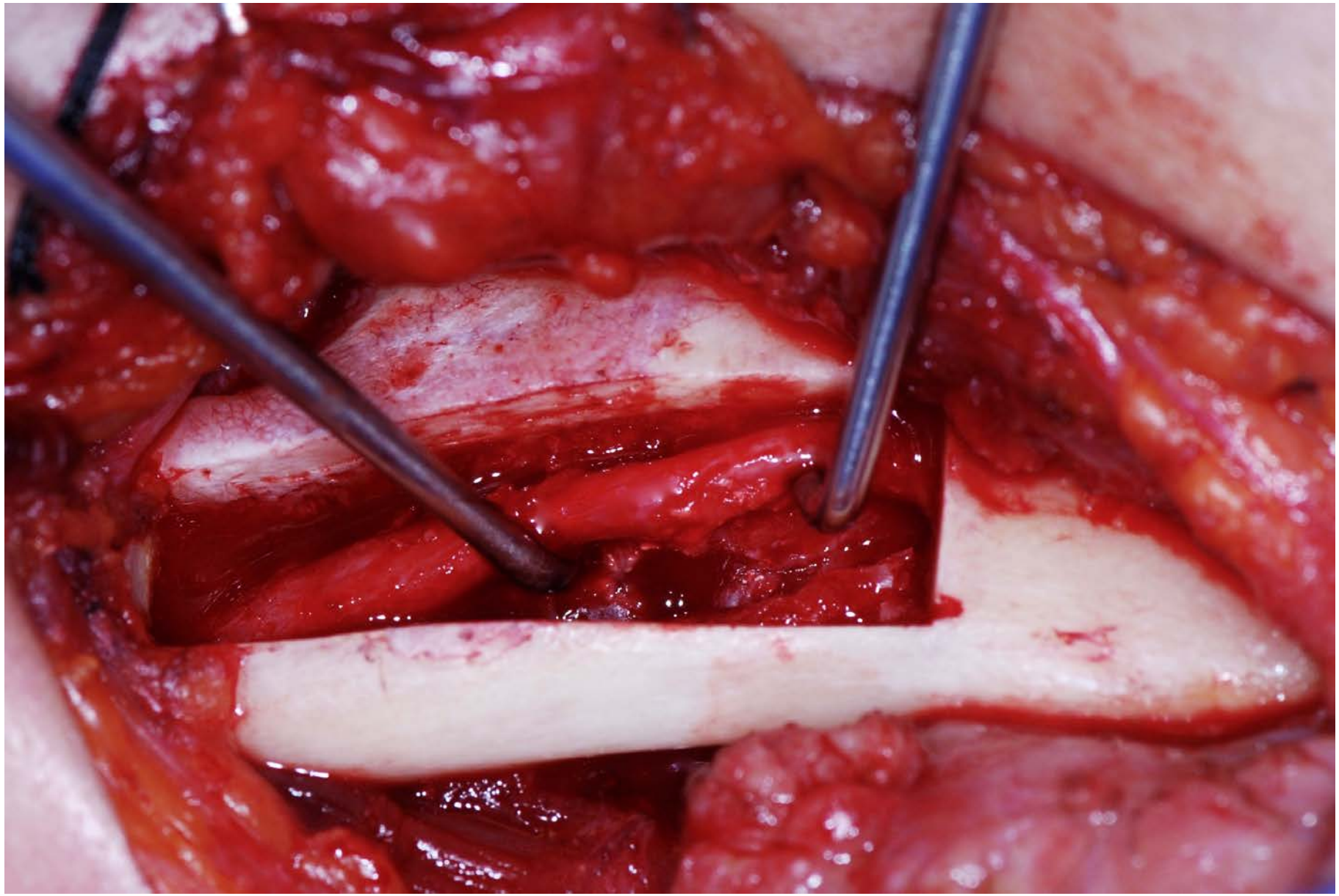

Foreign Body In IAN Canal

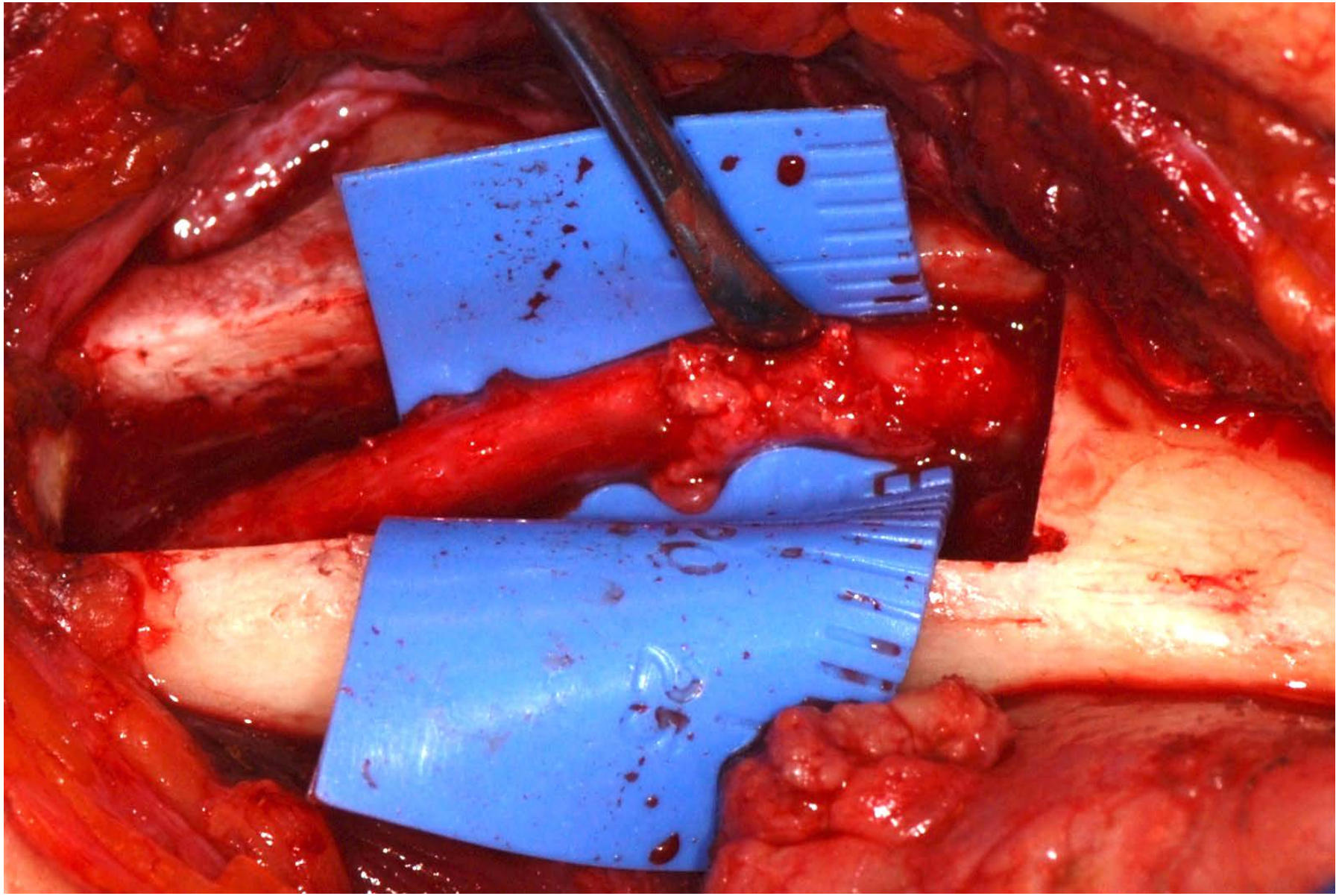


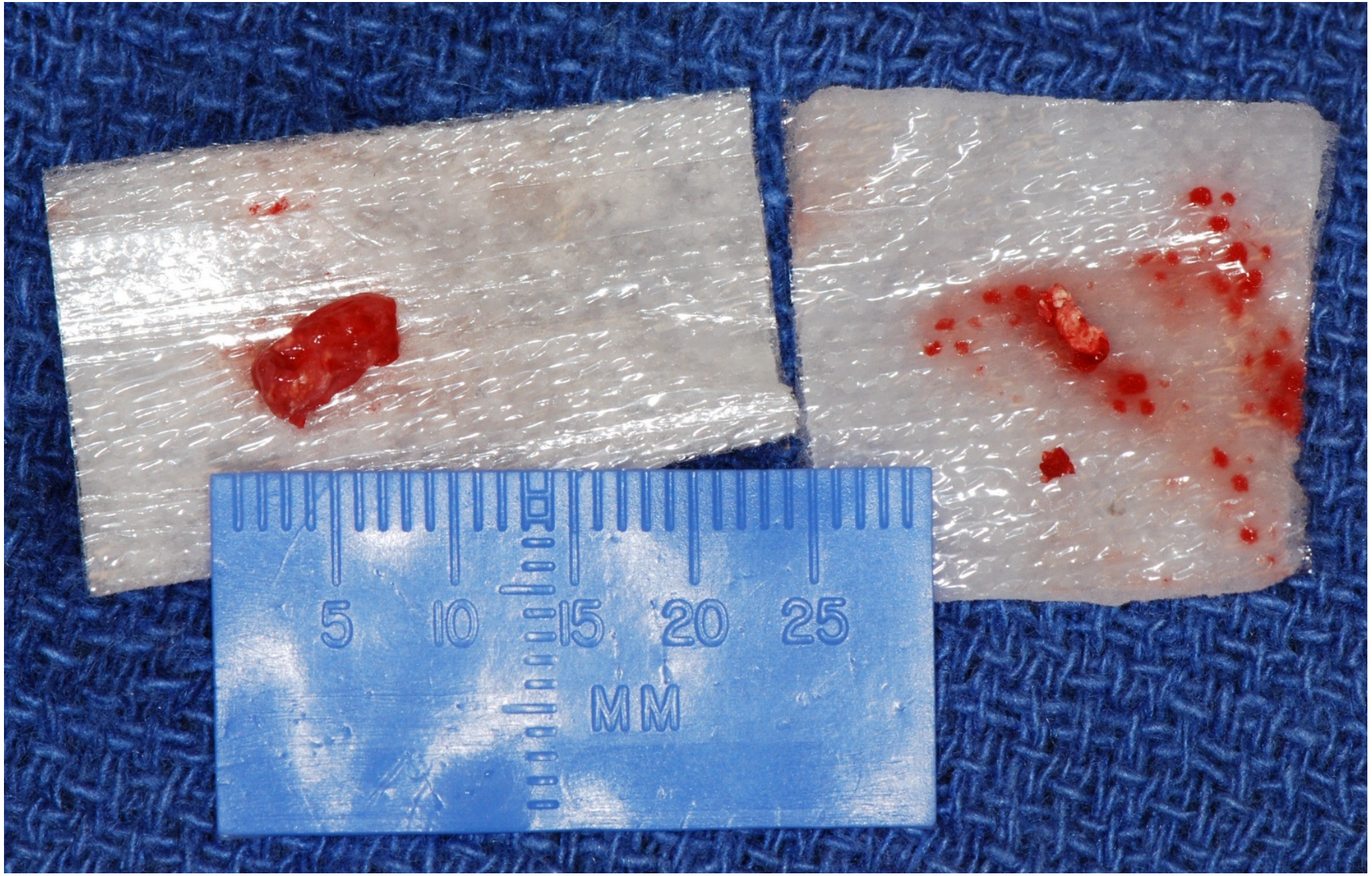
Foreign Body In IAN Canal

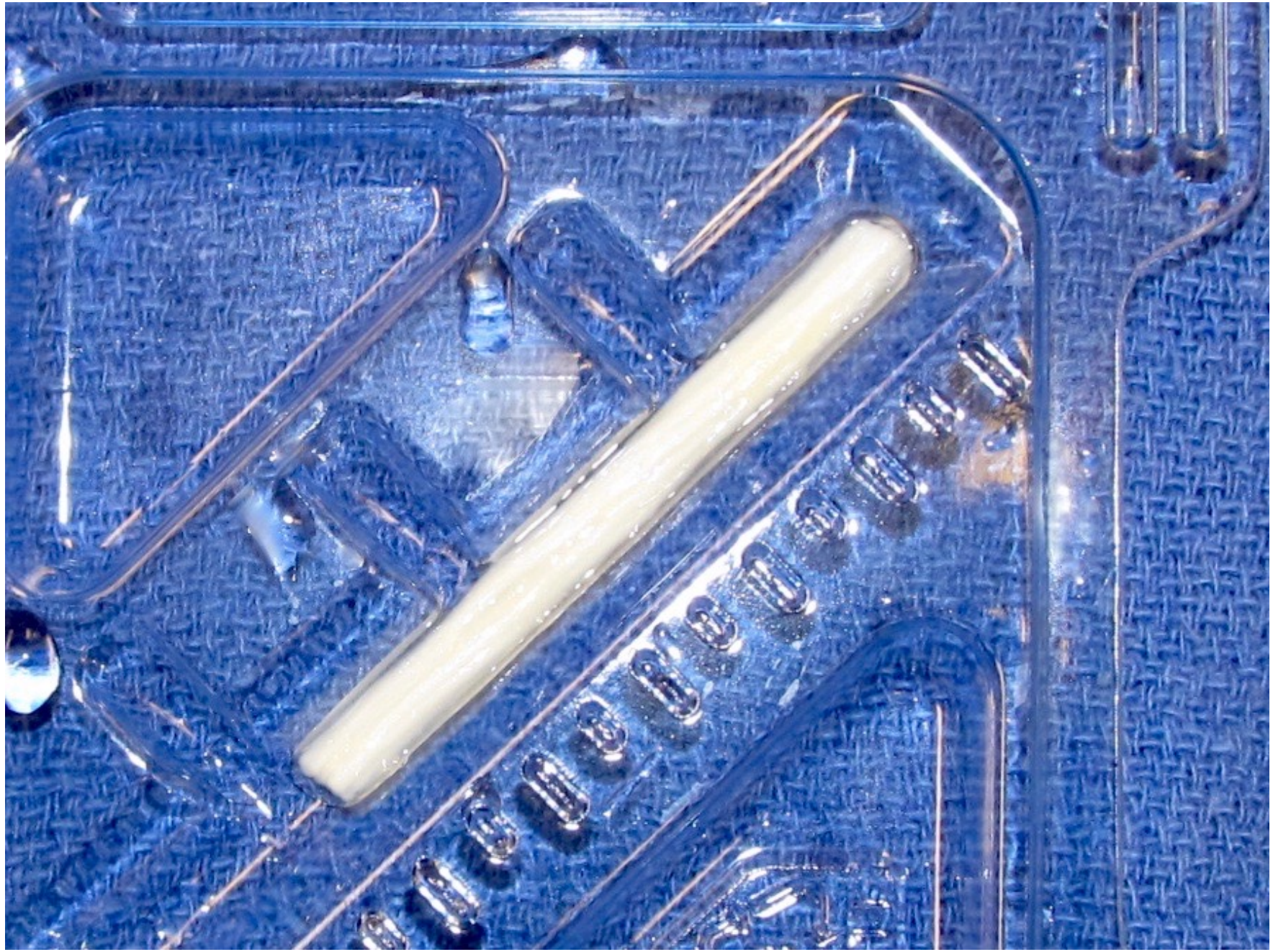


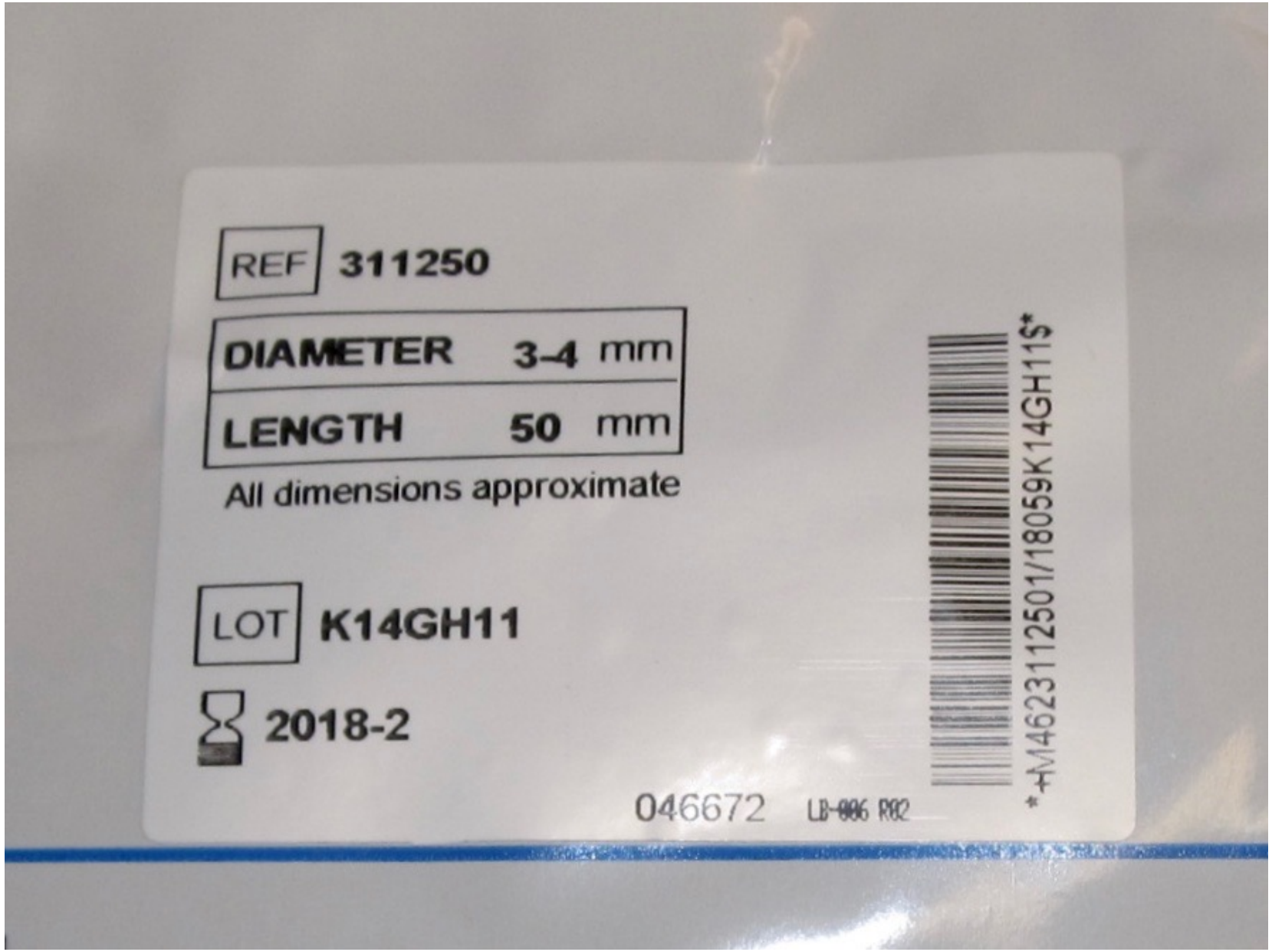


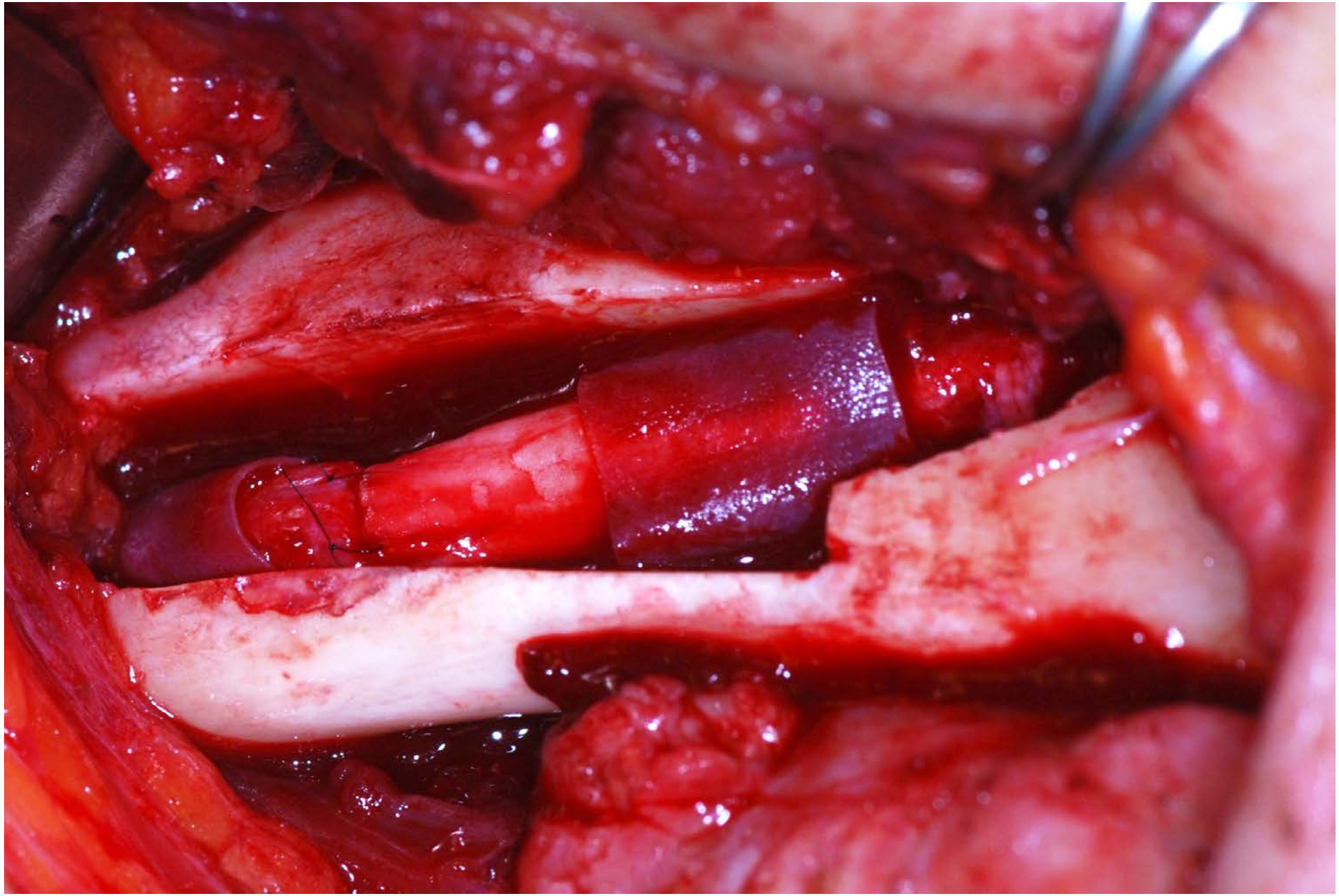


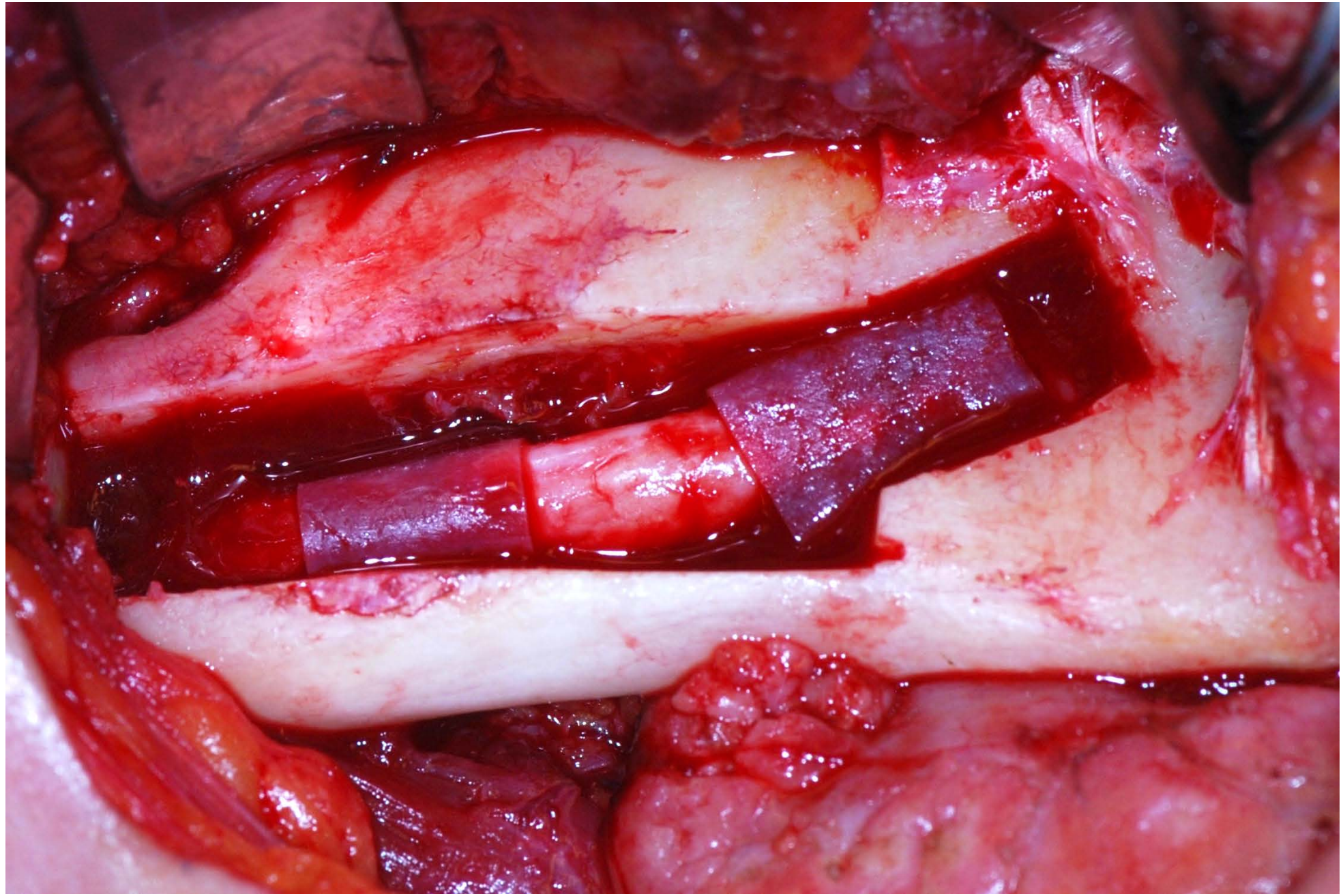


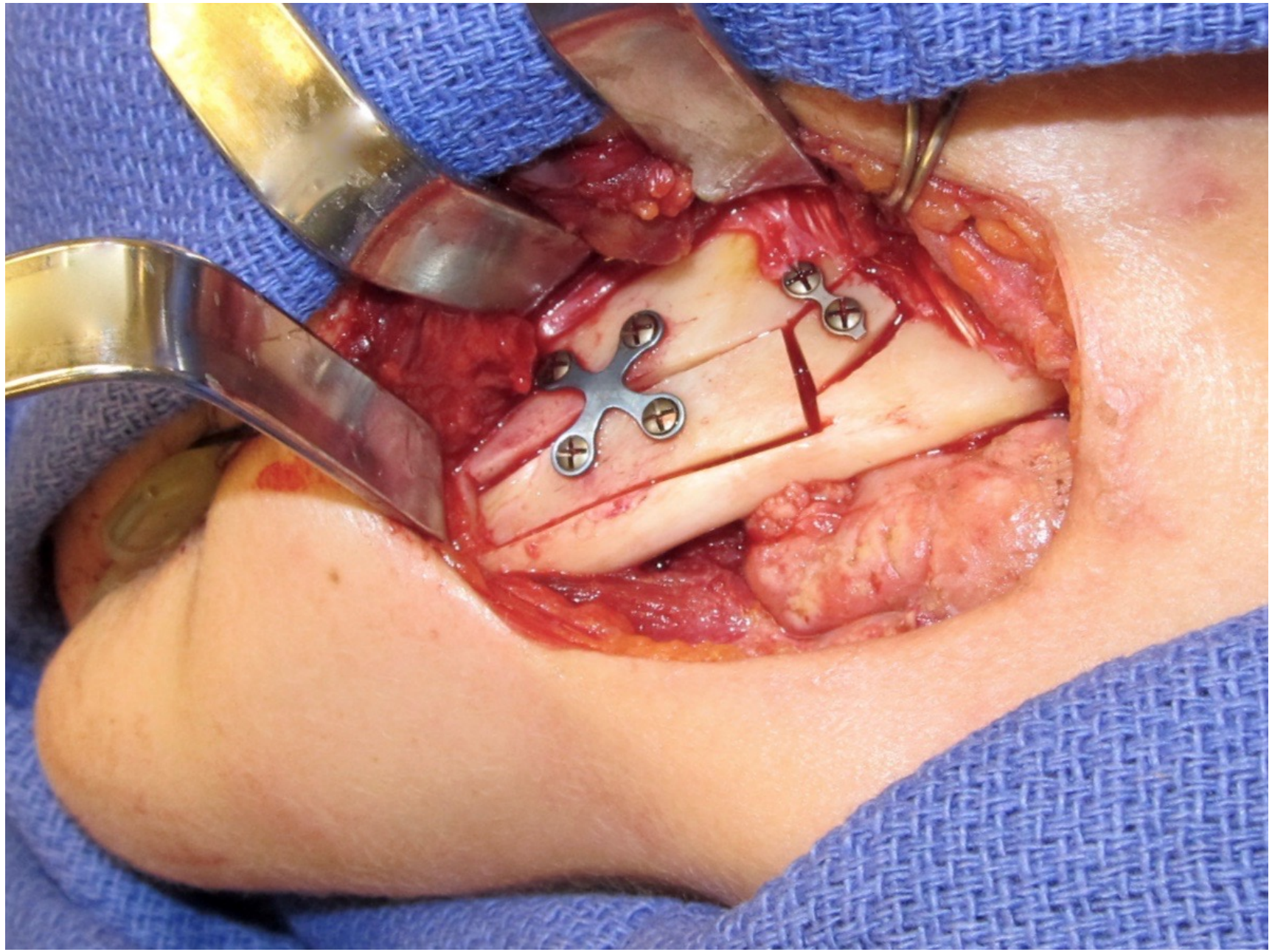

5
10
15
20
25
MM

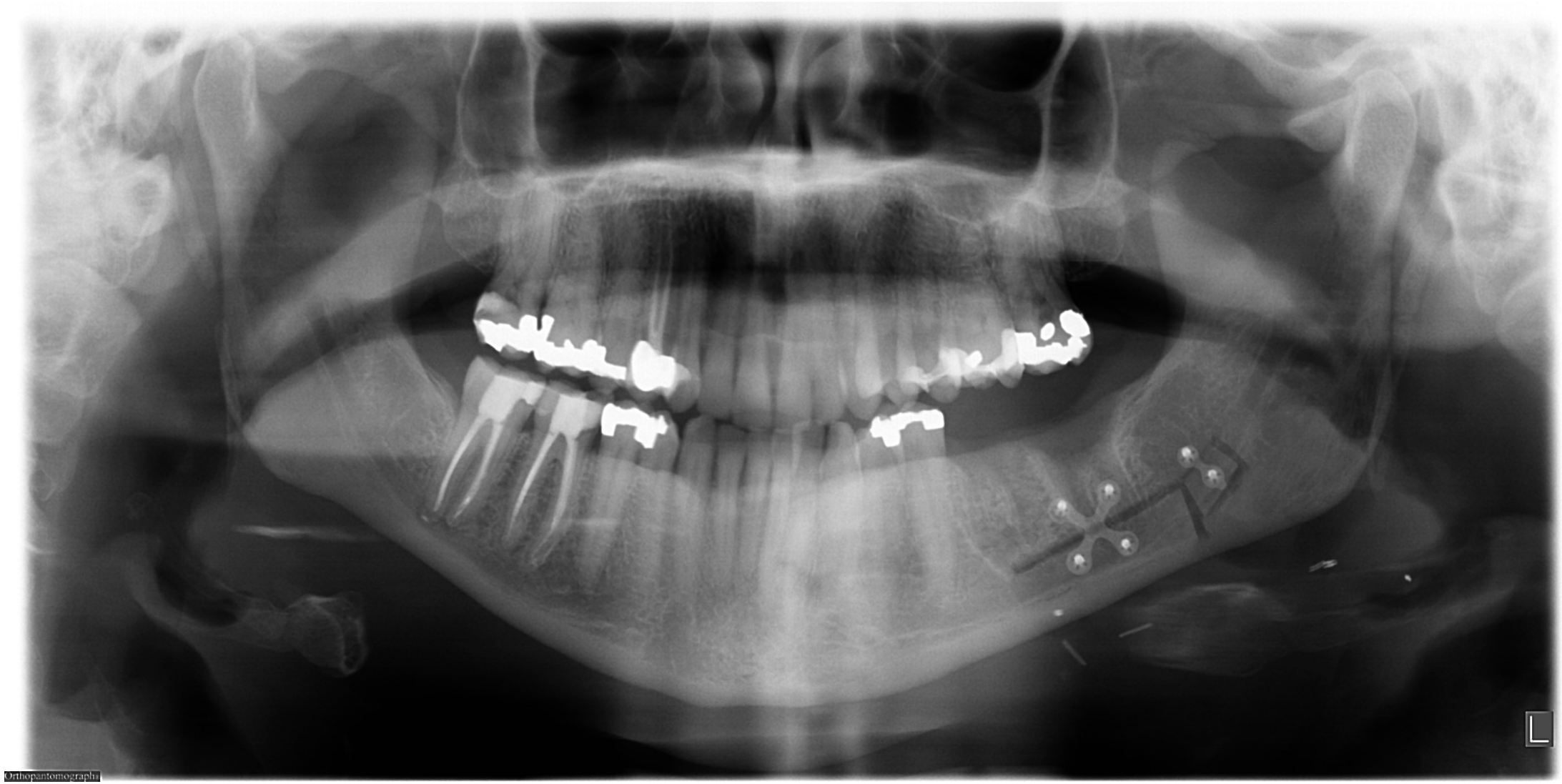



REF 311250
DIAMETER 3-4 mm
LENGTH 50 mm
All dimensions approximate
LOT K14GH11
2018-2
046672
*+M4623112501/18059K14GH11S*



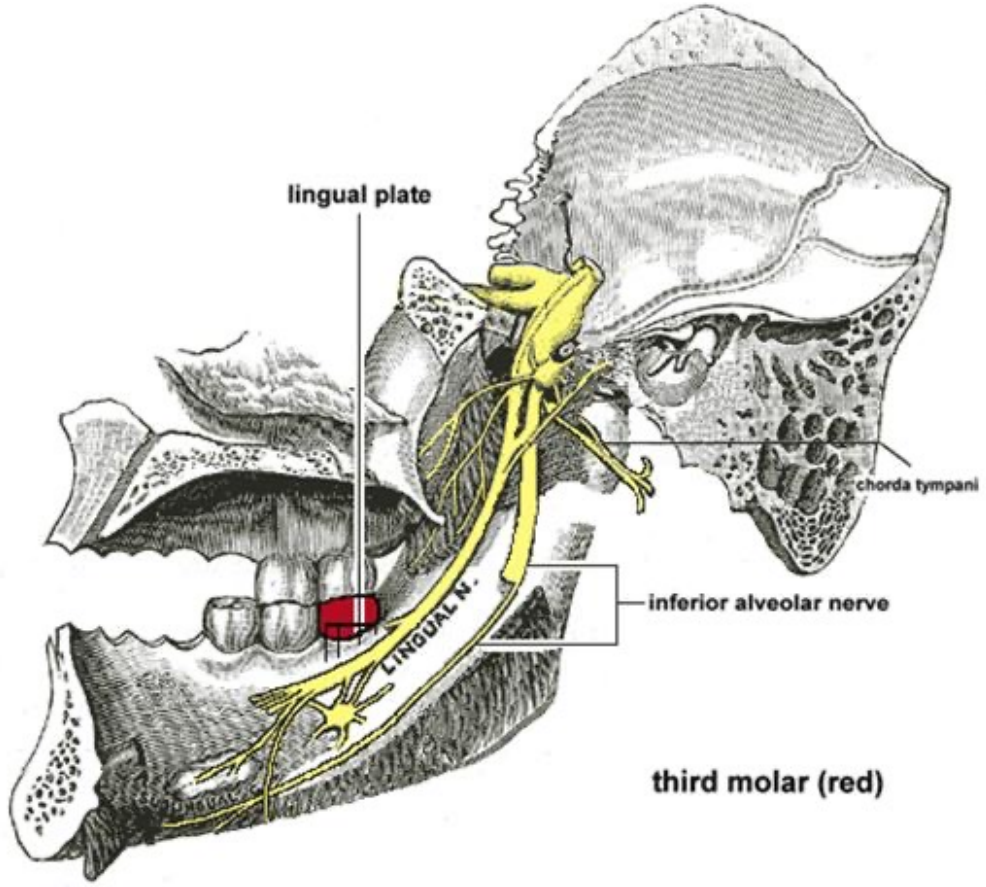





Orthopantomograph

# Lingual nerve anatomy

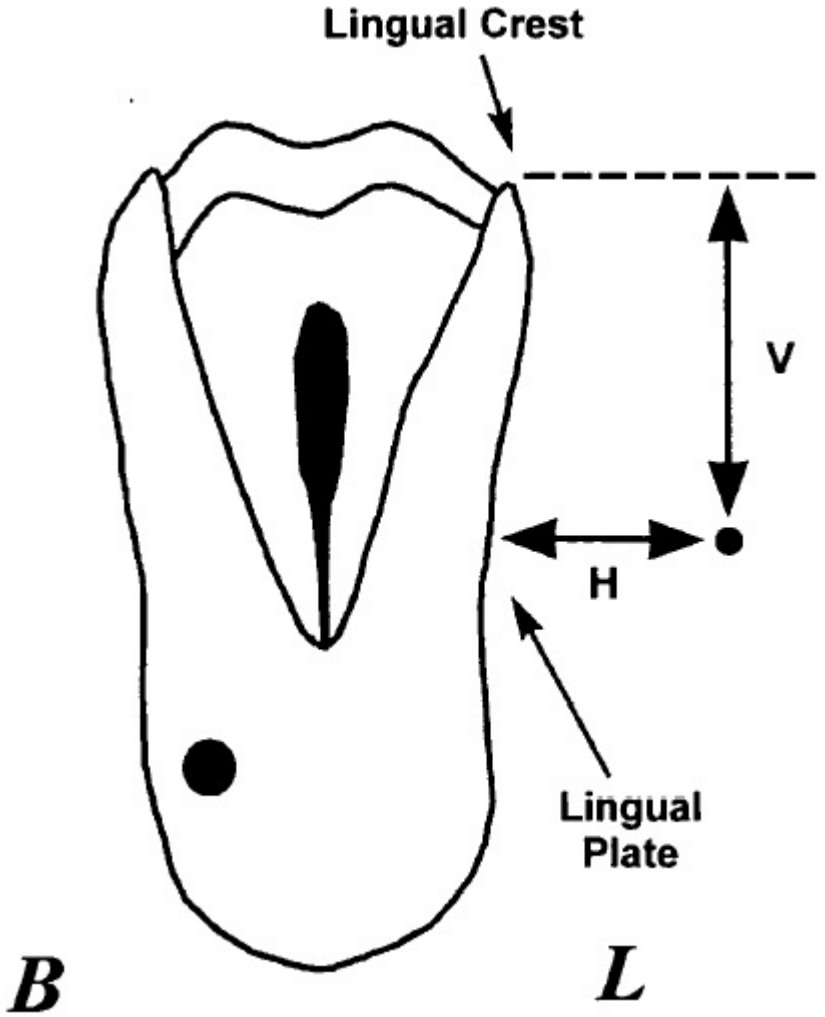
- Within soft tissue
- Variable position
- Oligofascicular
- 3.2mm

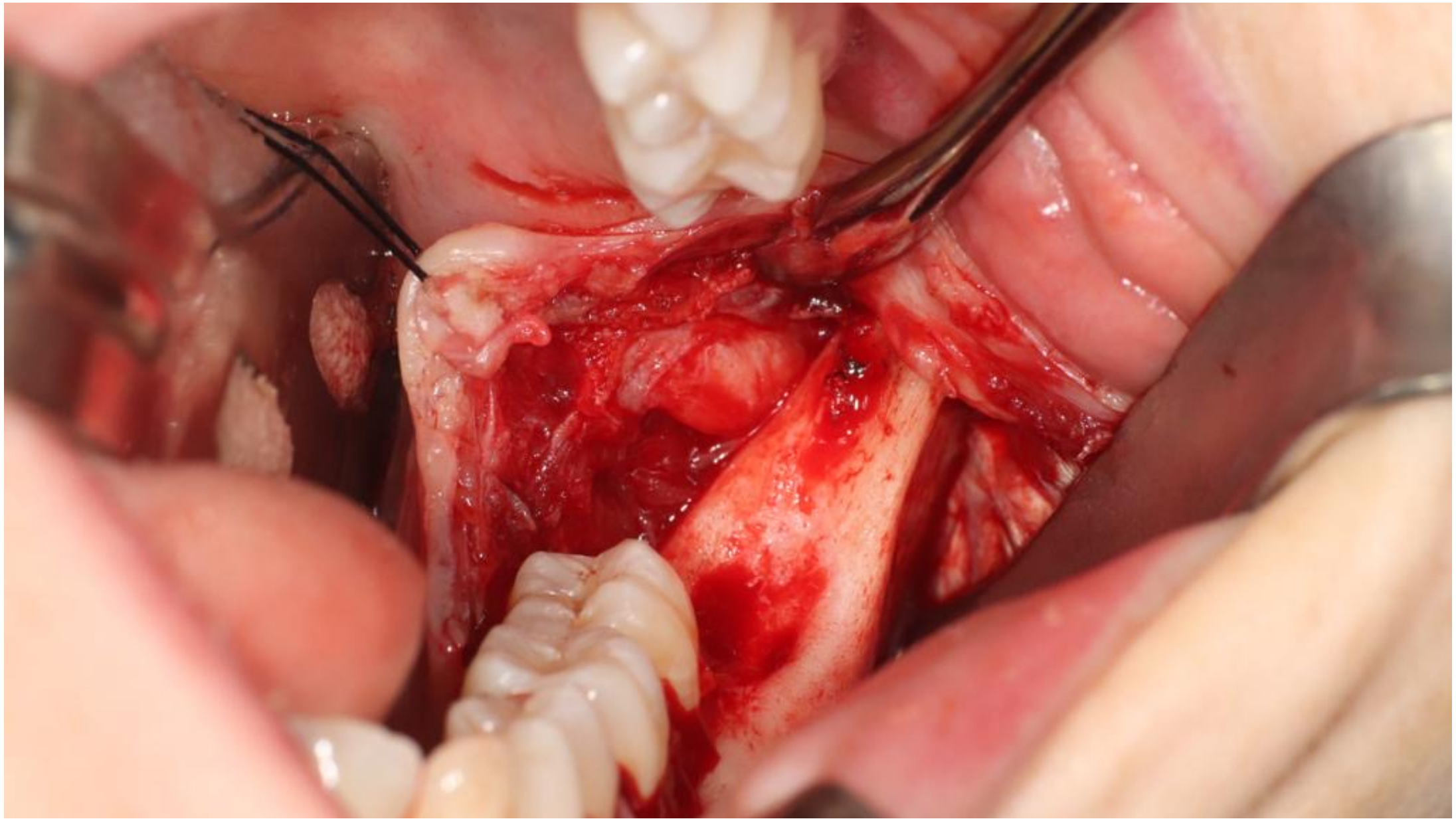


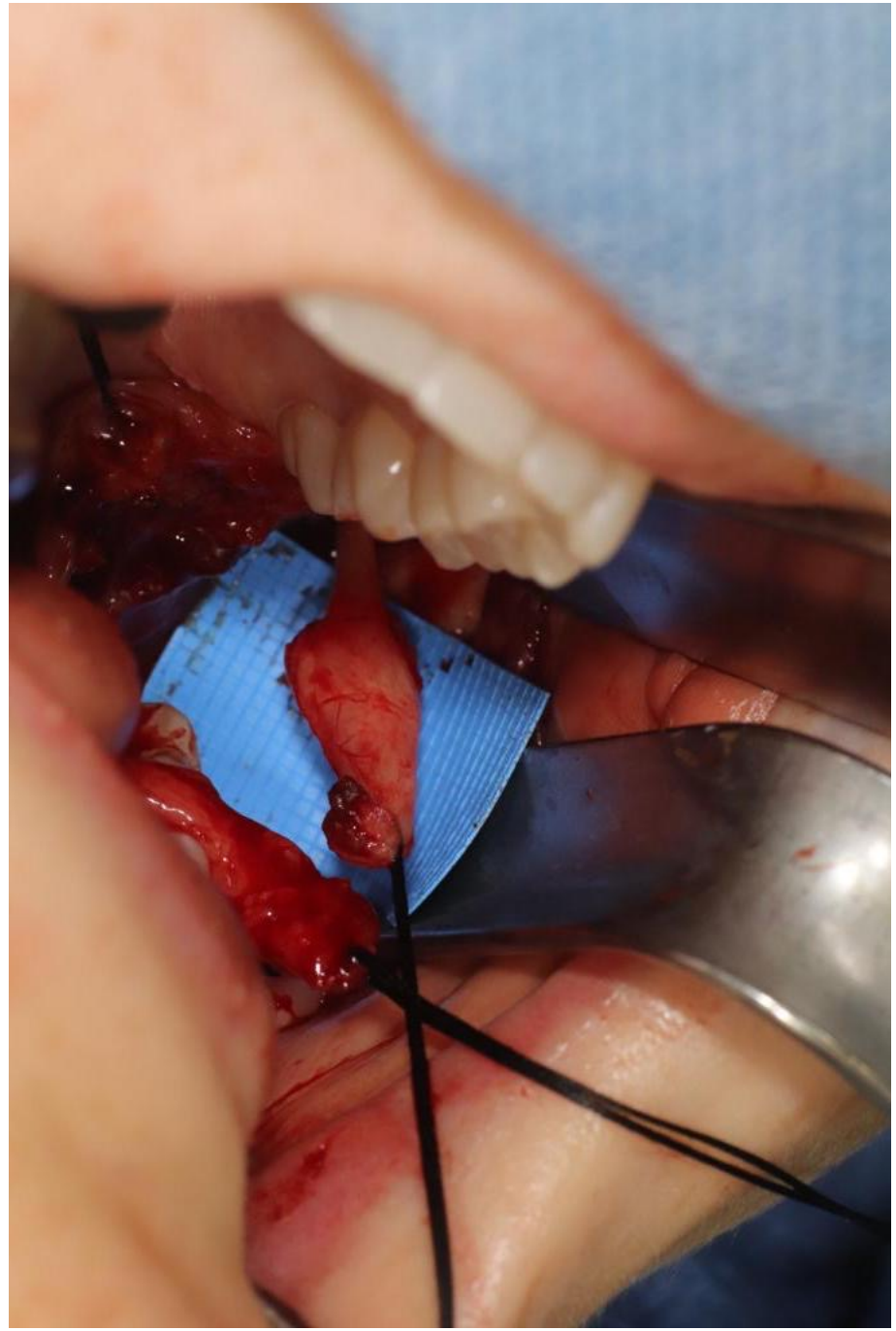
# An Anatomic Study of the Lingual Nerve in the Third Molar Region

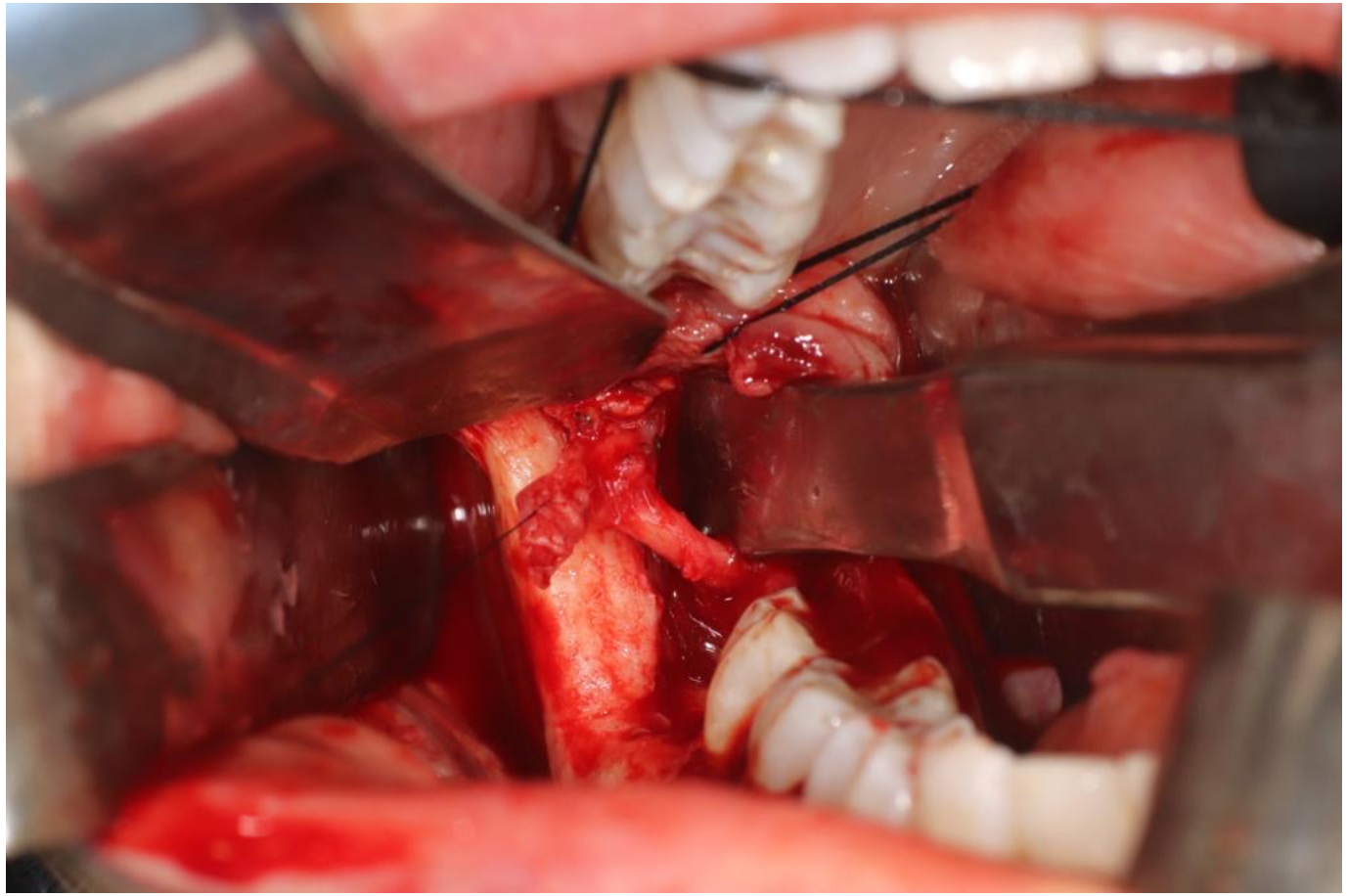
*Hossein Behnia, DMD,* Arash Kheradvar, MD,† and Mahmoud Shahrokhi‡*

- In third molar region, nerve lies 2.06 mm (+- 1.10) medial to lingual plate and 3.01 mm (+- 0.42) inferior to lingual crest
- May be in direct contact with plate in 25% of people
- May lie above the crest in 10-15% of people

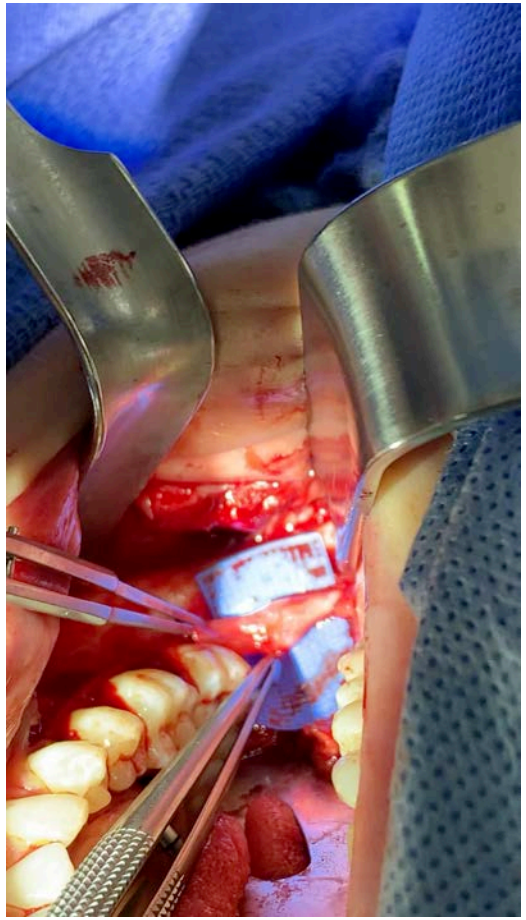


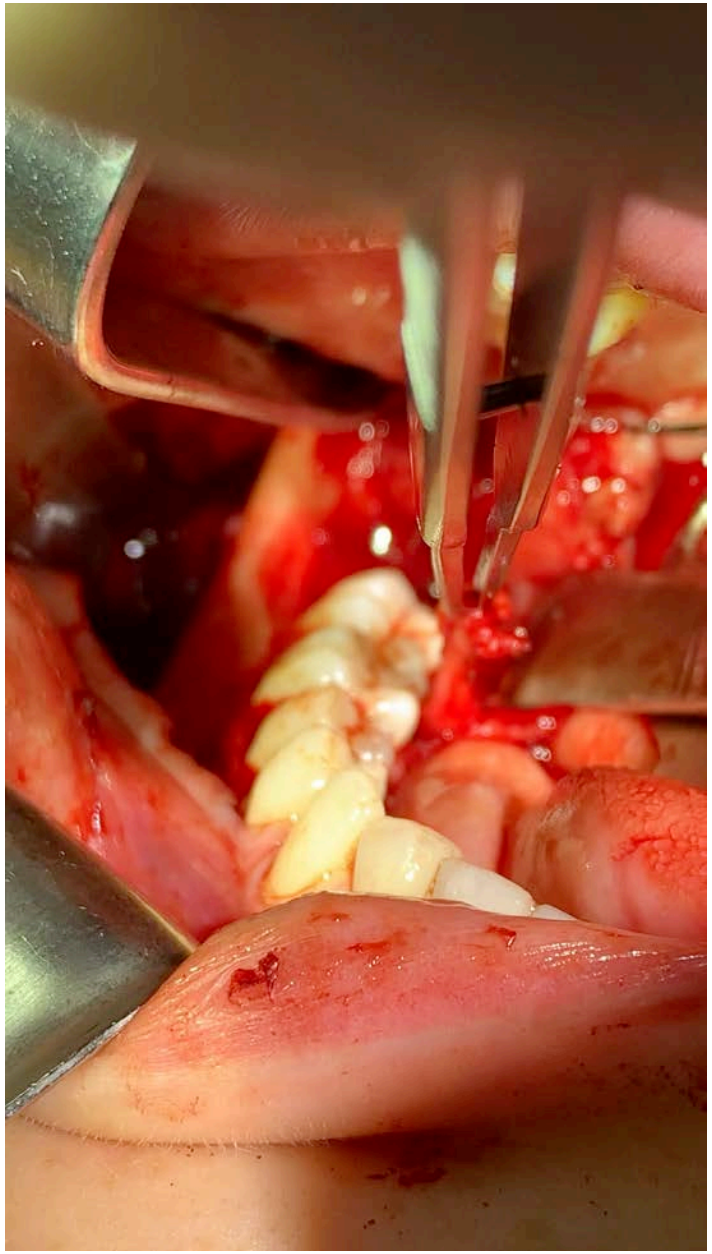


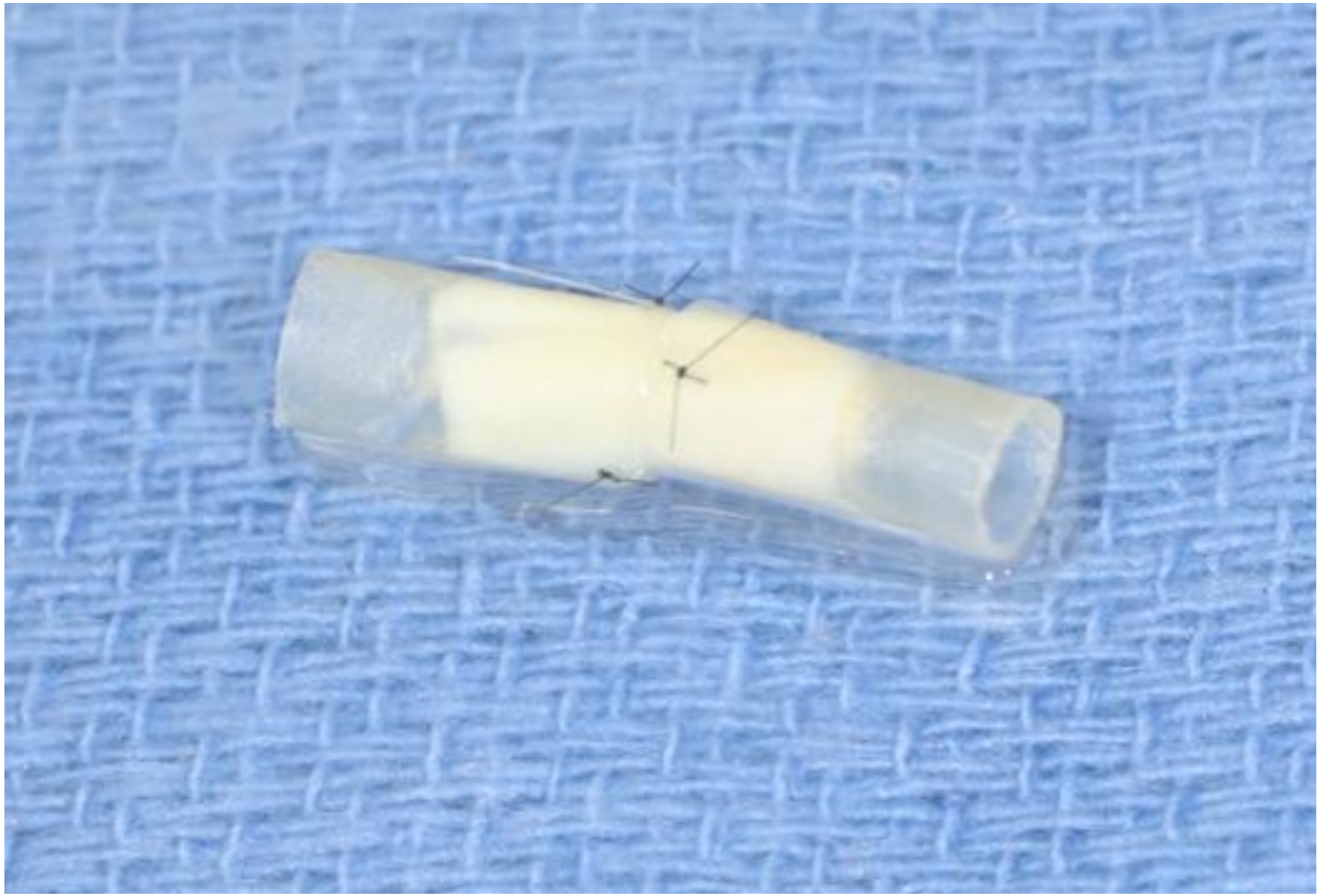


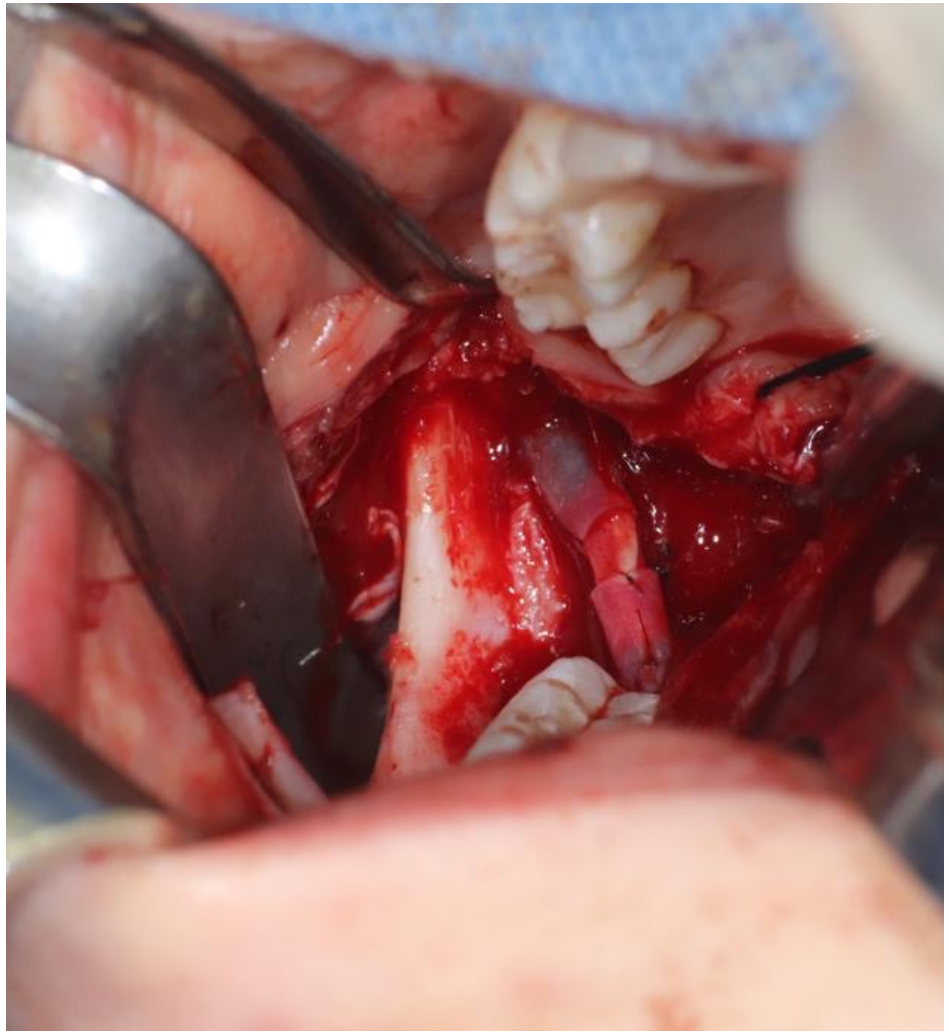


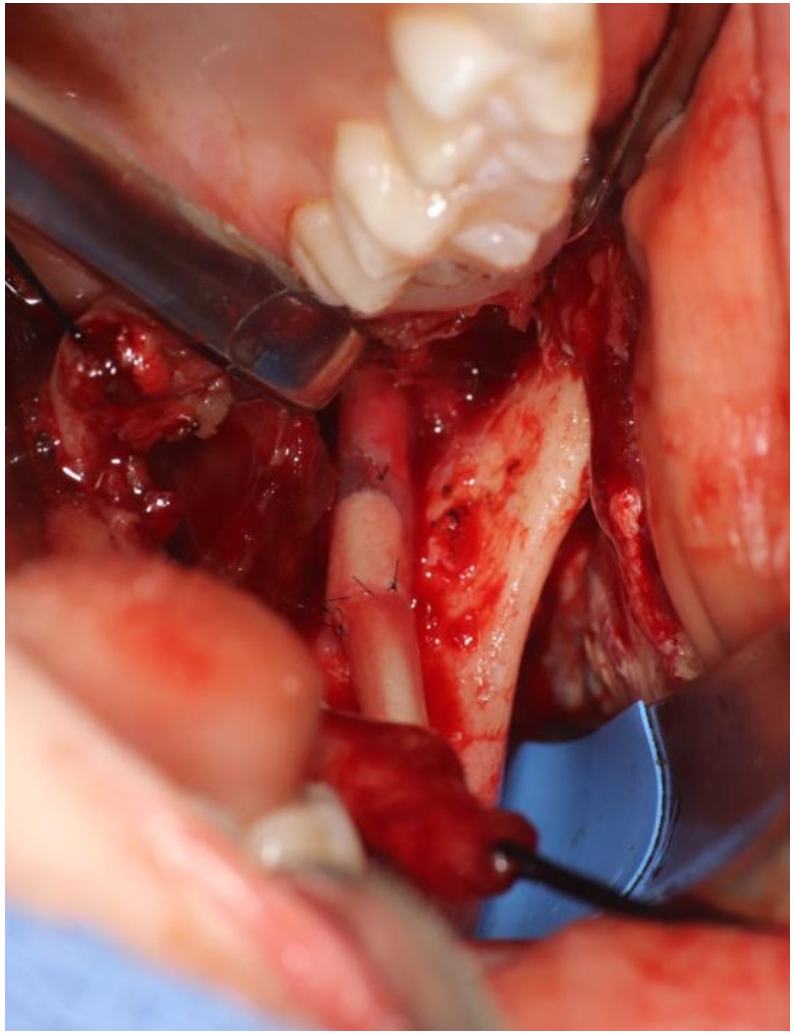

CM
1
2
3
INCHES
1











# PATHOLOGY AND ABLATIVE SURGERY

- Ablative surgery can create sizeable defects

- The most common nerve affected in ablative surgery is the IAN.

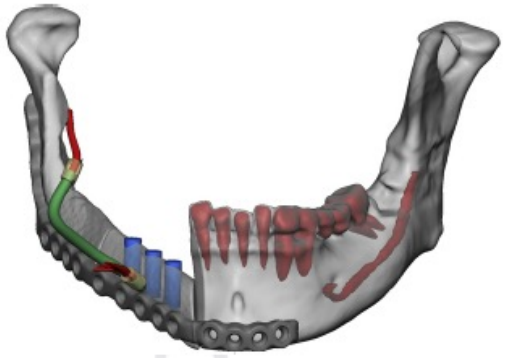
# A Case-and-Control, Multisite, Positive Controlled, Prospective Study of the Safety and Effectiveness of Immediate Inferior Alveolar Nerve Processed Nerve Allograft Reconstruction With Ablation of the Mandible for Benign Pathology

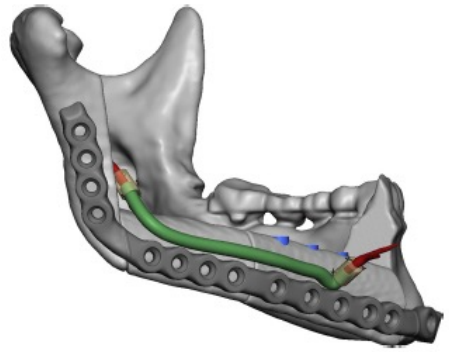
*John R. Zuniga, DMD, MS, PhD,* Fayette Williams, DDS, MD,† and Daniel Petrisor, DMD, MD‡*

# Overview

- Journal of Oral and Maxillofacial Surgery, 2017

- Purpose: This study determined whether immediate reconstruction of the inferior alveolar nerve with a long (>4.5 cm) processed nerve allograft (PNA) in conjunction with simultaneous ablation and reconstruction of the mandible would be effective in safely restoring subjective sensation and achieving functional sensory recovery.





# Materials and Methods

- Study Design and Sample
  - A case-and-control, prospective, multisite, multi-surgeon study
  - Patient Selection
    - 2010-2015

**Table 1. INCLUSION AND EXCLUSION CRITERIA**

| |
|---|
| Inclusion |
| 1. Age 5-70 yr, any gender, any race |
| 2. Benign mandibular pathology that will require resection of ≥4.5 cm of the mandible, which includes the IAN |
| 3. Normal sensation of lip and chin before surgery |
| 4. Consents to have immediate reconstruction of 4.5- to 7.0-cm gap of the IAN with AVANCE after ablation of the mandible with or without simultaneous bone, soft tissue, or dental reconstruction without using BMP |
| Exclusion |
| 1. History of IAN injury |
| 2. Acute infection at time of surgery |
| 3. History of radiation therapy to head or neck |
| 4. Past or current history of malignancy |
| 5. Past or current history of MRONJ |
| 6. Uncontrolled hypertension, diabetes, or currently smoking |

# Materials and Methods

**Table 2. DEMOGRAPHICS BY AGE, GENDER, PATHOLOGY, IAN GAP, PNA GRAFT LENGTH, AND USE OF AXOGUARD**

| Patient Number | Age (yr) | Gender | Pathology | IAN Gap (mm) | PNA Graft Length (mm) | AxoGuard |
|---|---|---|---|---|---|---|
| 101 | 35 | Male | Ameloblastoma | 70 | 70 | 2 |
| 102 | 11 | Male | Ossifying fibroma | 70 | 70 | 2 |
| 103 | 37 | Male | Ameloblastoma | 70 | 70 | 2 |
| 104 | 29 | Male | Ameloblastoma | 55 | 60 | 2 |
| 105 | 68 | Female | Keratocyst | | | |
| 106 (no graft placed)* | 23 | Female | Ameloblastoma | | | |
| 107 | 28 | Female | Ameloblastoma | 60 | 70 | 2 |
| 108 (no graft placed)† | 23 | Female | Ameloblastoma | | | |
| 109 | 36 | Female | Ameloblastoma | 60 | 65 | 3 |
| 110 | 28 | Female | Ameloblastoma | 50 | 55 | 3 |
| 111 | 22 | Female | Myxoma | 70 | 70 | 3 |
| 112 (no graft placed)‡ | 14 | Female | Ameloblastoma | | | |
| 113 | 10 | Female | Ossifying fibroma | 60 | 60 | 3 |
| 114 | 60 | Female | Sclerosing osteomyelitis | 50 | 60 | 3 |
| 115 | 12 | Female | Ameloblastoma | 47 | 50 | 2 |
| 116 | 25 | Male | Ossifying fibroma | 45/70 | 50/70 | 3/3 |
| 117 | 18 | Female | Ameloblastoma | 45 | 45 | 4 |
| 118 | 14 | Female | Ameloblastoma | 45/45 | 45/45 | 3/3 |
| 119 | 18 | Female | Ameloblastoma | 70/70 | 70/70 | 3/3 |
| 120 | 64 | Female | Ameloblastoma | 70 | 70 | 3 |
| 121 | 25 | Male | OKC | 70 | 70 | 3 |
| 122 | 12 | Male | Myxoma | 60 | 70 | 3 |

# Results

- 18 patients with 20 nerve injuries in the outcomes population
- Progressive sensory recovery over time
- Functional sensory recovery (grades S3, S3+, and S4):
  - 44% at 3 months
  - 84% at 6 months
  - **90% at 12 months**
- Neither positive control achieved functional sensory recovery

**Table 2. CLASSIFICATION OF SENSORY RECOVERY (MEDICAL RESEARCH COUNCIL SYSTEM)**

| Grade (Stage) | Recovery of Sensibility |
|---|---|
| S0 | No recovery |
| S1 | Recovery of deep cutaneous pain |
| S1+ | Recovery of some superficial pain |
| S2 | Return of some superficial pain and tactile sensation |
| S2+ | S2 with over-response |
| S3* | Return of some superficial pain and tactile sensation without over-response; 2-point discrimination >15 mm |
| S3+ | S3 with good stimulus localization; 2-point discrimination = 7-15 mm |
| S4 | Complete recovery; S3+; 2-point discrimination = 2-6 mm |

# Conclusion

- Provides level III evidence to support the safety and effectiveness of PNA for the immediate reconstruction of the IAN simultaneous with the ablation and reconstruction of the mandible for benign pathology

- Confirms the previously published data on IAN reconstructions during mandibular resections

- Functional sensory recovery in most patients (90%) compared with no repair in the present study or those reported in the historical literature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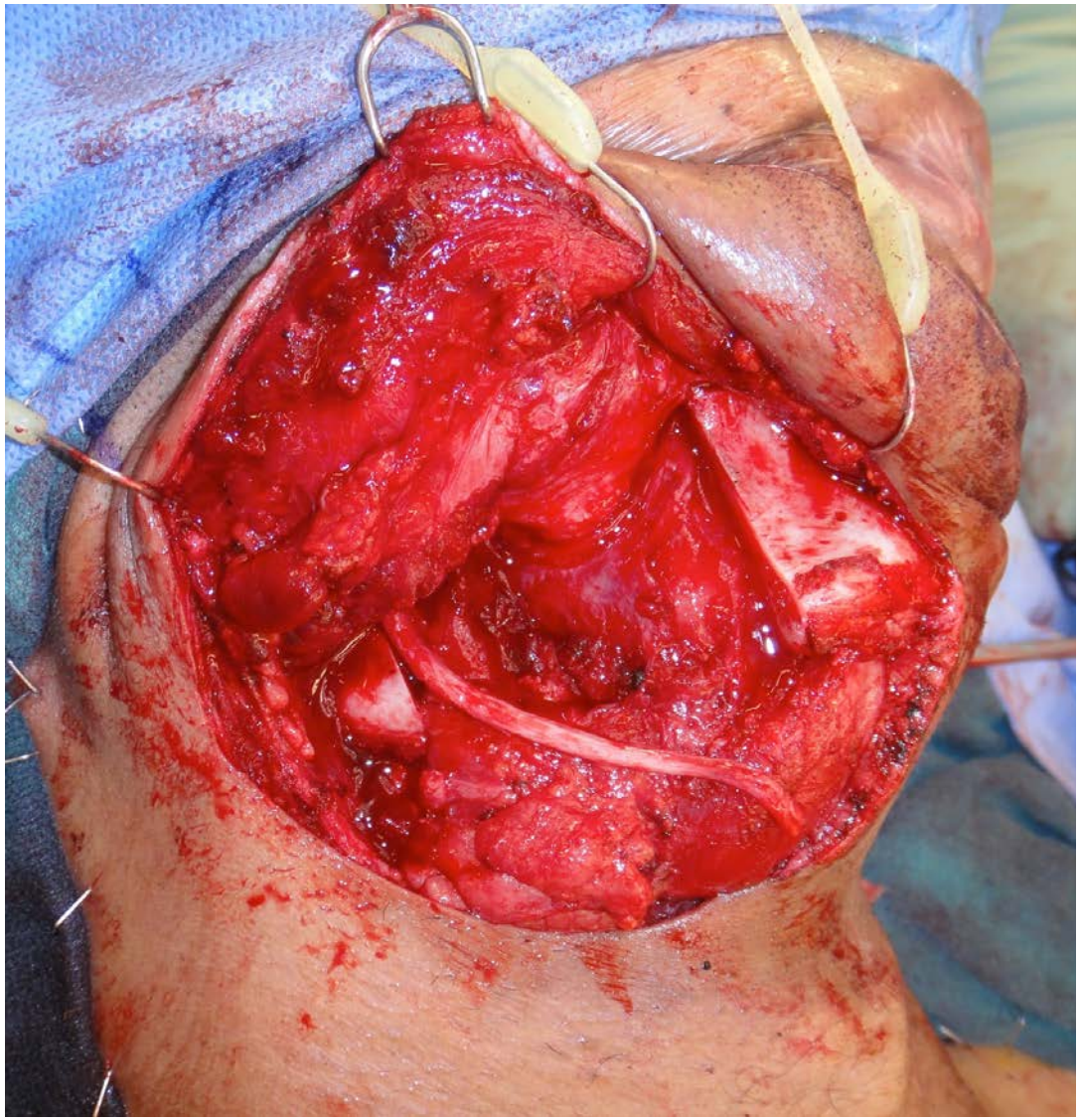

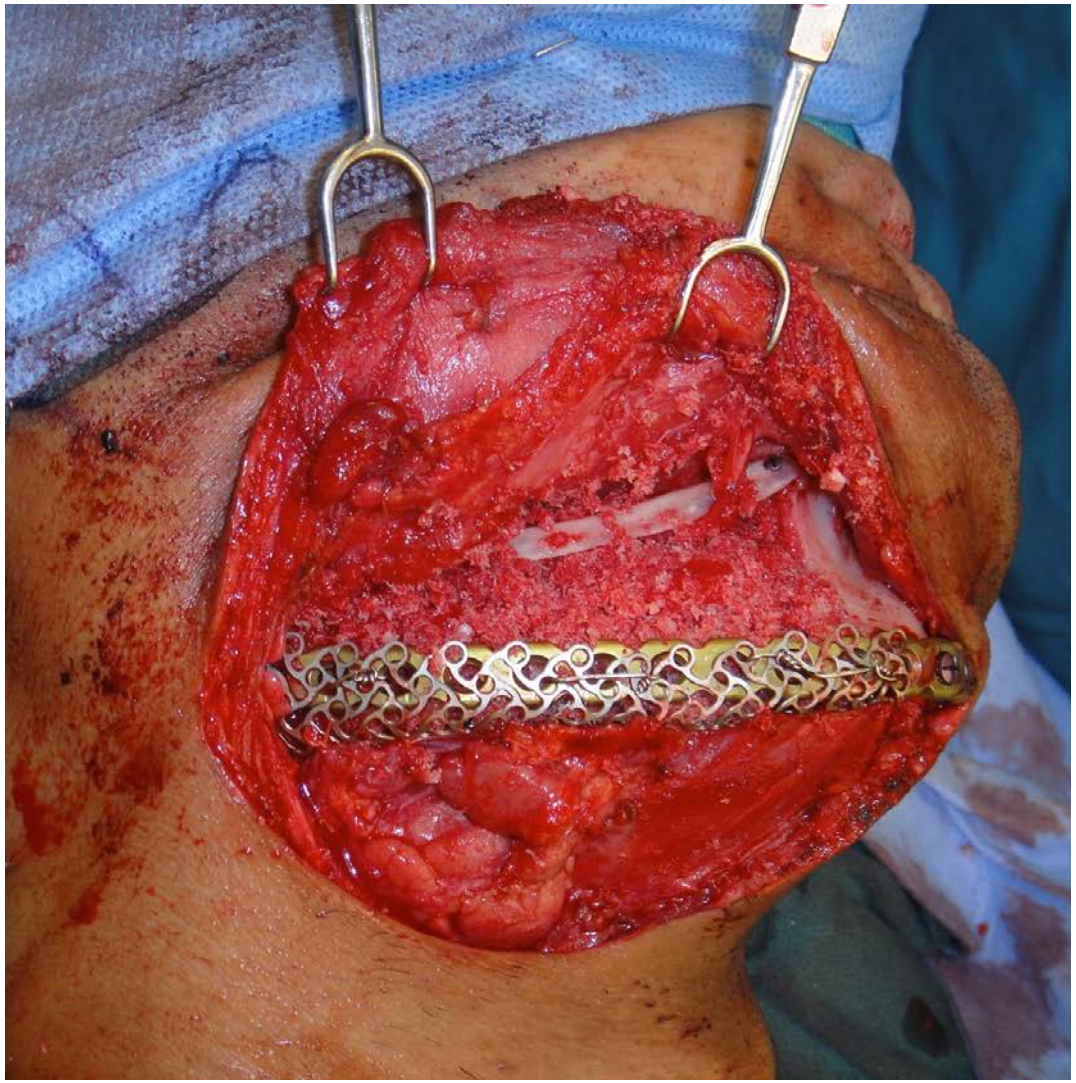

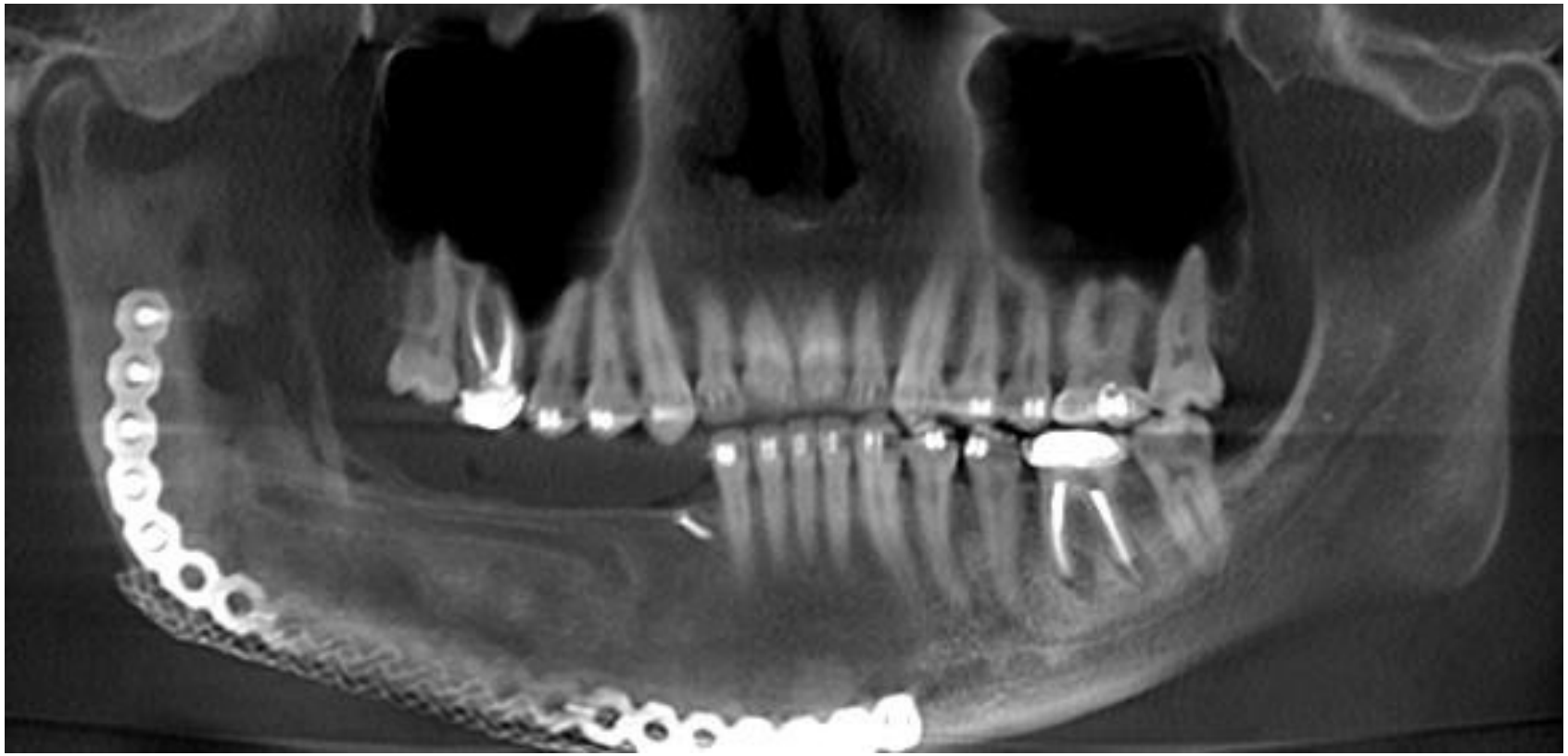

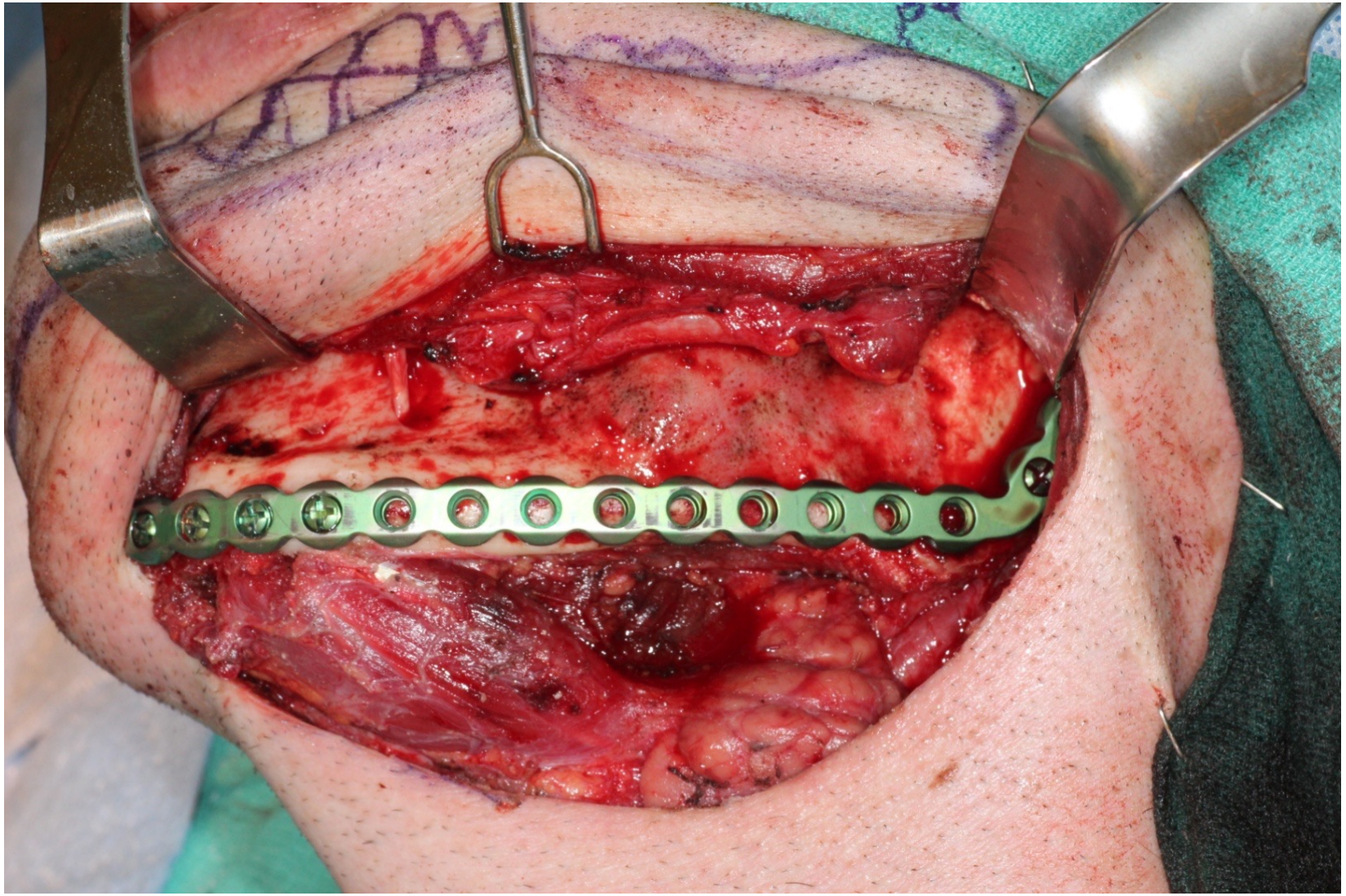


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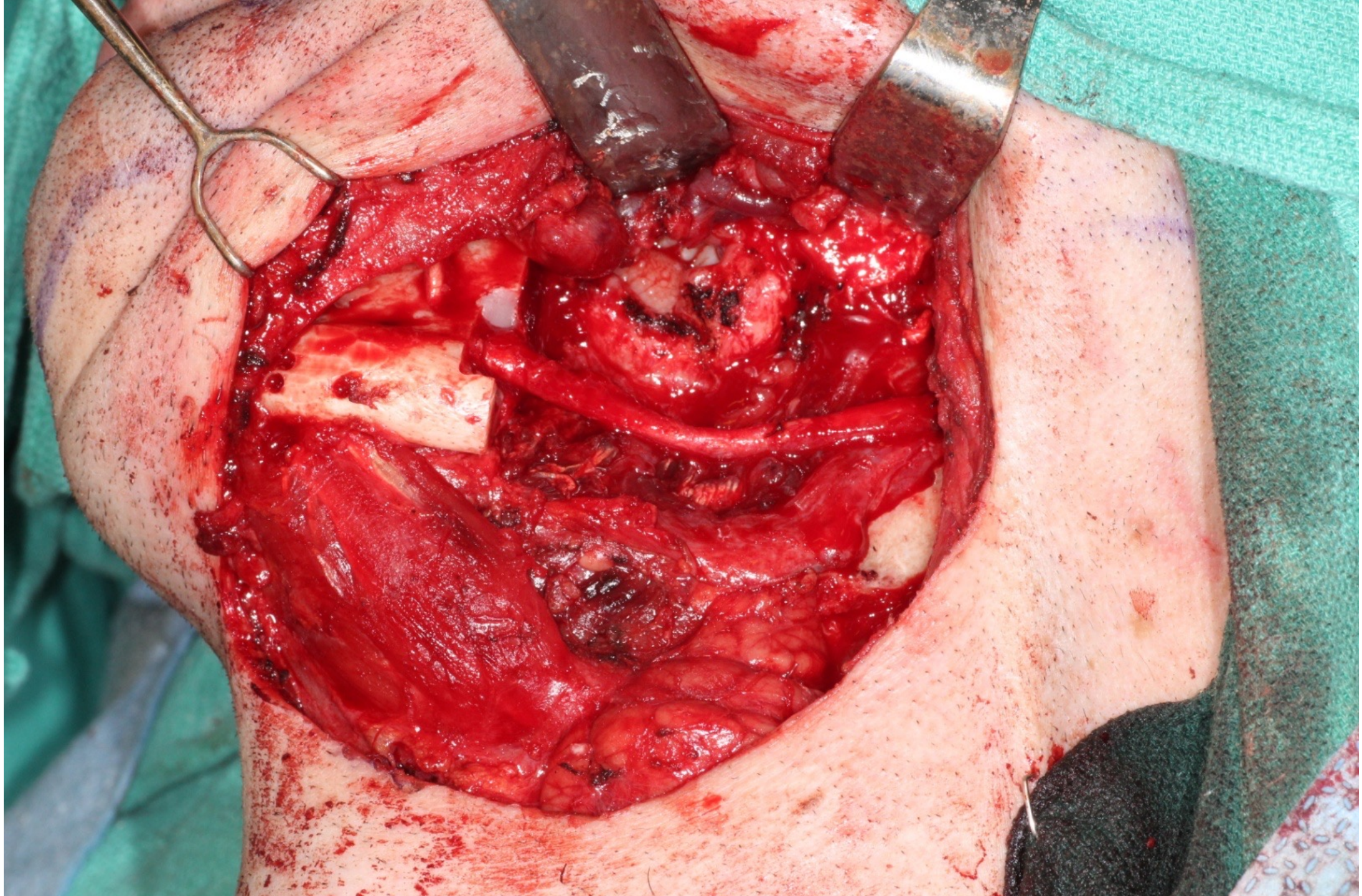

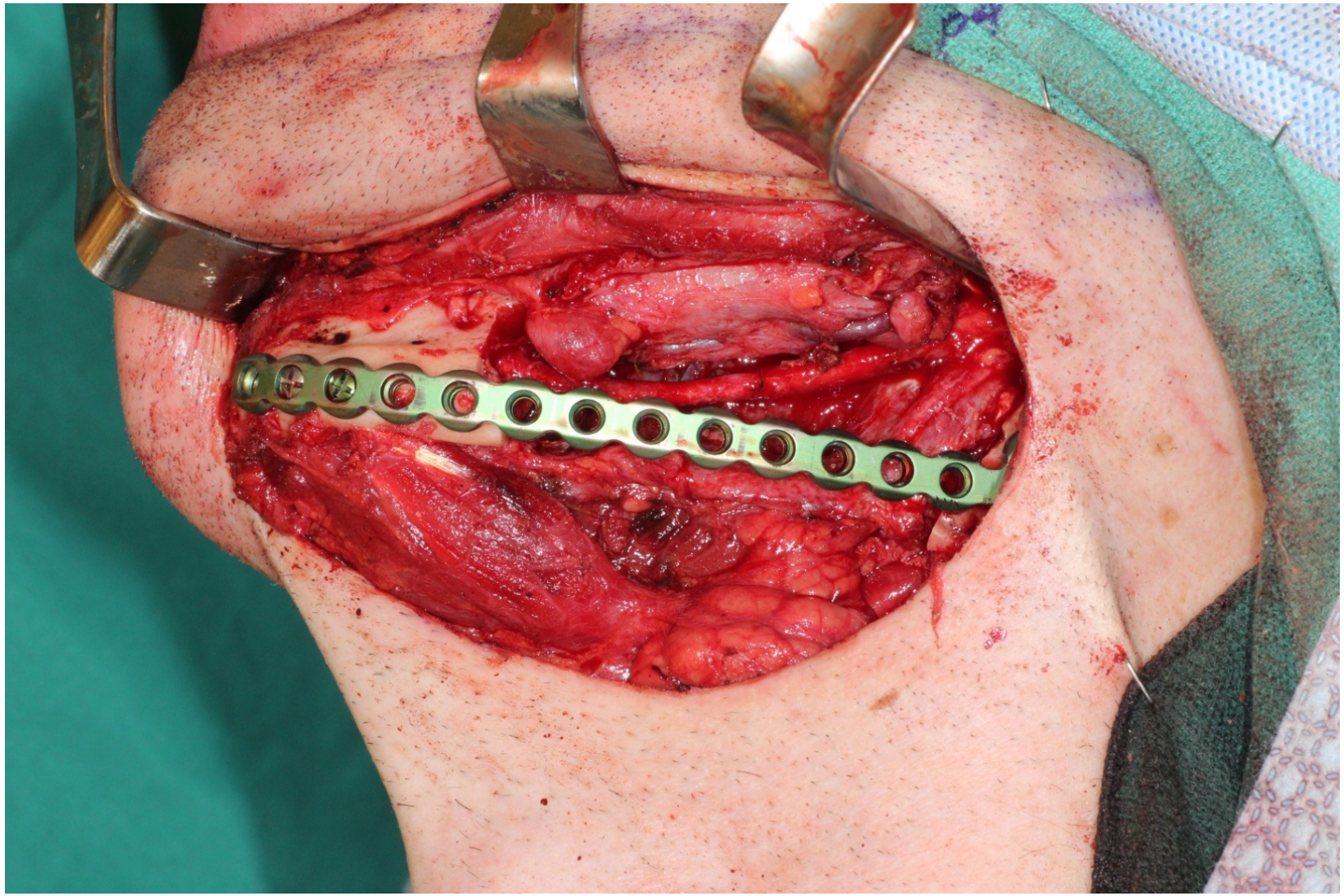

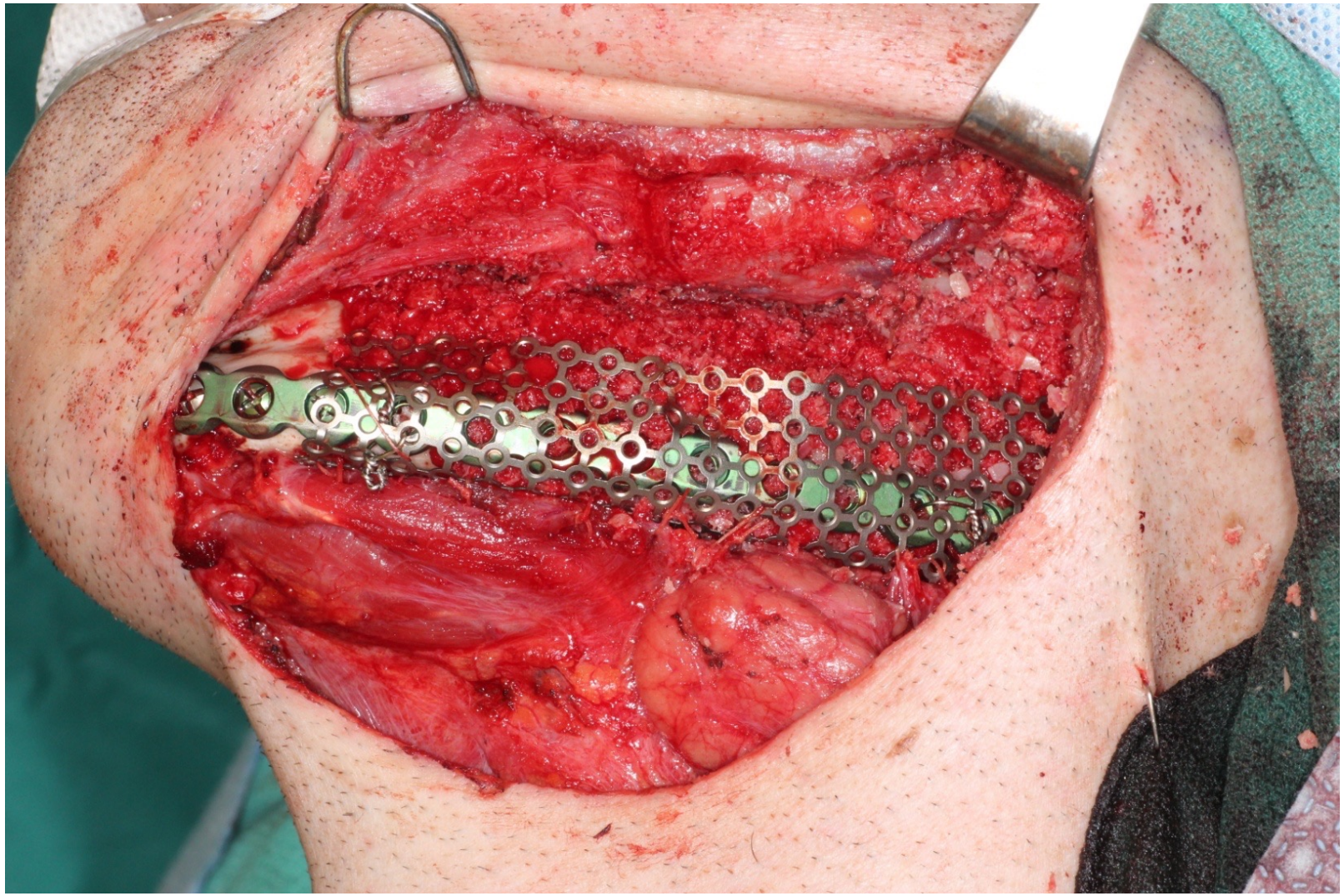

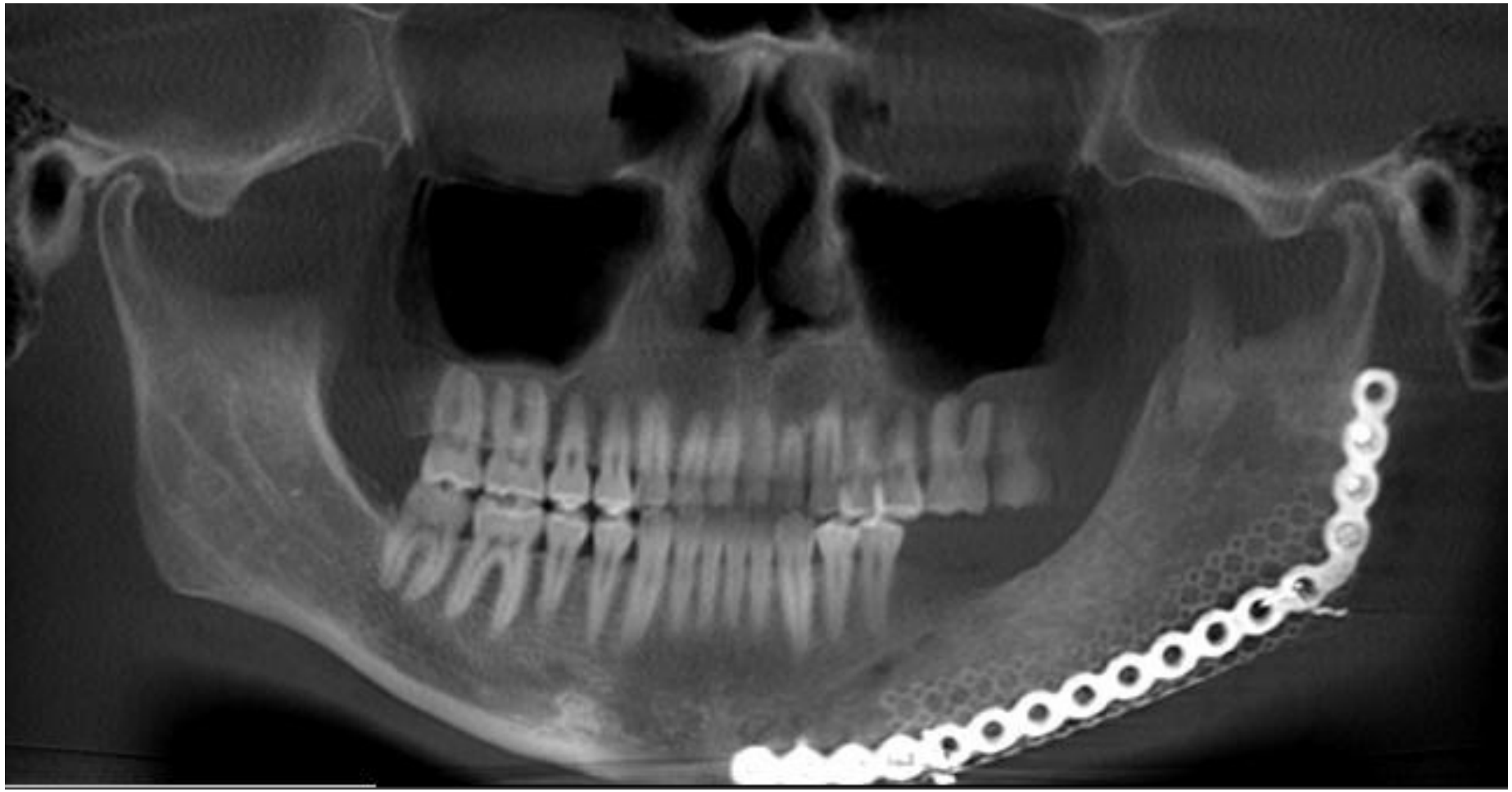

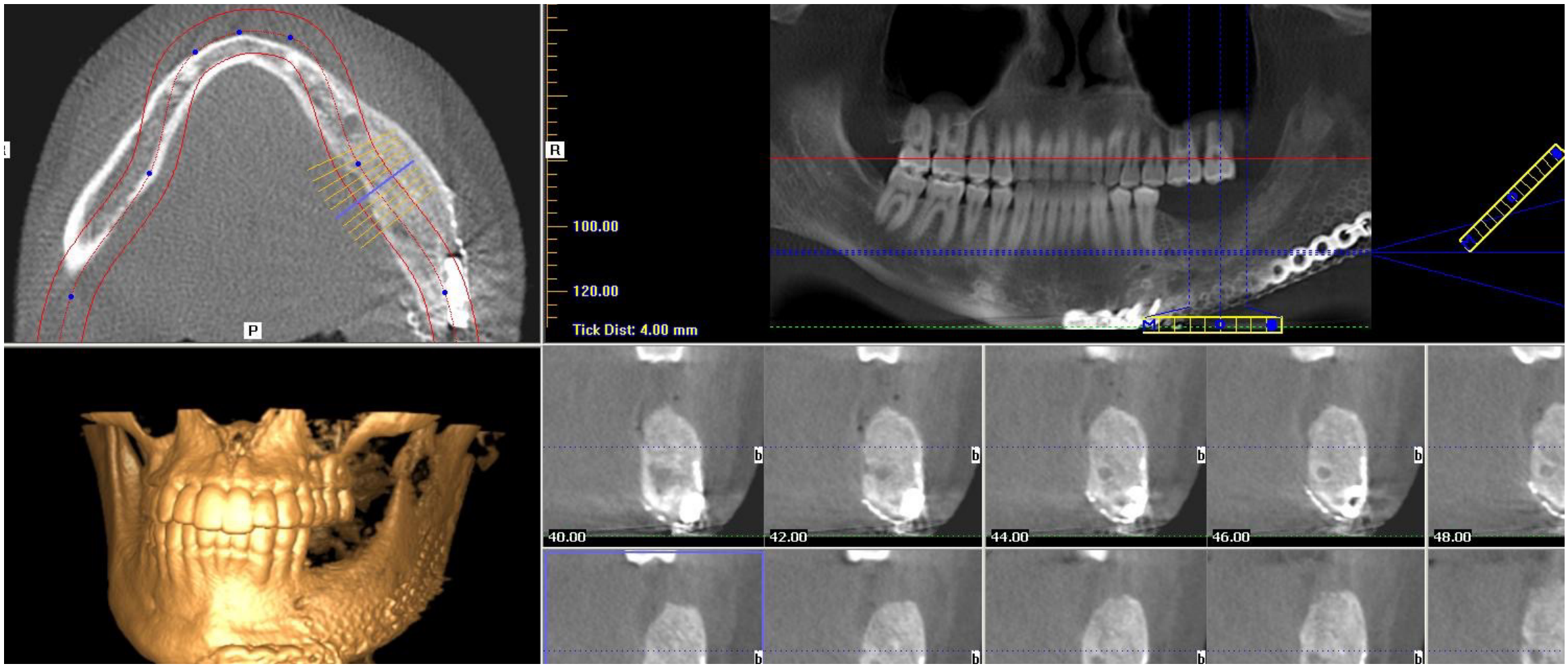
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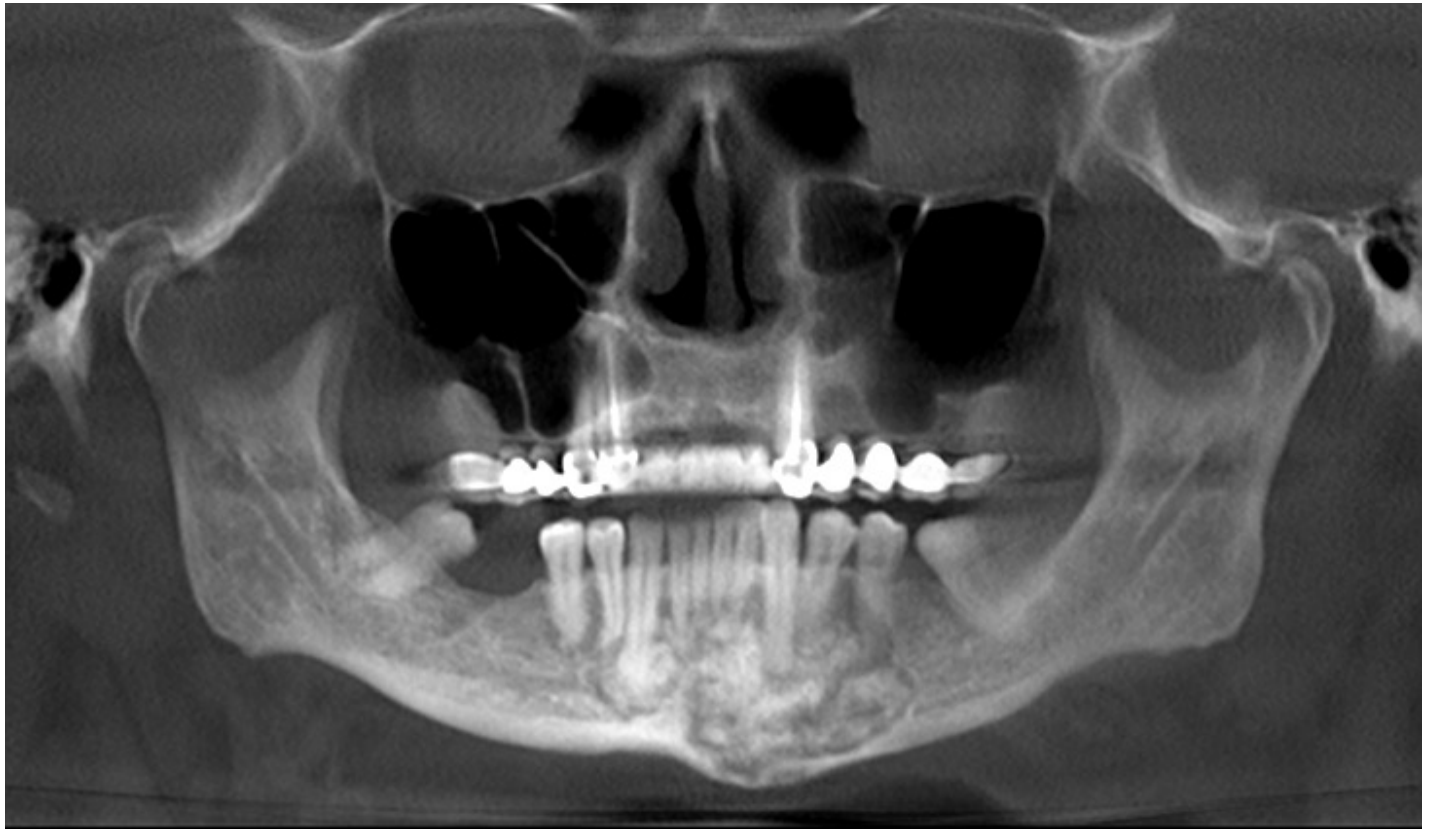

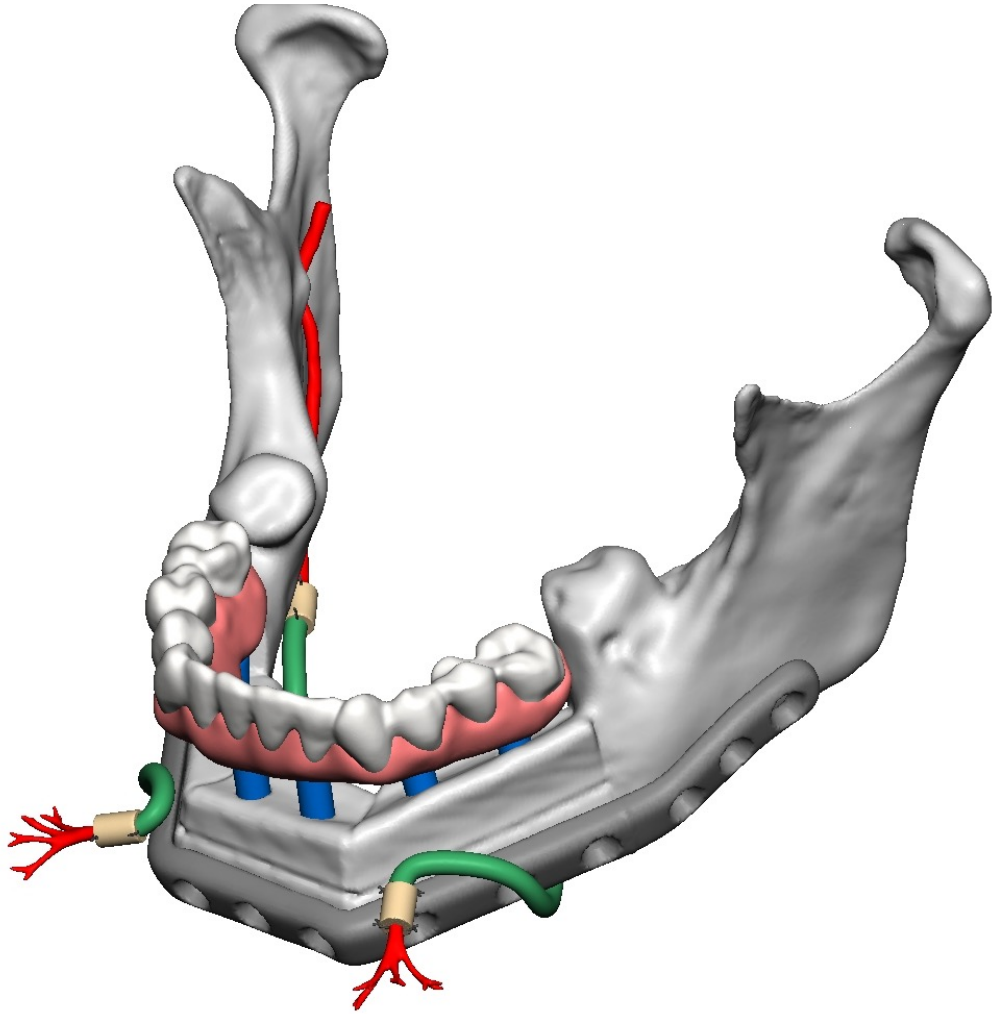

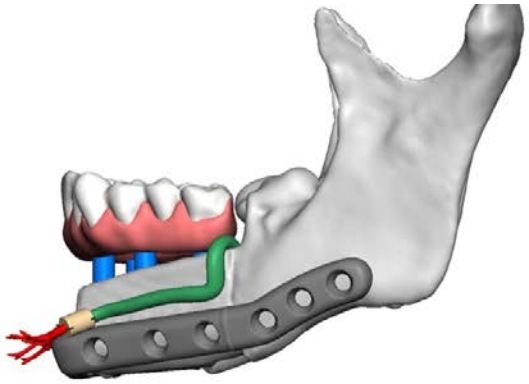

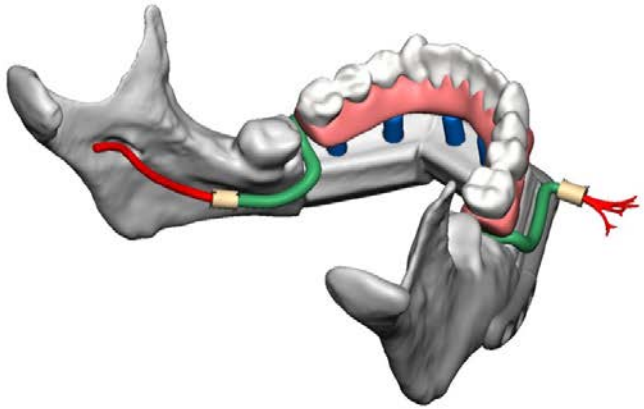

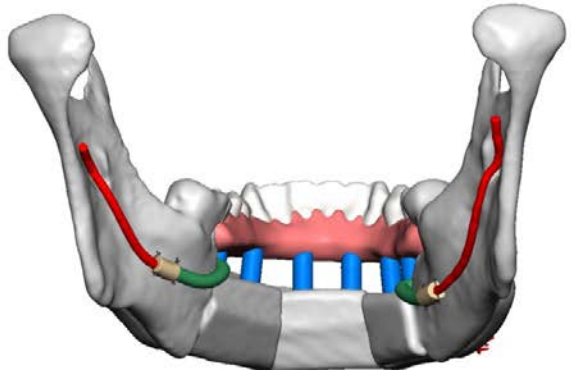

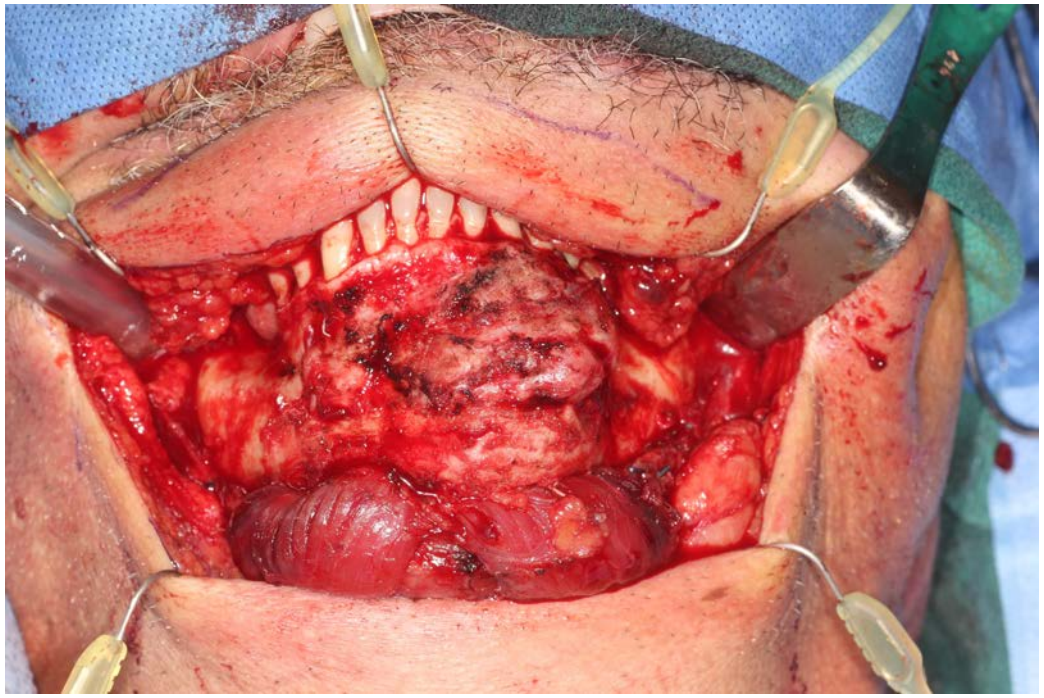

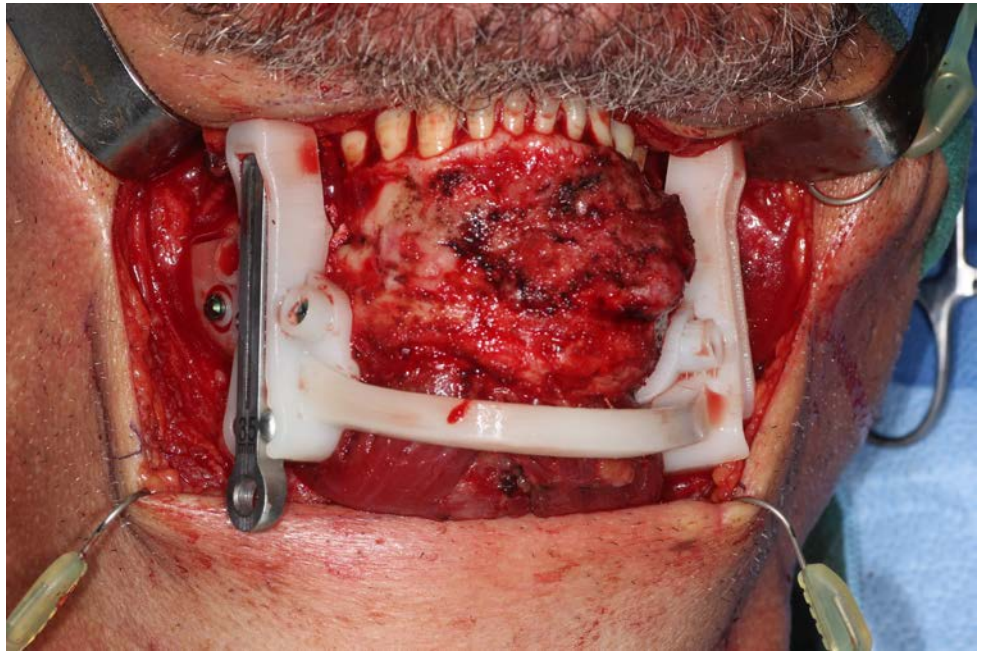


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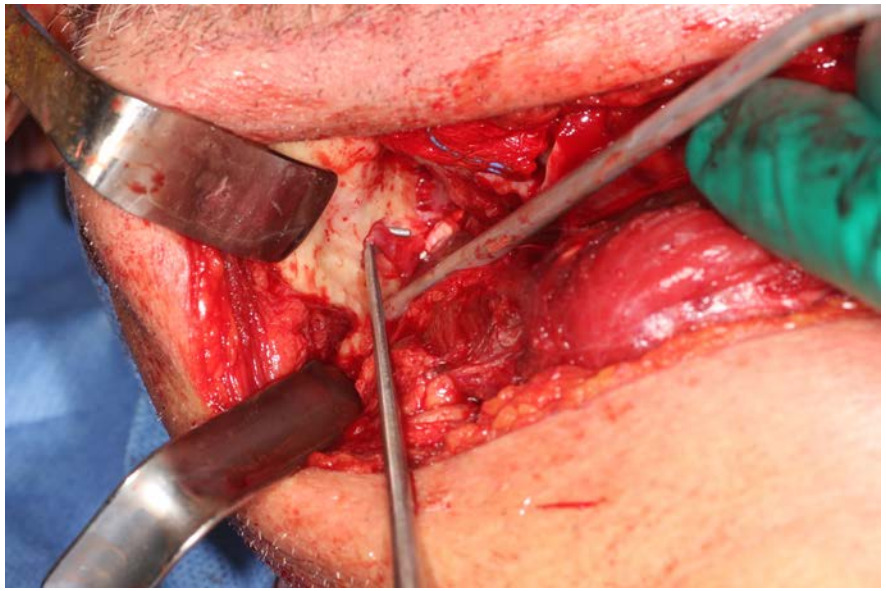
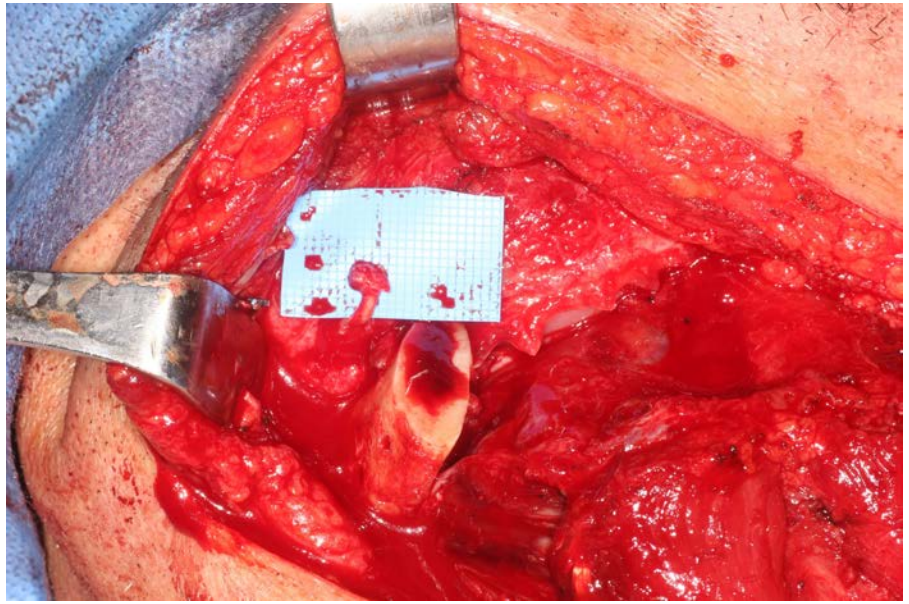
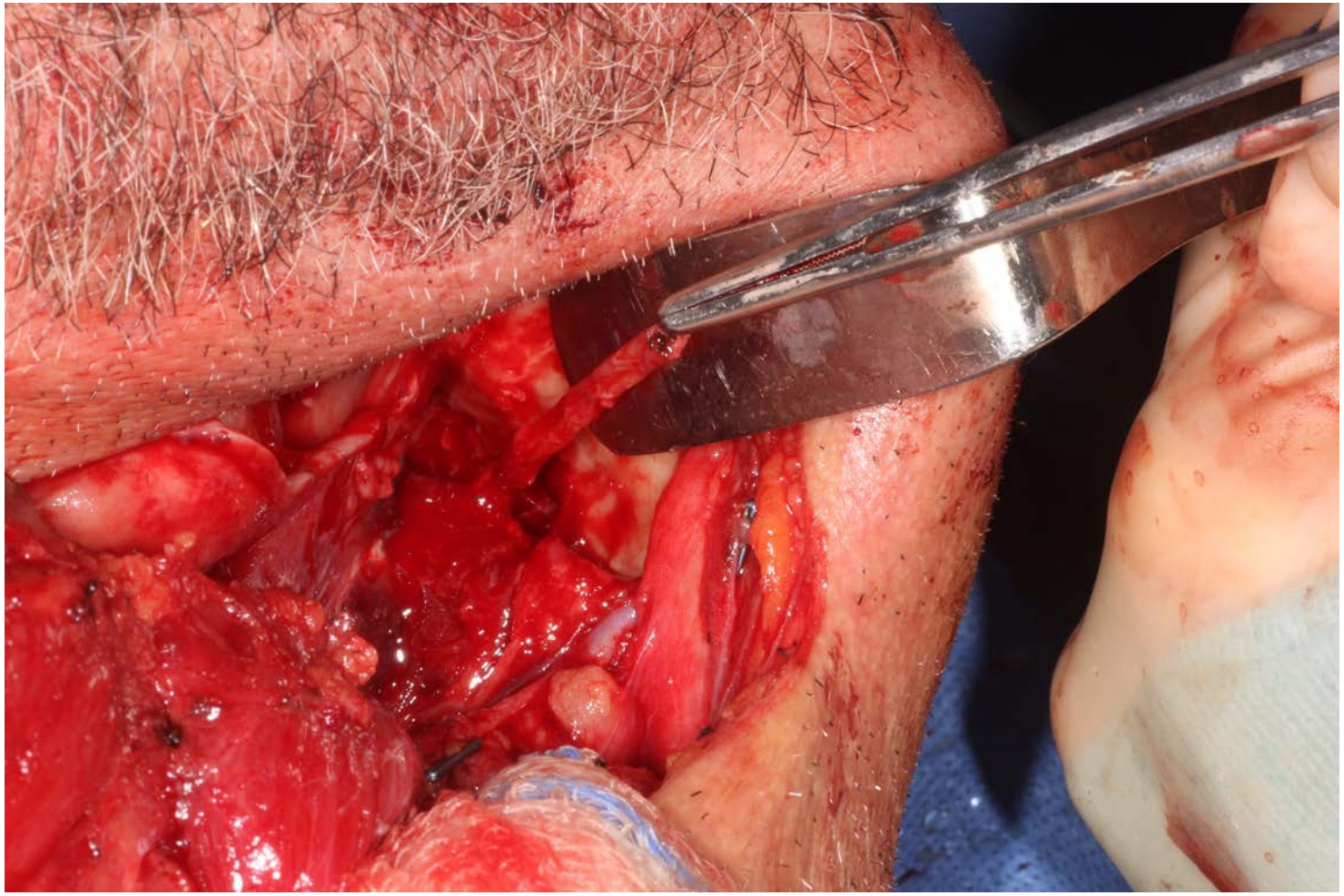
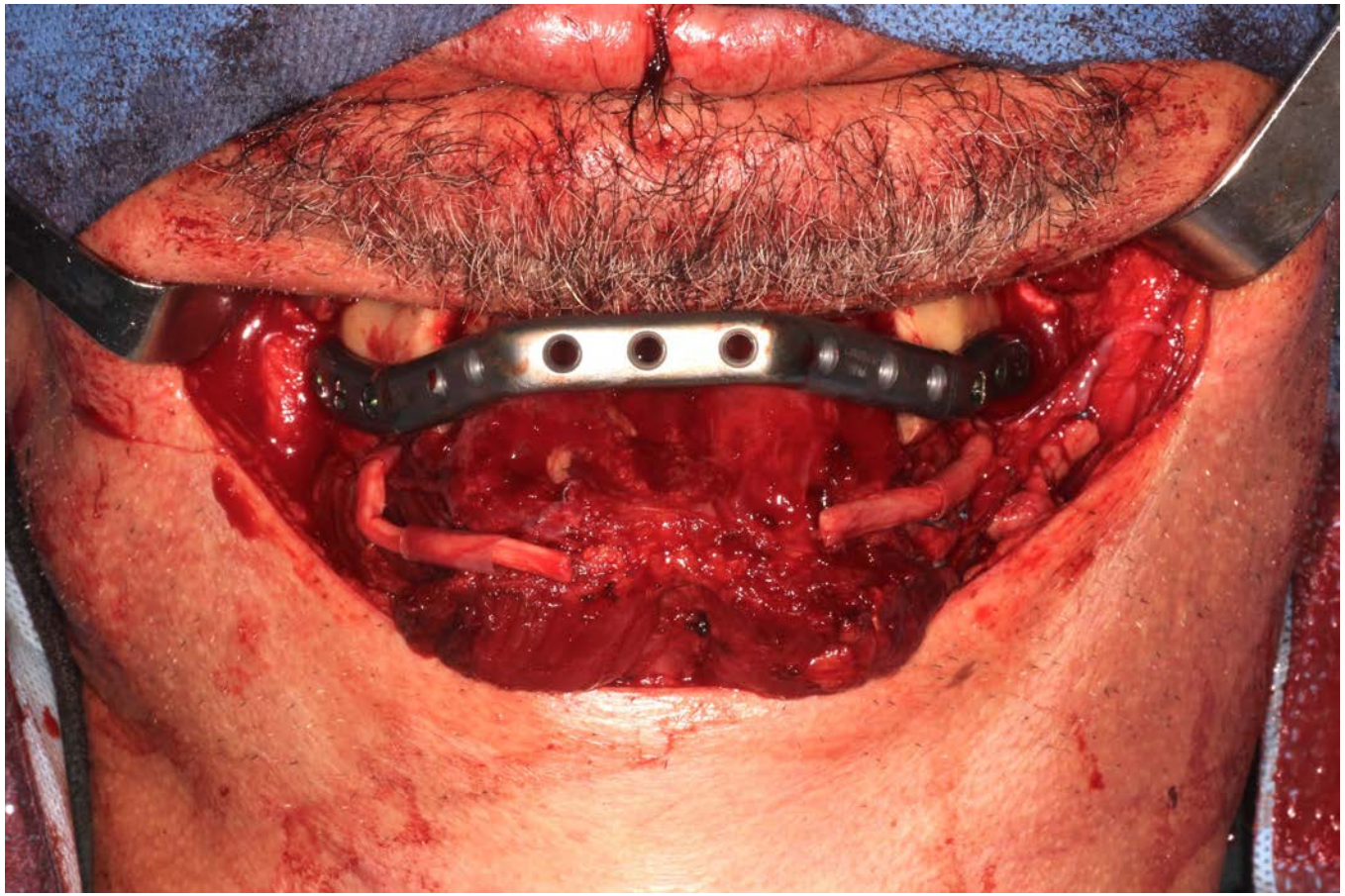
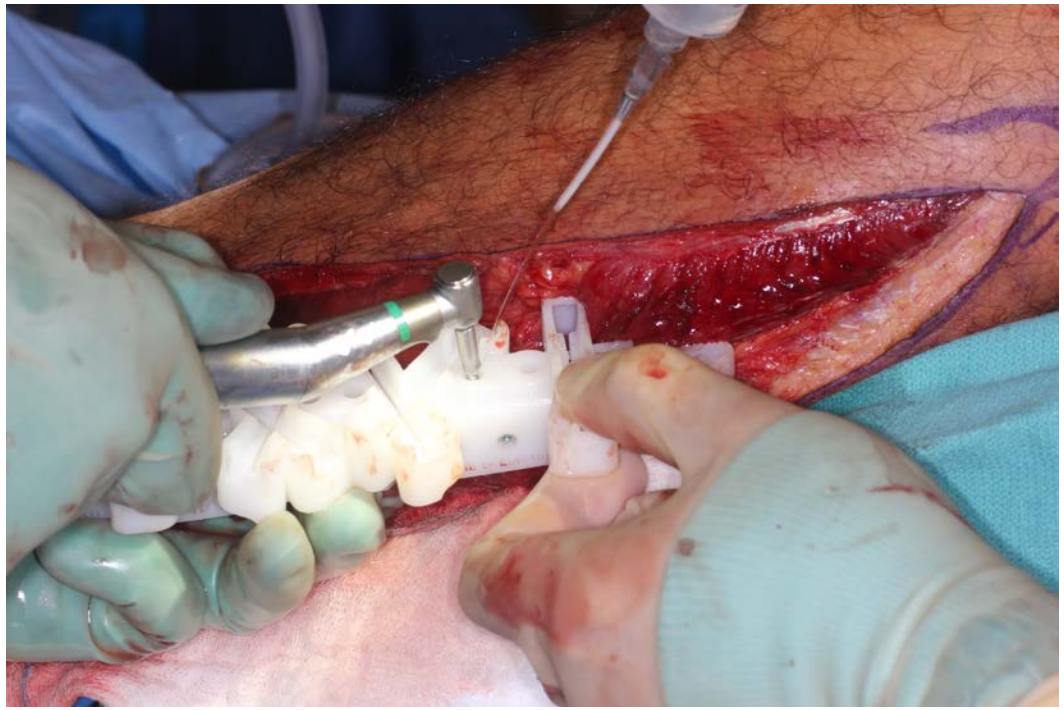
CM 1 2 3 4 5 6 7 8 9 10

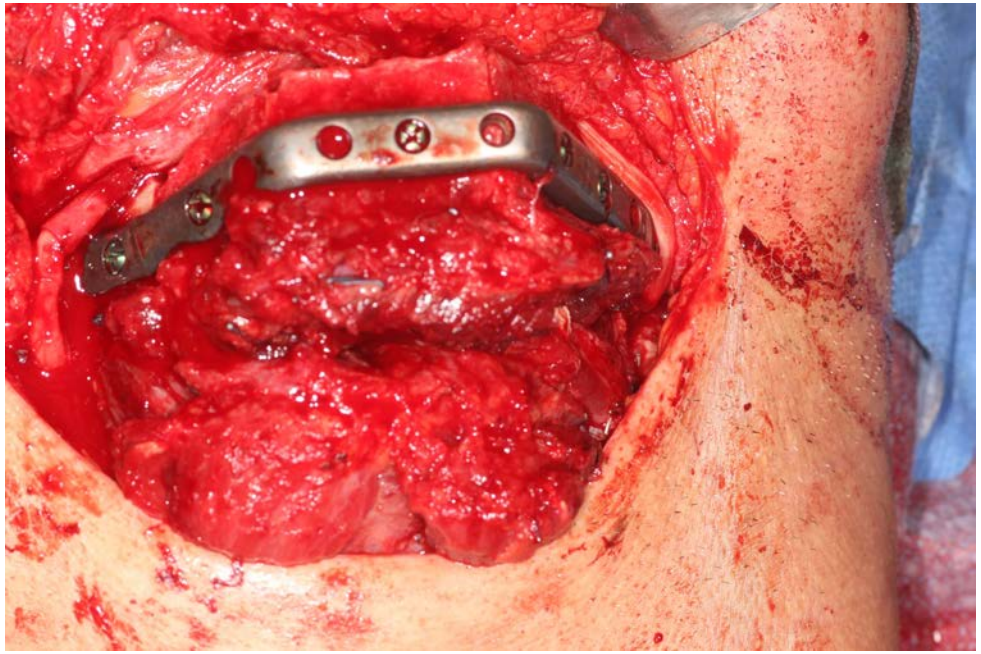


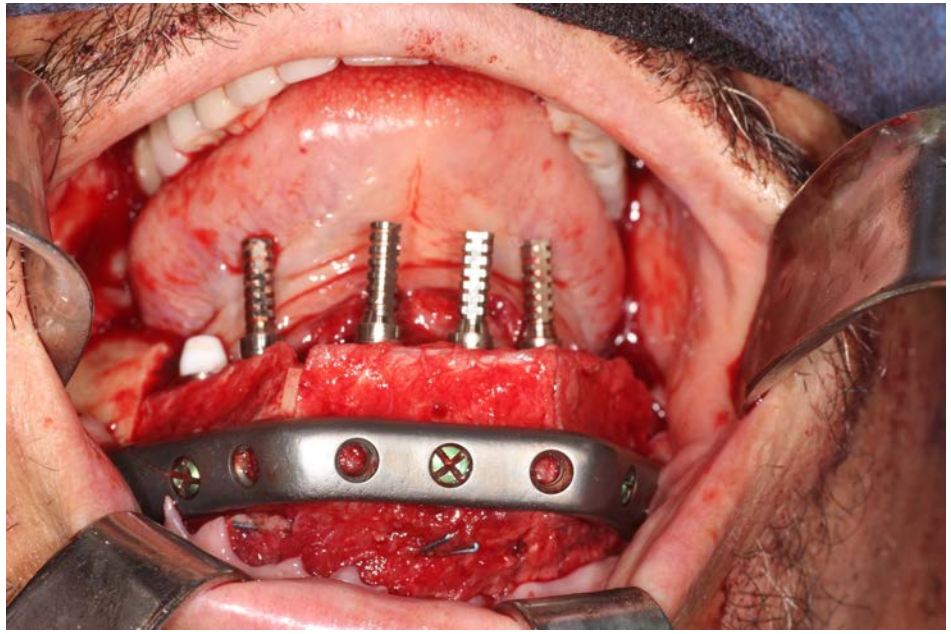


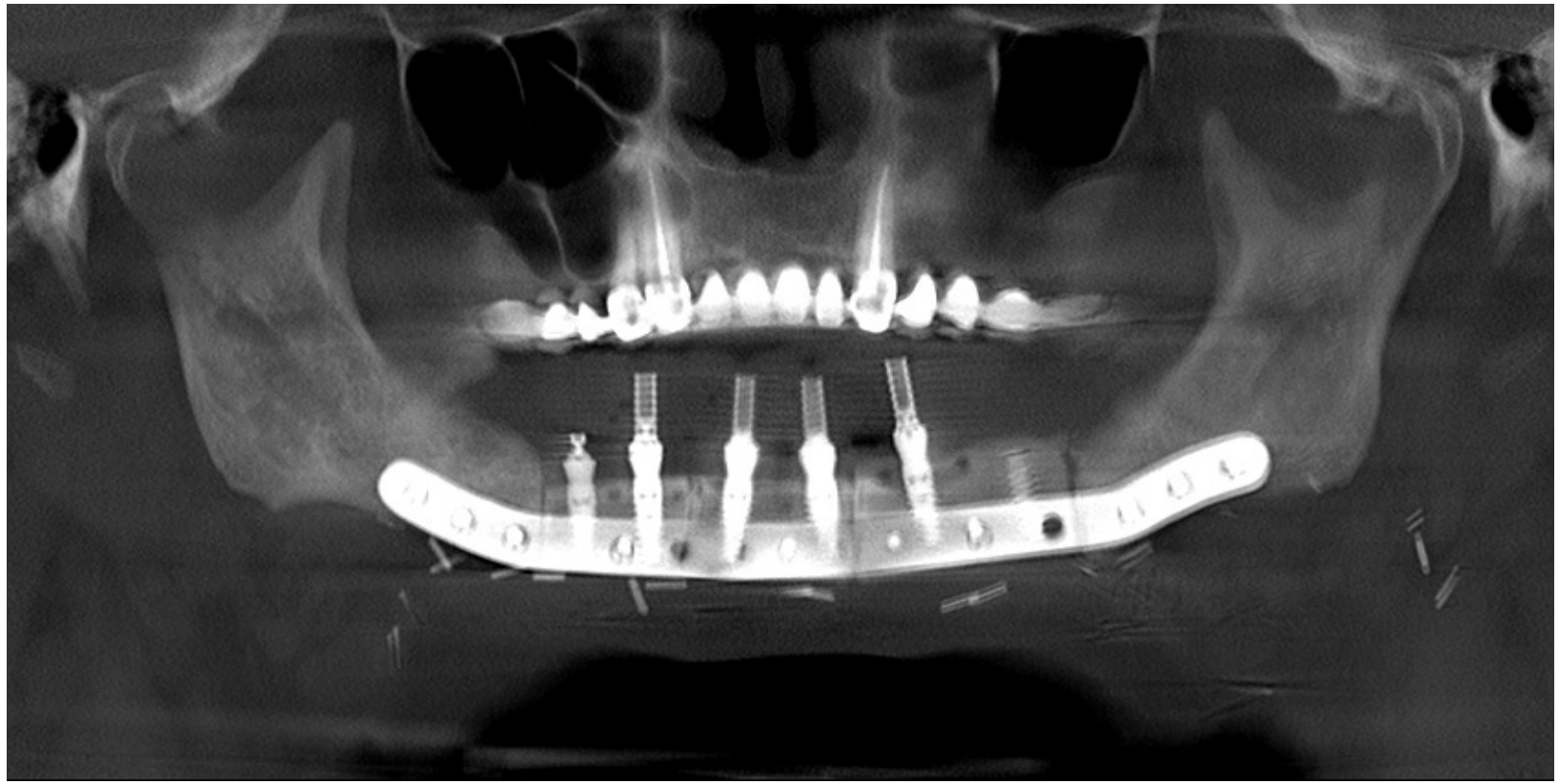


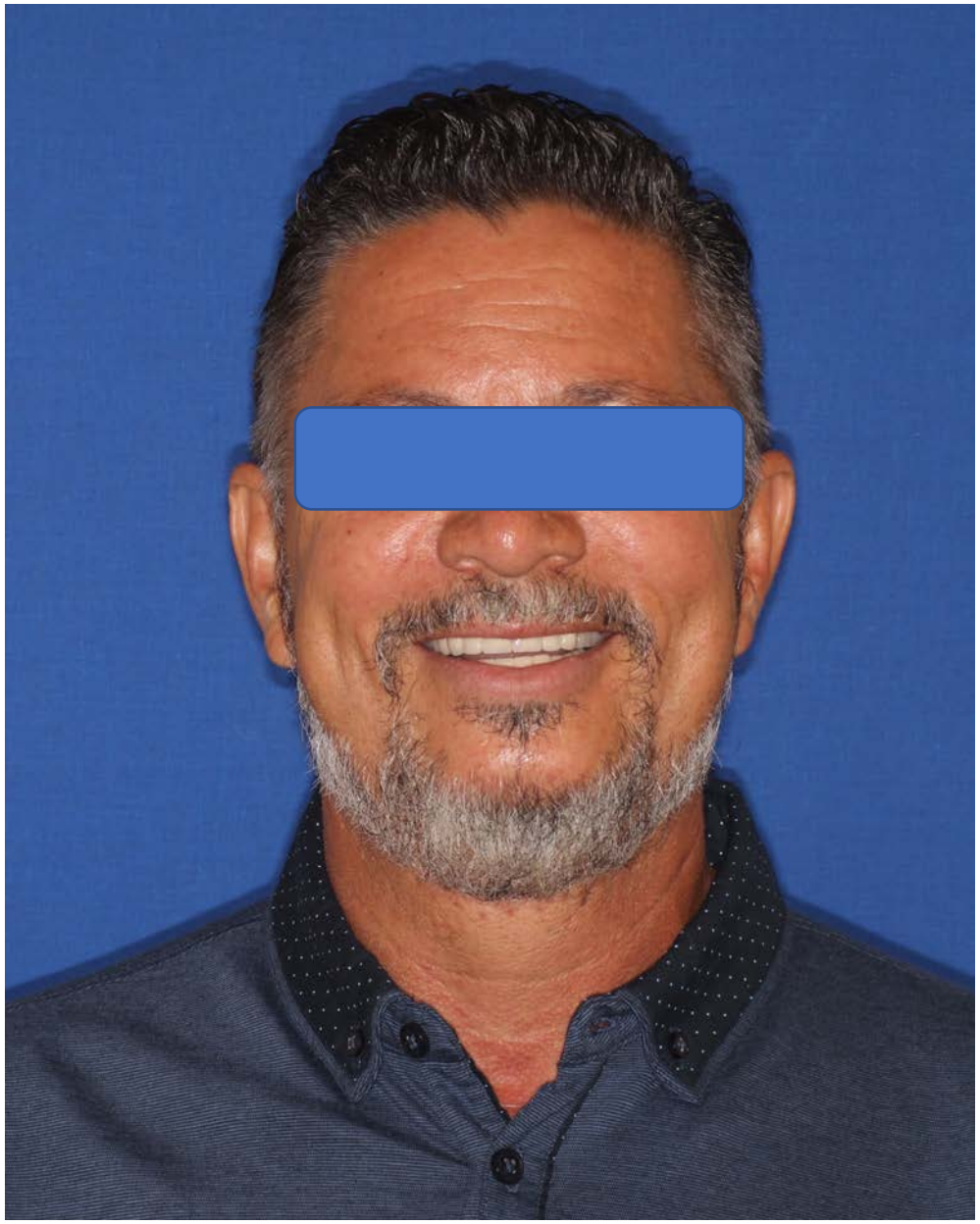


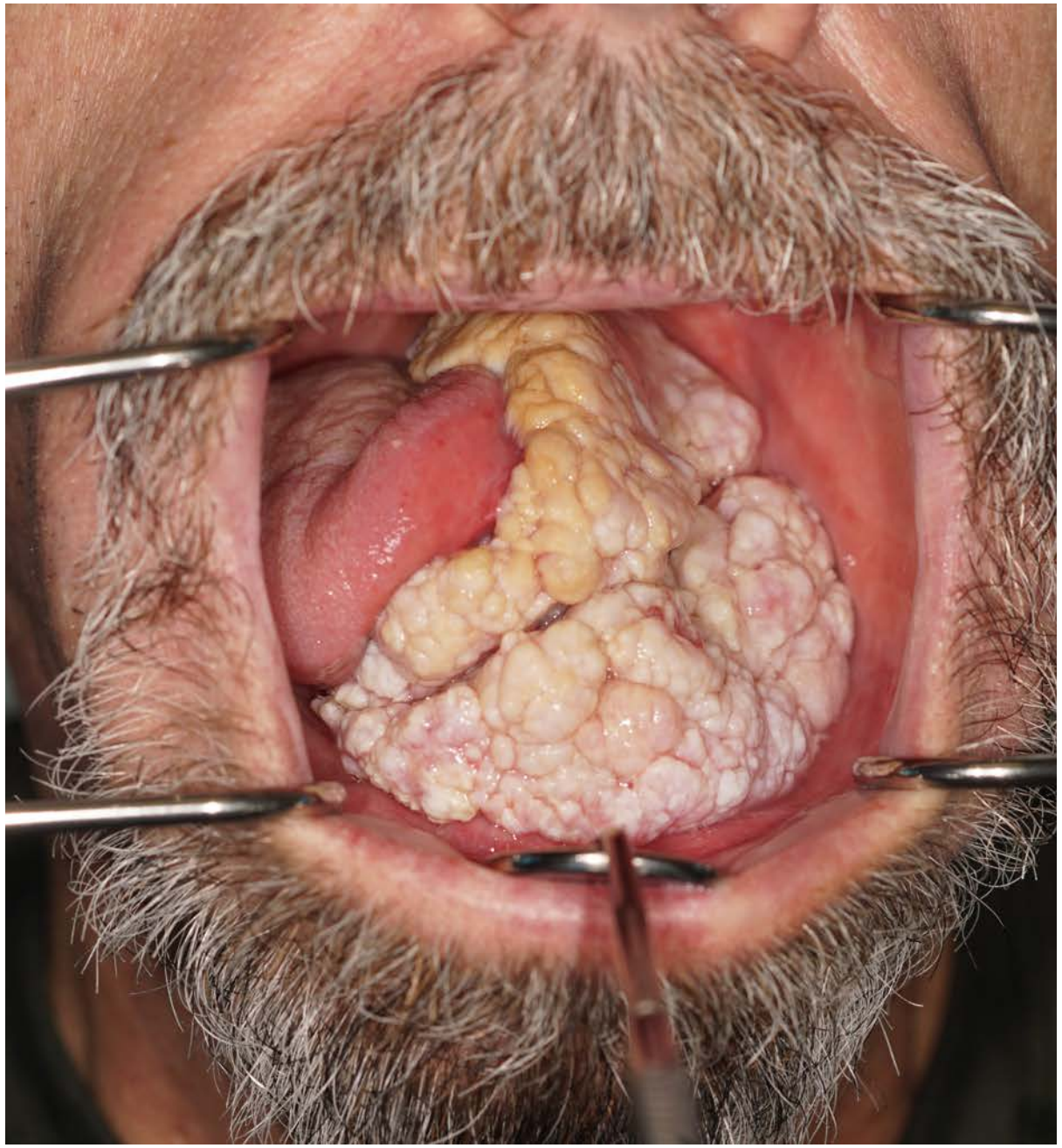


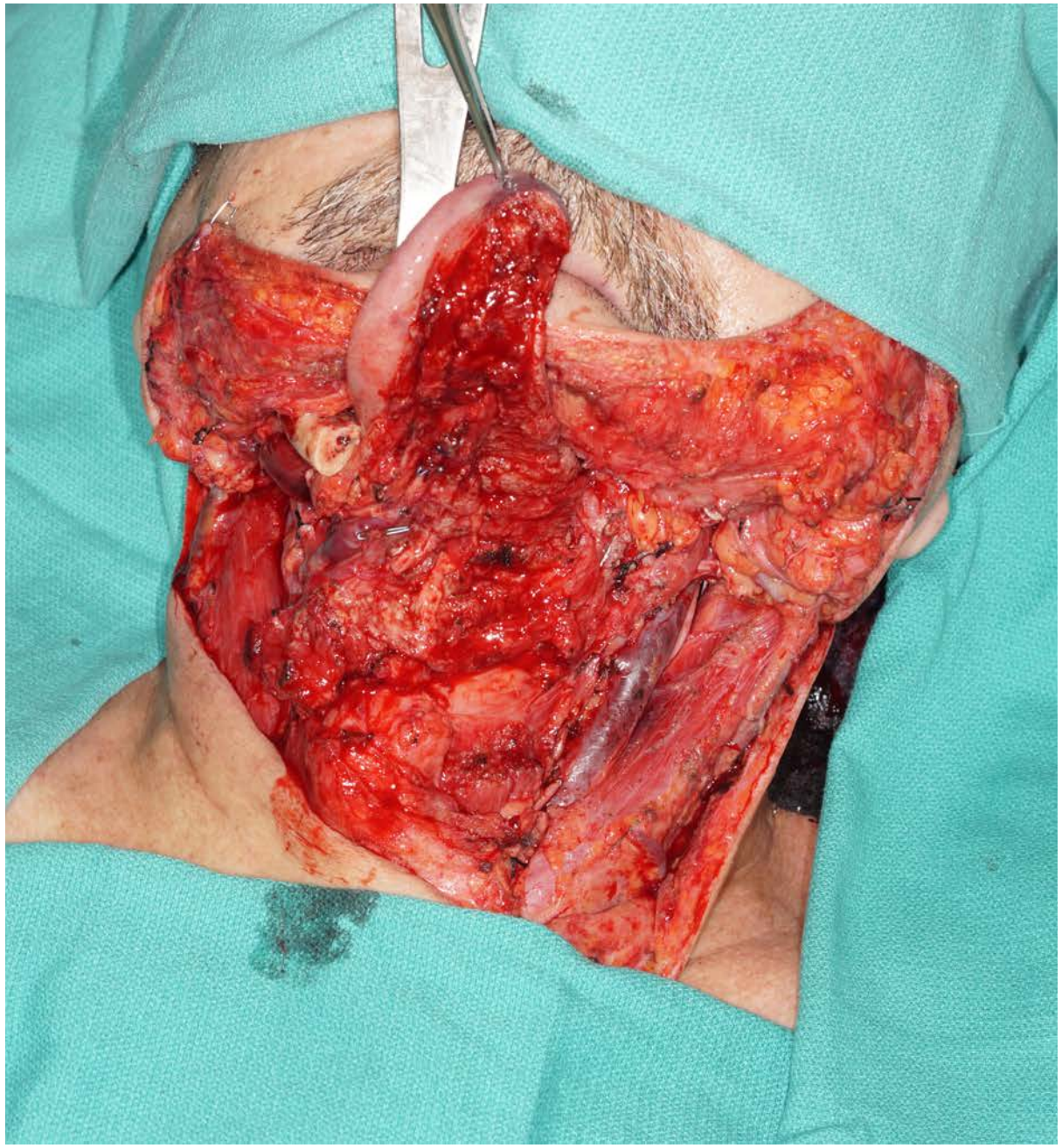


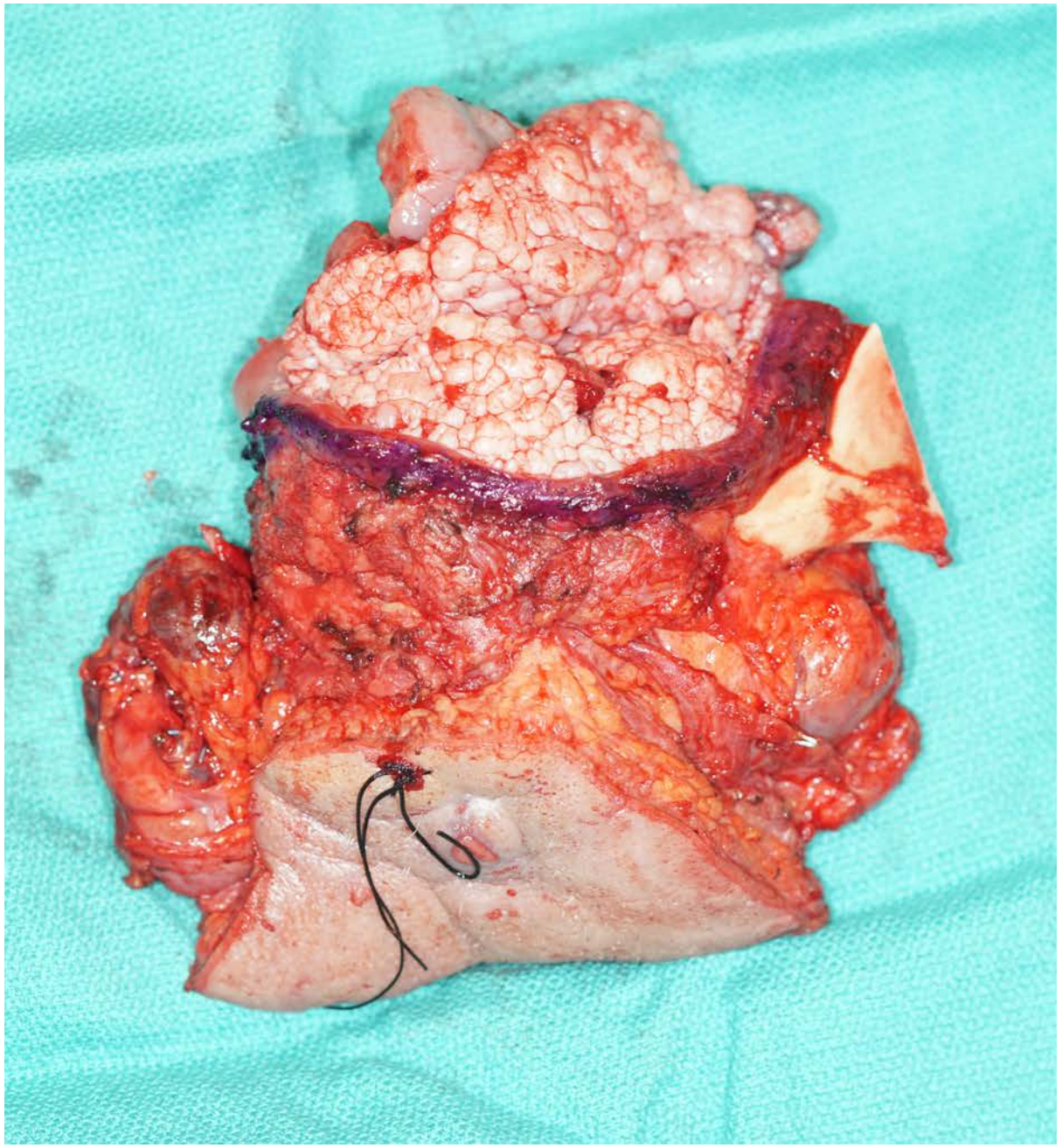


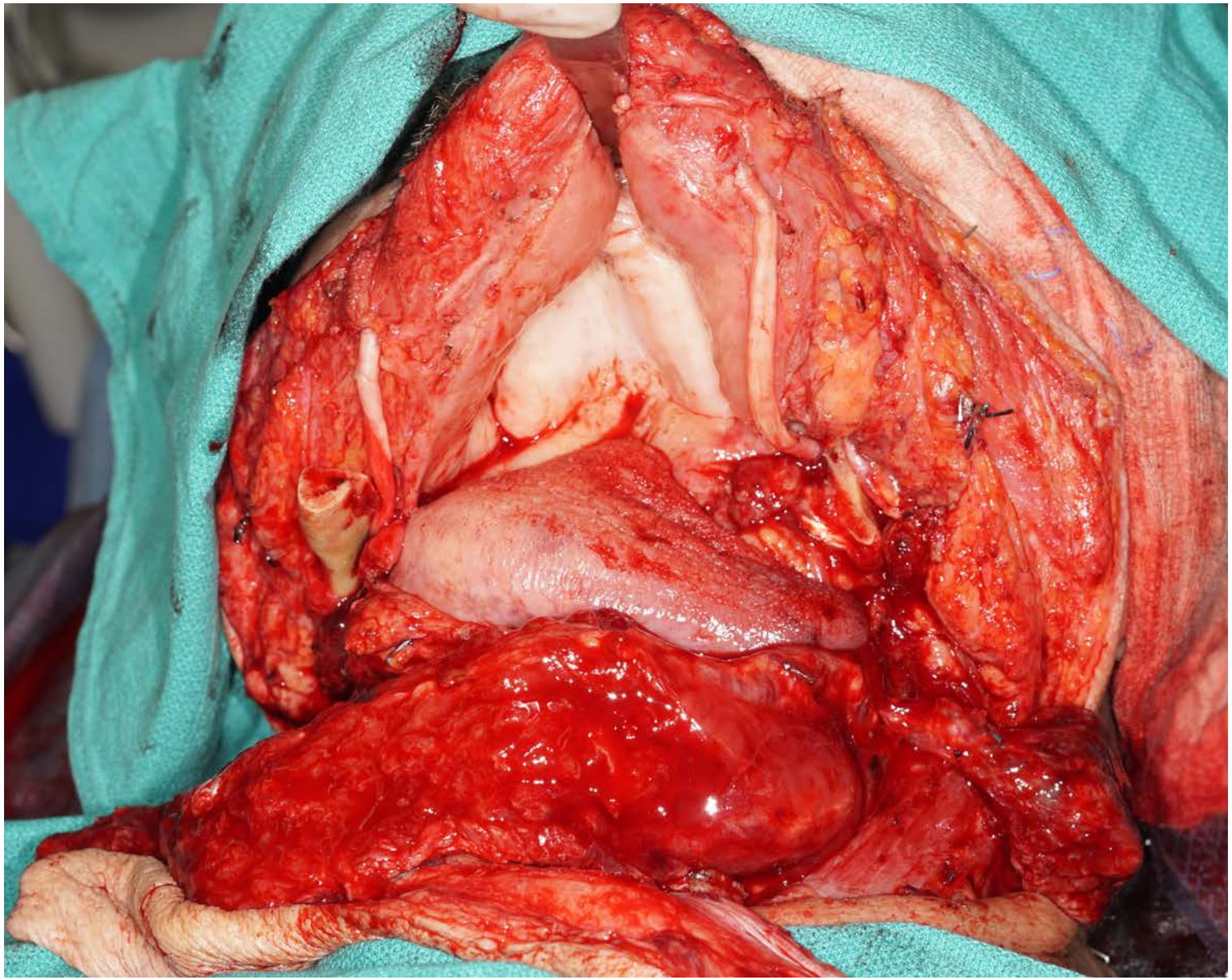


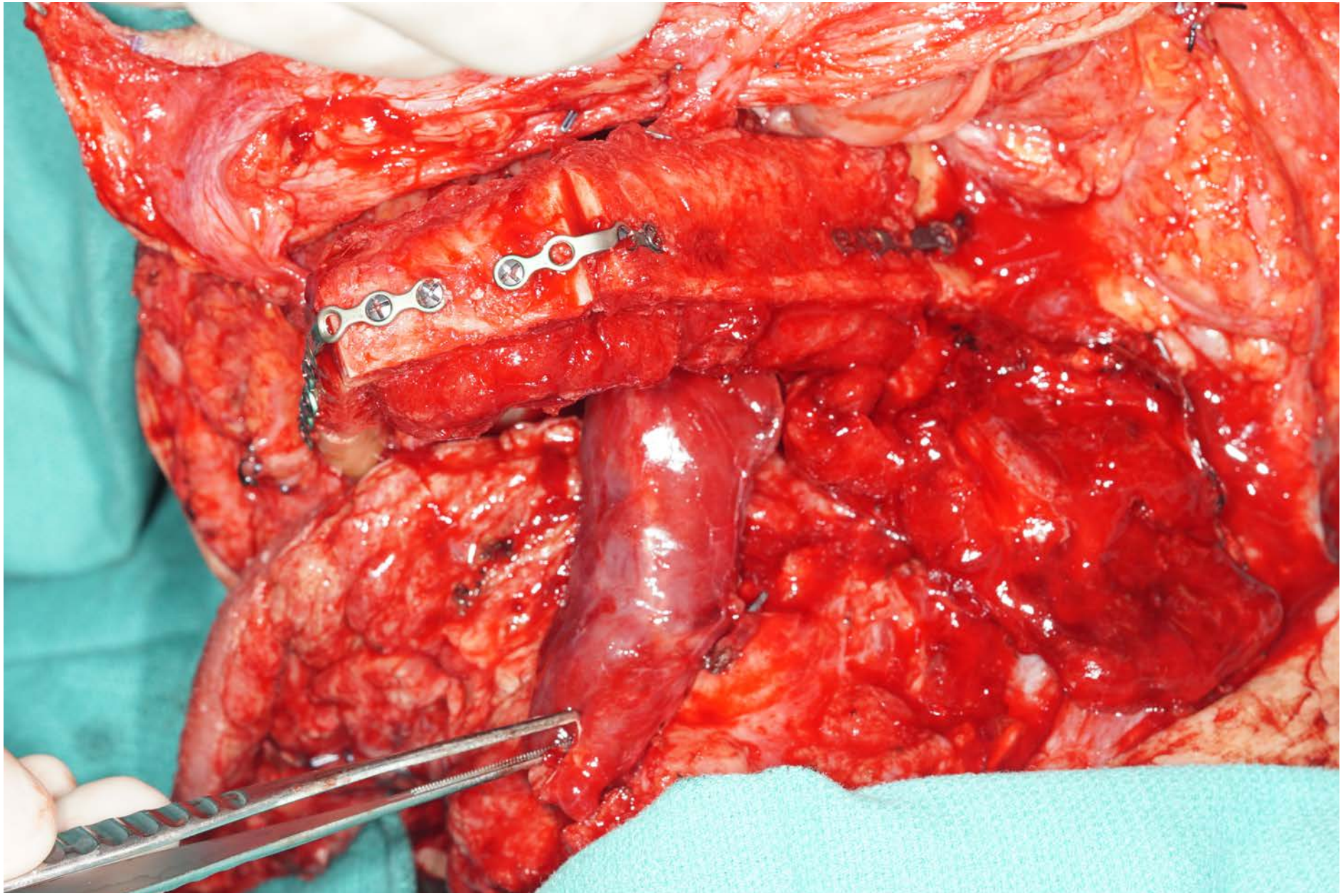


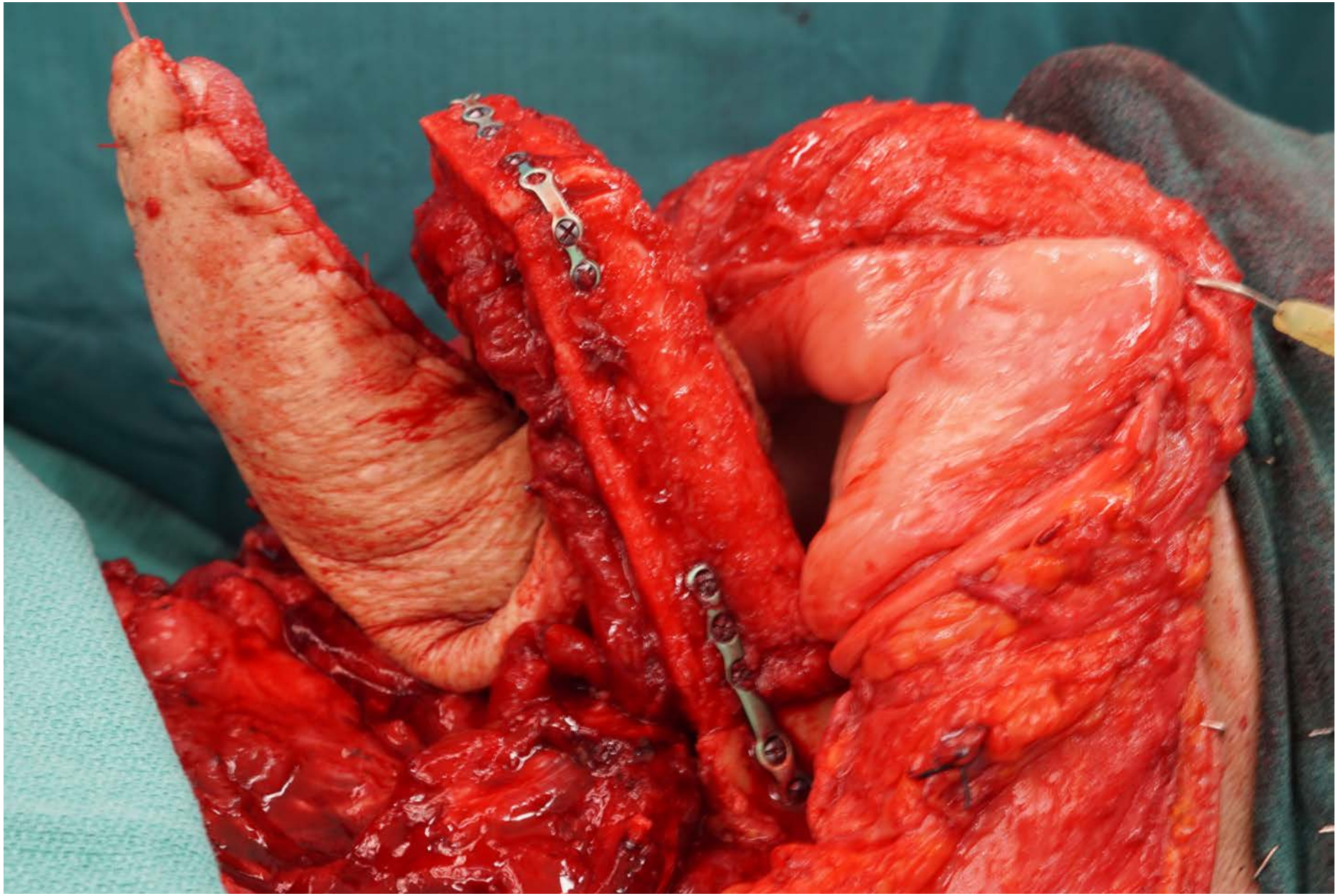


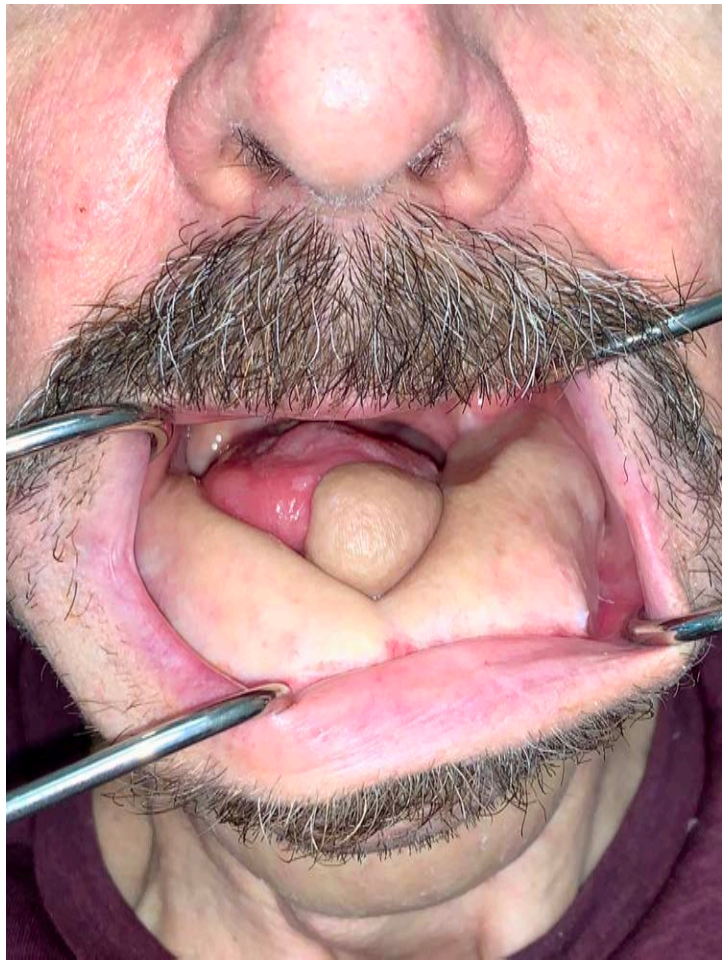


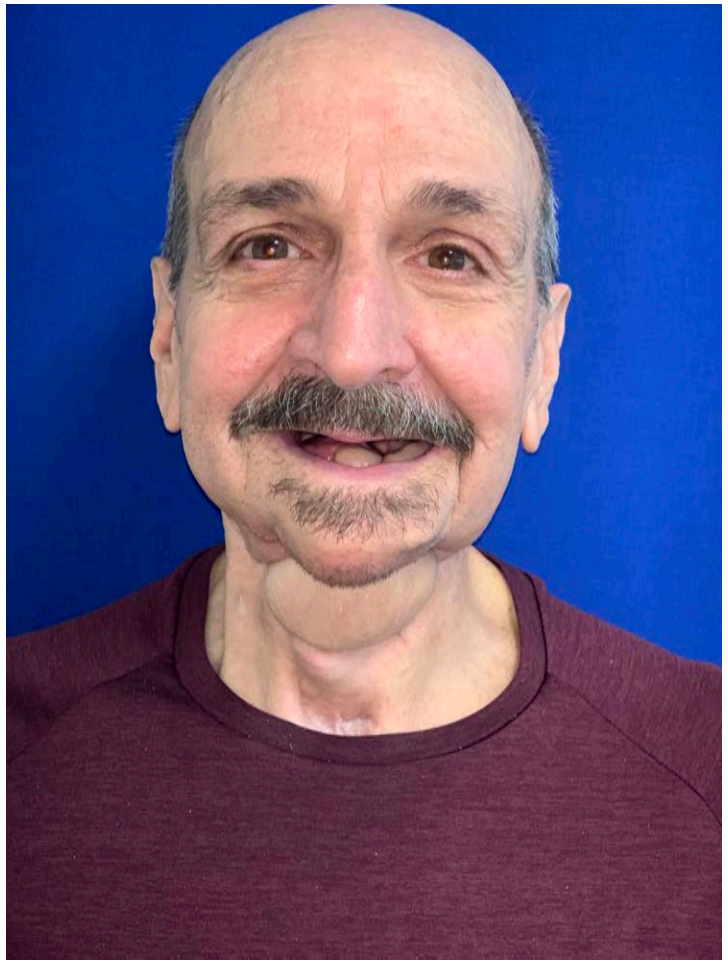


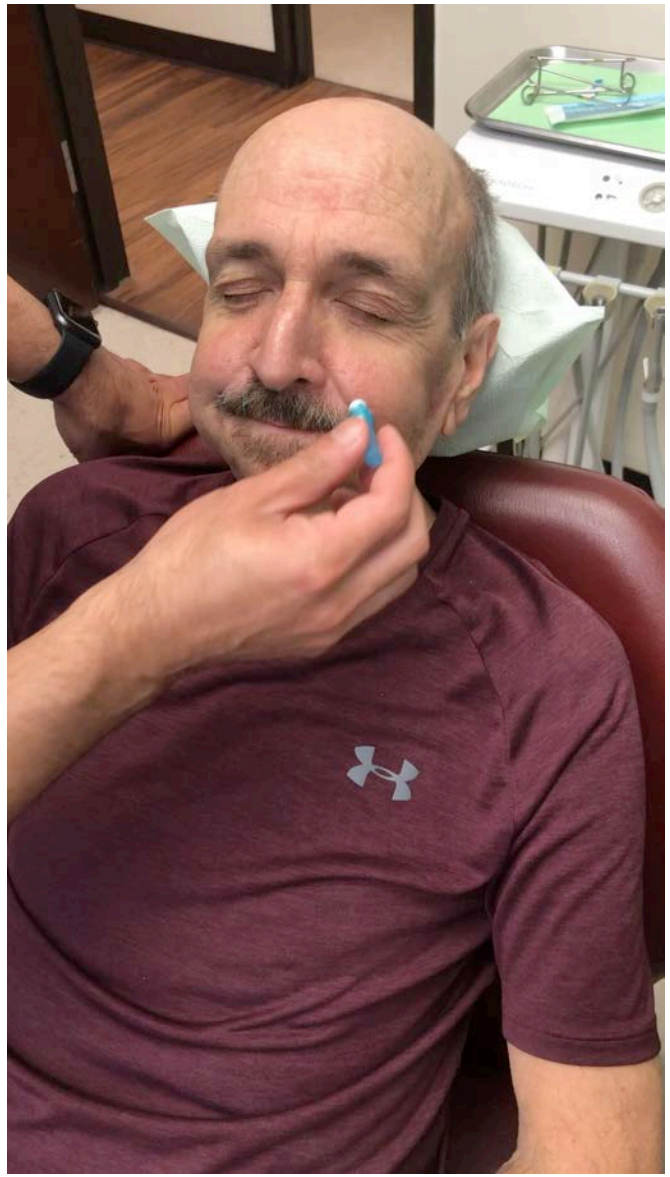












# Thank You

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# Which Nerve fibers are responsible for fine touch?

1. C Fibers
2. A Beta
3. A Delta
4. A Alpha

The **A alpha** fibers are the largest myelinated fibers with the fastest conduction velocity; they mediate position and fine touch through muscle spindle afferents and skeletal muscle afferents.
The **A beta** fibers mediate proprioception.
The smallest myelinated fibers are the **A delta** fibers that carry pain (“first” or “fast” pain) and temperature information.
The smaller diameter and slower-conducting **unmyelinated C fibers** mediate “second” or “slow” pain and temperature sensations.

# References

Ducic I, Yoon J. Reconstructive Options for Inferior Alveolar and Lingual Nerve Injuries After Dental and Oral Surgery: An Evidence-Based Review. *Ann Plast Surg*. 2019;82(6):653-660. doi:10.1097/SAP.0000000000001783

Zuniga JR. Sensory outcomes after reconstruction of lingual and inferior alveolar nerve discontinuities using processed nerve allograft--a case series. *J Oral Maxillofac Surg*. 2015;73(4):734-744. doi:10.1016/j.joms.2014.10.030