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Title: A Standardized Surgical Technique for Medial Transnasal Canthopexy

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Author Questionnaire

1. **Microscopy**: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? NO

   NO

2. **Software:** Does the part of your protocol being filmed include step-by-step descriptions of software usage? **NO**

3. **Filming location:** Will the filming need to take place in multiple locations? **NO**

4. **Testimonials (optional):** Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **NO**

Current Protocol Length
Number of Steps: 26
Number of Shots: 45

Introduction

Videographer: Obtain headshots for all authors available at the filming location.

INTRODUCTION:

~~What is the scope of your research? What questions are you trying to answer?~~

1.1. **Anne Morice:** Medial canthopexy is a technically challenging surgical procedure that benefits greatly from video-assisted instruction for educational purposes.
   1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

CONCLUSION:

~~What research gap are you addressing with your protocol?~~

1.2. **Anne Morice:** There is a lack of educational and video support concerning transnasal medial canthopexy. Our publication will help train surgeons for the realization of this technique.
   1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~What advantage does your protocol offer compared to other techniques?~~

1.3. **Anne Morice:** Our protocol allows precise anatomical fixation of the medial canthal ligament with stable results, ensuring a satisfactory outcome without visible scars.
   1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. ~~*Suggested B-roll: 4.6.1.*~~

Videographer: Obtain headshots for all authors available at the filming location.

Ethics Title Card

This research has been approved by the Institutional Review Board (IRB) at CESP, CHRU de Tours

Protocol

2. Drawing of the Incision Lines and Realization of the Orbitonasal Approach

Demonstrator: Boris Laure

NOTE: Authors have reviewed the footage and provided file names.

2.1. To begin, draw the incision line on each side of the face by following the Tessier orbitonasal incision along a bayonet-shaped line at the medial canthus, extending into a sub-tarsal approach **[1]**. Create a sequence of broken lines along the incision to assist in dissection and reduce the risk of visible retractile scarring **[2]**.

File Name: P1017103.MOV-h265.MP4 0 :17 to 0 :21

screen shot of P1017104.MOV-h265.MP4

2.1.1. WIDE: Talent marking the bayonet-shaped incision line at the medial canthus, extending laterally following the sub-tarsal path.

2.1.2. Talent drawing interrupted or dashed lines over the initial incision path.

~~2.2. For a unilateral medial transnasal canthopexy, draw the Tessier orbitonasal incision on the affected side **[1]**. On the opposite side, draw a curved incision line approximately 1.5 centimeters long, placed in front of the medial canthal tendon **[2]**.~~

~~2.2.1. Talent marking the orbitonasal incision on the affected side of the face.~~

~~2.2.2. Talent drawing a 1.5-centimeter arcuate line anterior to the medial canthal tendon on the contralateral side.~~

NOTE: 2.2 was not filmed

2.3. Infiltrate the incision sites and the medial canthus area with a subperiosteal injection of 1 percent adrenaline-lidocaine solution, provided there are no contraindications **[1]**.

2.3.1. Talent injecting the adrenaline-lidocaine solution beneath the periosteum at the marked incision lines and medial canthus region.

File Name: P1017106.MOV-h265.MP4 00:25-00:55

2.4. Using an 11-scalpel blade, perform a skin incision along the previously marked lines, cutting down to the orbicularis muscle plane and extending laterally toward the lateral canthus **[1]**.

2.4.1. Talent performing the skin incision with an 11-scalpel blade along the broken line, reaching the orbicularis muscle, and continuing laterally.

File Name: P1017107.MOV-h265.MP4 00:05-00:31

2.5. Then, using Ragnell scissors, continue dissection through the preseptal plane until reaching the periosteum at the infraorbital margin **[1]**. Using a 15-scalpel blade, incise

the periosteum along the infraorbital margin **[2]**.

2.5.1. Talent dissecting through the tissue in the preseptal plane using Ragnell scissors, advancing down to the periosteum at the infraorbital margin.
File Name: P1017109.MOV-h265.MP4 00:12-01:22

2.5.2. Talent performing a periosteal incision along the infraorbital margin using a 15-scalpel blade.
File Name: P1017109.MOV-h265.MP4 01:52-02:14

2.6. With an elevator, dissect the infraorbital margin in a subperiosteal plane **[1]**. Then, roughen approximately 2 centimeters of the orbital floor and medial wall to achieve sufficient exposure **[2]**.

2.6.1. Talent using an elevator to dissect beneath the periosteum along the infraorbital margin.
File Name: P1017109.MOV-h265.MP4 02:21-02:34

2.6.2. Talent scraping and roughening the orbital floor and medial wall to extend the exposure area. File Name: P1017109.MOV-h265.MP4 02:40-03:45

2.7. Now, insert a lacrimal probe into the lower lacrimal passage to assist in identifying anatomical structures during dissection **[1]**. ~~Gradually dissect the orbicularis muscle medially using Ragnell scissors until the medial canthal tendon is fully exposed **[2]**.~~

2.7.1. Talent gently probing the lower lacrimal passage with a lacrimal probe.
File Name: P1017113.MOV-h265.MP4 03:00-03:17, 03:26-03:38

2.7.2. ~~Talent using Ragnell scissors to dissect the orbicularis muscle medially and expose the medial canthal tendon~~.
NOTE: Not filmed

2.8. Isolate the medial canthal tendon along its entire length **[1-TXT]**. ~~Then, use Ragnell scissors and an elevator to detach it from the periosteal plane **[2]**.~~

2.8.1. Talent carefully isolating the medial canthal tendon from surrounding tissues.
TXT: Use Ragnell scissors and elevator to detach from periosteal plane
File Name: P1017113.MOV-h265.MP4 01:43-02:15

2.8.2. ~~Talent detaching the medial canthal tendon from the periosteum~~ **NOTE: Not filmed**

2.9. Using an elevator, dissect the medial orbital wall in a subperiosteal plane, pushing the lacrimal sac downward and then continue dissection **[1]**. ~~Continue the dissection to include the superior orbital rim and the inner part of the orbital roof, being cautious not~~

~~to fracture the lamina papyracea **[2]**.~~

2.9.1. Talent dissecting the medial wall in a subperiosteal plane with an elevator, depressing the lacrimal sac.
File Name: P1017110.MOV-h265.MP4 00:03-00:13

2.9.2. Talent continuing the dissection upward toward the superior orbital rim and orbital roof. **NOTE: Not filmed**

2.9.3. ~~With an elevator, release the lacrimal passages and the lacrimal sac down to the lacrimonasal canal **[1]**.~~ Expose the ascending process of the maxilla using an elevator **[2-TXT].**

~~2.9.3. Talent using an elevator to mobilize the lacrimal passages and sac up to the lacrimonasal canal.~~ **NOTE: Deleted by authors**

2.9.4. Talent exposing the ascending process of the maxilla by dissecting with an elevator. **TXT: Similarly, perform the orbitonasal approach on the contralateral side** File Name: P1017114.MOV-h265.MP4 00:02

~~2.10. For a unilateral medial canthopexy, perform the orbitonasal approach on the side where the medial canthus needs to be reattached **[1]**. On the opposite side, make a curved incision measuring approximately 1.5 centimeters in length and located about 10 millimeters anterior to the medial canthal tendon using a 15-scalpel blade **[2]**.~~ **NOTE: Not filmed**

~~2.10.1. Talent performing the orbitonasal approach on the affected side of the face.~~

2.10.2. ~~Talent making a curved incision in front of the medial canthal tendon on the contralateral side using a 15-scalpel blade~~.

3. Creating the Tansosseous Wire

3.1. To create the transosseous wire, perforate the maxillary frontal process using the largest square pin, behind the anterior lacrimal crest or at the level of the posterior lacrimal crest **[1]**. Angle the perforation slightly backward to direct the medial canthus traction toward the orbital apex **[2]**. Use a malleable retractor to shield the eye and lacrimal sac during the procedure **[3]**.
File Name: P1017114.MOV-h265.MP4 00:07-00:58

3.1.1. Talent positioning the largest square pin against the frontal process of the maxilla.

3.1.2. Talent perforating the bone in a backward direction to align traction with the

orbital apex.

3.1.3. Talent placing a malleable retractor to protect the eye and lacrimal sac during drilling.

~~3.2. Using a fine square pin, perforate the nasal septum with a deeper and more posterior trajectory compared to the initial perforation **[1]**.~~ **NOTE: Not filmed**

3.2.1. ~~Talent using the fine square pin to perform a second perforation through the nasal septum.~~

3.3. On the contralateral side, perform a bone perforation at the level of the lacrimal crest, just above the upper edge of the medial canthal tendon **[1]**. Use a malleable retractor to protect the eyeball and the lacrimal sac during this step **[2]**.
File Name: P1017115.MOV-h265.MP4 00:09

3.3.1. Talent performing a bone perforation at the lacrimal crest, directly above the superior border of the medial canthal tendon.

3.3.2. Talent inserting a malleable retractor to shield the eye and lacrimal sac during the perforation.

4. Creating a Transnasal Wire "Shuttle" and Insertion of Staged Wires on the Medial Canthal Tendon, and Contralateral Transnasal Passage

4.1. To begin creating a transnasal wire shuttle, fold the wire in half to form a loop **[1]**. Pass this loop through the bone defect from one side to the opposite side **[2]**.

4.1.1. Talent folding a non-locking steel wire into a loop.
File Name: P1017118.MOV-h265.MP4 00:00-00:10

4.1.2. Talent inserting the looped wire through the bony tunnel from one side of the nasal structure to the other.
File Name: P1017119.MOV-h265.MP4 00:39-00:56

4.2. Insert two additional wire loops head-to-head using the first loop **[1]**.

4.2.1. Talent inserting two additional steel wire loops, head to head through the initial loop File Name: P1017119.MOV-h265.MP4 01:35-02:30

~~4.3. For unilateral medial canthopexy, insert the looped wire from the affected side toward the opposite side **[1]**. Then, insert only one additional loop through the first loop, using it as a guide **[2]**.~~ **NOTE: Not filmed**

~~4.3.1. Talent inserting a single looped wire from the affected medial canthus side across to the contralateral side.~~

4.3.2. ~~Talent inserting one additional wire loop through the first one~~.

4.4. Carefully pass three separate 3-0 locking steel wires through the medial canthal tendon, ensuring each wire has a firm and secure hold **[1]**.

4.4.1. Talent threading three different 3-0 locking steel wires through the medial canthal tendon with precision.File Name: P1017120.MOV-h265.MP4 01:27-03:26
File Name: P1017121.MOV-h265.MP4 00:05-02:13

~~4.5. Cut each of the three steel wires to different lengths to prevent confusion during placement **[1]** and secure them individually using mosquito clamps **[2]**.~~ **NOTE: Not filmed**

~~4.5.1. Talent trimming each steel wire to a unique length.~~

4.5.2. ~~Talent securing the ends of each wire with mosquito clamps.~~

4.6. Pass the wires in pairs through the metal loop located on the affected side and fold them back onto themselves to prepare for transnasal passage **[1]**.

4.6.1. Talent inserting the steel wires, two at a time, through the metal loop and folding them over themselves, with different size for each steel wire, to avoid confusion after transnasal passage . File Name: P1017121.MOV-h265.MP4 03:54-08:38

4.7. Gradually pull the wire shuttle with the 3 attached steel wires at opposite side in the transnasal passage **[1]**. Then remove the loop and place the wire distinctly for bilateral fixation later **[2].**

4.7.1. Shot of the wire shuttle being pulled at the opposite side of the transnasal passage.
File Name: P1017121.MOV-h265.MP4 08:38-09:34

4.7.2. Shot of the loop being removed and the wired being placed.
File Name: P1017121.MOV-h265.MP4 09:35-12:41

4.8. Gradually pull the loop from the opposite side to draw the steel wires transnasally through the bone tunnels **[1]**. Once the loop has successfully pulled the wires through, remove the loop and arrange the wires separately **[2]**.

NOTE: Move to 4.4

4.8.1. Talent gently pulling the metal loop to guide the steel wires across the nasal bridge. File Name: P1017119.MOV-h265.MP4 02:27-02:52

4.8.2. Talent removing the metal loop and organizing the passed steel wires into two distinct pairs. File Name: P1017119.MOV-h265.MP4 03:21-03:53, 04:10-04:20

5. Contralateral Fixation of the Medial Canthus Tendon by Blocking the Steel Wires on a Metallic Cleat

5.1. Create a metallic cleat by twisting together three or four number 1 steel wires, each approximately 1 centimeter in length, and tighten them securely **[1]**.

5.1.1. Talent twisting and tightening multiple short steel wires to form a compact metallic cleat.File Name: P1017122.MOV-h265.MP4 00:00-01:35

5.2. Anchor the passed steel wires onto the metallic cleat, positioning it firmly against the maxillary process **[1-TXT]**. Then cut the steel wires **[2].**

5.2.1. Talent anchoring the steel wires to the metallic cleat and placing it against the maxillary process. **TXT: Achieve an overcorrection; Perform it bilaterally**
File Name: P1017124.MOV-h265.MP4 00:36-00:51
File Name: P1017125.MOV-h265.MP4 00:27-00:51, 02:04-04:30

5.2.2. Cut the steel wires
File Name: P1017127.MOV-h265.MP4 00:38-01:50

~~5.3. On the contralateral side, perform insertion of staged steel wires into the medial canthal tendon **[1]**. Use the wire shuttle to perform the transnasal passage of these wires **[2]** and fix the medial canthal tendon by securing the wires to a metallic cleat, following the same procedure as previously done **[3]**.~~ **NOTE: Not filmed**

~~5.3.1. Talent threading staged steel wires through the contralateral medial canthal tendon.~~

~~5.3.2. Talent passing the wires transnasally using the loop shuttle.~~

~~5.3.3. Talent fixing the contralateral tendon by anchoring wires to a metallic cleat.~~

5.4. To close the orbitonasal approach, ~~perform a two-layer closure. First, reapproximate the maxillary periosteum to the periorbital tissue using 4-0 Polyglactin sutures~~ **[1].** ~~Then~~, close the skin layer using interrupted 6-0 Polypropylene sutures **[2]**.

~~5.4.1. Talent suturing the maxillary periosteum to the periorbital tissue using 4-0 Polyglactin sutures.~~

5.4.2. Talent performing interrupted skin sutures using 6-0 Polypropylene.
File Name: P1017128.MOV-h265.MP4 10:45
AUTHOR'S NOTE: Show only the end as a screen shot

~~5.5. On the contralateral side in a case of unilateral canthopexy, perform a single-layer closure of the skin using interrupted 6-0 Polypropylene sutures~~ **[1].** **NOTE: Not filmed**

~~5.5.1. Talent closing the contralateral incision with interrupted 6-0 Polypropylene sutures.~~

Results

6. Results

6.1. In patients with craniosynostosis, transnasal medial canthopexy achieved visibly improved facial symmetry and orbital alignment postoperatively **[1],** with corresponding changes confirmed by craniofacial CT scans **[2].**

6.1.1. LAB MEDIA: Figure 4. *Video editor: Show the clinical photograph labeled "after surgery," highlighting the improved facial symmetry and orbital alignment*.

6.1.2. LAB MEDIA: Figure 4. *Video editor: Show the postoperative CT scan (fourth image), highlighting the corrected alignment of the medial orbital wall and bone fixation*.

6.2. Over the past 10 years, 9 unilateral and 5 bilateral transnasal medial canthopexies were performed in patients aged 9 to 79 years with congenital dystopia or traumatic orbital bone injuries, achieving satisfactory results **[1].**

6.2.1. LAB MEDIA: Table 1. *Video editor: Highlight the "Procedure" column*

6.3. Two patients required dacryocystorhinostomy due to persistent epiphora following the procedure **[1].**

6.3.1. LAB MEDIA: Table 1. *Video editor: Highlight the column "post-operative epiphora".*

Pronunciation Guide:

1. Canthopexy
   Pronunciation link: https://www.merriam-webster.com/dictionary/canthopexy
   IPA: /ˈkænθoʊˌpɛksi/
   Phonetic Spelling: kan·thoh·pek·see
2. Transnasal
   Pronunciation link: https://www.merriam-webster.com/dictionary/transnasal
   IPA: /trænzˈneɪzəl/
   Phonetic Spelling: tranz·nay·zuhl
3. Medial
   Pronunciation link: https://www.merriam-webster.com/dictionary/medial
   IPA: /ˈmiːdiəl/
   Phonetic Spelling: mee·dee·uhl
4. Orbitonasal
   Pronunciation link: No confirmed link found
   IPA: /ˌɔːrbɪtoʊˈneɪzəl/
   Phonetic Spelling: or·bih·toh·nay·zuhl
5. Tessier
   Pronunciation link: https://www.howtopronounce.com/tessier
   IPA: /ˈtɛsjeɪ/
   Phonetic Spelling: teh·syay
6. Subtarsal
   Pronunciation link: No confirmed link found
   IPA: /ˌsʌbˈtɑːrsəl/
   Phonetic Spelling: sub·tar·suhl
7. Periosteum
   Pronunciation link: https://www.merriam-webster.com/dictionary/periosteum
   IPA: /ˌpɛriˈɑːstiəm/
   Phonetic Spelling: peh·ree·ah·stee·uhm
8. Subperiosteal
   Pronunciation link: https://www.merriam-webster.com/dictionary/subperiosteal
   IPA: /ˌsʌbˌpɛriˈɑːstiəl/
   Phonetic Spelling: sub·peh·ree·ah·stee·uhl
9. Infraorbital
   Pronunciation link: https://www.merriam-webster.com/dictionary/infraorbital
   IPA: /ˌɪnfrəˈɔːrbɪtəl/
   Phonetic Spelling: in·fruh·or·bih·tuhl
10. Orbicularis
    Pronunciation link: https://www.merriam-webster.com/dictionary/orbicularis
    IPA: /ɔːrˈbɪkjələrɪs/
    Phonetic Spelling: or·bik·yuh·lar·iss

11. Lacrimal
    Pronunciation link: https://www.merriam-webster.com/dictionary/lacrimal
    IPA: /ˈlæk.rɪ.məl/
    Phonetic Spelling: lak·ruh·muhl
12. Canthal
    Pronunciation link: https://www.merriam-webster.com/dictionary/canthal
    IPA: /ˈkænθəl/
    Phonetic Spelling: kan·thuhl
13. Peristal— *(not present; skipped)*
14. Lamina papyracea
    Pronunciation link: https://www.merriam-webster.com/medical/lamina%20papyracea
    IPA: /ˈlæmɪnə ˌpæpɪˈreɪsiə/
    Phonetic Spelling: lam·ih·nuh pap·ih·ray·see·uh
15. Maxilla
    Pronunciation link: https://www.merriam-webster.com/dictionary/maxilla
    IPA: /mækˈsɪlə/
    Phonetic Spelling: mak·sil·uh
16. Transosseous
    Pronunciation link: https://www.merriam-webster.com/dictionary/transosseous
    IPA: /ˌtrænzˈɑːsiəs/
    Phonetic Spelling: tranz·ah·see·uhs
17. Septum
    Pronunciation link: https://www.merriam-webster.com/dictionary/septum
    IPA: /ˈsɛptəm/
    Phonetic Spelling: sep·tuhm
18. Contralateral
    Pronunciation link: https://www.merriam-webster.com/dictionary/contralateral
    IPA: /ˌkɑːntrəˈlætərəl/
    Phonetic Spelling: kon·truh·la·tuh·ruhl
19. Transnasal
    Pronunciation link: https://www.merriam-webster.com/dictionary/transnasal
    IPA: /trænzˈneɪzəl/
    Phonetic Spelling: tranz·nay·zuhl
20. Craniosynostosis
    Pronunciation link: https://www.merriam-webster.com/medical/craniosynostosis
    IPA: /ˌkreɪni.oʊˌsɪnɑːˈstoʊsɪs/
    Phonetic Spelling: kray·nee·oh·sin·ah·stoh·sis
21. Dacryocystorhinostomy
    Pronunciation link: https://www.merriam-webster.com/medical/dacryocystorhinostomy
    IPA: /ˌdækri.oʊˌsɪstoʊˌraɪnɑːˈstɑːmi/
    Phonetic Spelling: dak·ree·oh·sis·toh·rye·nah·stah·mee

22. Epiphora
    Pronunciation link: https://www.merriam-webster.com/medical/epiphora
    IPA: /ɪˈpɪfərɪ/
    Phonetic Spelling: ih·pif·uh·ruh
23. Polyglactin
    Pronunciation link: https://www.merriam-webster.com/medical/polyglactin
    IPA: /ˌpɑːliˈglæk.tɪn/
    Phonetic Spelling: pah·lee·glak·tin
24. Polypropylene
    Pronunciation link: https://www.merriam-webster.com/dictionary/polypropylene
    IPA: /ˌpɑːliˈproʊpəlɪn/
    Phonetic Spelling: pah·lee·proh·puh·lin
25. Dystopia
    Pronunciation link: https://www.merriam-webster.com/medical/dystopia
    IPA: /dɪsˈtoʊpiə/
    Phonetic Spelling: dis·toh·pee·uh
26. Craniofacial
    Pronunciation link: https://www.merriam-webster.com/medical/craniofacial
    IPA: /ˌkreɪnioʊˈfeɪʃəl/
    Phonetic Spelling: kray·nee·oh·fay·shuhl