

MONDAY NERVE/PEDIATRICS

2:00 PM - 2:05 PM

RM92 Microsurgical Interventions to Improve Outcomes in Erectile Dysfunction

University of Southern California

ASRM Medical Student Research Grant

Presenter: **Orr Shauly, MD**

Orr Shauly, MD (1), (1) University of Southern California

Background: The use of ilioinguinal, iliohypogastric, genitofemoral, sciatic, and femoral end-to-side nerve transfers have all been reported in the literature to successfully correct neurogenic erectile dysfunction. However, little is known about the anatomic variations in size, length, fascicle distribution, and topography of these nerves. The goal of this study is to identify structural, topographic, and distributional variations in humans of the nerves in question to gain a better understanding of various surgical options of end-to-side neurotomy that may be potentially available to patients with ED. As a secondary endpoint, this study sought to identify the best candidates for surgical end-to-end or end-to-side neurotomy in patients with sensory or parasympathetic dysfunction.

Methods: Four adult male cadavers were obtained from the USC Keck School of Medicine fresh tissue cadaver lab run in partnership with Los Angeles County + USC Medical Center. Cause of death was unknown, however all the specimens contained complete pelvic viscera and surrounding related tissues. The cadavers are unembalmed and refrigerated to maintain tissue integrity. The diameter, length, and number of sensory branches of the ilioinguinal, genitofemoral and dorsal nerve of the penis were assessed in each individual cadaver. The distances from sensory branch points of the ilioinguinal and genitofemoral nerves to the base of the dorsal nerve of the penis and to the cavernous plexus of the prostate were also measured. Diameter was assessed using a metric caliper, and length was assessed with a metric ruler.

Results: The mean diameter of the anterior scrotal nerve (sensory branch of the ilioinguinal nerve) across all four cadavers measured 0.9mm (SD = 0.2mm), with the mean distance from the sensory branch point at the superficial inguinal ring to the base of the dorsal nerve of the penis measuring 8.0cm (SD = 1.7cm), and mean distance to the cavernous plexus of the prostate measuring 5.7cm (SD = 0.7cm). The genitofemoral nerve was found to be larger in diameter than the ilioinguinal, with a mean of 1.8mm (SD = 0.6mm, $p = 0.12$) although not significant. Distance to the dorsal nerve of the penis was similar with a mean of 8cm (SD = 1.0cm), but was further from the cavernous plexus, with a mean distance of 6.6cm (SD = 1.9cm, $p = 0.53$). We identified an average of 0.7 sensory branch from the ilioinguinal nerve as it exits the superficial inguinal ring, and 1.0 sensory branch from the genitofemoral nerve as it travels medially. The dorsal nerve of the penis demonstrated an average of 3.7 sensory branches, with mean diameter of 1.6mm (SD = 1.0mm). The average diameter of the dorsal nerve of the penis was measured at 3.7mm (SD = 0.6mm) across all cadavers, significantly larger than both the genitofemoral ($p = 0.02$) and ilioinguinal ($p = 0.01$) nerves.

Conclusion: Thus far, we have identified both the genitofemoral and ilioinguinal nerves as excellent candidates for end-to-end neurotomy with the dorsal nerve of the penis in the case of ED caused by somatosensory deficit.

2:10 PM - 2:15 PM

RM94 The Role of Microsurgery in Testicular Auto-Transplantation

Indiana University, Indianapolis

Presenter: **Michael W. Chu, MD**

Michael W. Chu, MD(1), Julia A. Cook, MD(2), Sarah E. Sasor, MD(3), Konrad Szymanski, MD(2), Martin Kaefer, MD(2) and Sunil S. Tholpady, MD PhD(2,4)

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The Role of Microsurgery in Testicular Auto-Transplantation **Background:** Microsurgery for the treatment of undescended, intra-abdominal testis is controversial. The efficacy is questioned, especially compared to orchiopexy procedures, and functional outcomes measures requires long-term follow-up. Other commonly cited reasons include the requirement for microsurgical expertise, small caliber vessels, and prolonged operative times. However, recent advancements in microsurgical techniques has improved graft survival in other procedures and operative times have significantly decreased. The purpose of this study was to report the ten year experience of orchiopexy and revascularization of pediatric auto-transplanted testes. **Methods:** A retrospective review was performed for patients who underwent an orchiopexy and microvascular supercharging of intra-abdominal testes from 2007 to 2017. Patient demographics, perioperative course, complications, and clinical outcomes were analyzed. **Results:** Nine patients underwent 11 orchiopexy and revascularization procedures. All cases had successful orchiopexy and microvascular supercharging. The average length of stay was 6.7 days, the longest follow-up was 9.8 years and the median was 7.3 months. Average operative time was 584 mins (366 to 659). Endocrine studies were performed in two patients and ultrasound imaging was performed in four patients; which showed signs of testicular growth. **Conclusion:** Undescended testes may occur in 1% of the population. Patients with bilateral, impalpable and solitary, unilateral testis patients are prime candidates for microvascular auto-transfer. Our early data shows that this technique is safe, effective, and has the potential to avoid orchiectomy, decrease testicular torsion, psychological disturbance, impaired fertility, and malignant degeneration.

2:15 PM - 2:20 PM

RM95 Emerging Non-Surgical and Surgical Techniques to Treat Erectile Dysfunction: A Systematic Review of Treatment Options and Published Outcomes

Keck Hospital of USC, Los Angeles

Presenter: **Orr D. Shauly, M.S.**

Orr D. Shauly, M.S.(1), Daniel Joseph Gould, MD PhD(2) and Ketan M. Patel, M.D.(3)

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Background: Erectile dysfunction is one of the most common causes of morbidity in male patients among all ages, with a prevalence demonstrated as high as 50-60% in men aged 40-70. Erectile dysfunctions may be caused by physical or psychological trauma, the former of which may be treatable through surgical intervention. Physical trauma may be further categorized as either vasculogenic, neurogenic, or idiopathic in nature. Although many patients do not respond well to non-surgical treatment options, few opt for surgical intervention. This is likely due to the difficulty of the procedures, as well as relatively low historical success rates. As such, a systematic review of the literature was performed to identify novel surgical interventions for ED.

Methods: A systematic review of the literature was performed to identify novel and emerging interventions for erectile dysfunction and to investigate the details of each surgical procedure, as well as to identify clinical considerations for the support of *in vivo* study results.

Results: A total of 19 manuscripts were included in this review, representing data on three minimally invasive approaches to ED treatment and eight novel surgical techniques. The data revealed compelling evidence in support of microsurgical treatment for ED – namely microvascular arterial bypass penile revascularization surgery (MABS) and cavernous nerve graft reconstruction. Nerve grafts varied – with end-to-side ilioinguinal, genitofemoral, and sural grafts all demonstrating high rates of success. Furthermore, minimally invasive botulinum toxin (BoNT-A) treatment and adipose derived stem cell (ADSC) therapy have both shown extreme promise in rat models; with BoNT-A treatment entering phase two human clinical trials this year.

Conclusion: The surgical options for ED may all benefit from involvement of a microsurgeon. Microsurgeons are trained in small vessel anastomosis, as well as nerve transfers and reconstructions. Many of the surgical methods investigated in this review are microsurgical interventions that demonstrate high rates of success in patients with neurogenic or vasculogenic ED. As such, microsurgeons are uniquely trained and positioned to be of value to ED treatment. There is no doubt the combination of Urological and Plastic and Reconstructive Surgical teams will prove to be a potent force in the surgical management of erectile dysfunction.

2:20 PM - 2:25 PM

RM96 Reconstruction of Pediatric Craniofacial Defects after Oncologic Resection

Katarzyna Kania, Houston

Presenter: **Katarzyna E Kania, MD, MPH**

Katarzyna E Kania, MD, MPH(1), Matthew G Kaufman, MD(2), Robert F Dempsey, MD(3), William Chris Pederson, MD(3) and Edward P Buchanan, MD, FACS(3)

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Background

Tumors of the pediatric facial skeleton and soft tissue pose a challenge in clinical practice, with treatment often leading to functional disabilities and permanent disfigurement. These rare benign or malignant tumors typically originate from osteogenic, fibrogenic, neurogenic, hematopoietic, or epithelial origin. Those that require oncologic resection and reconstruction are treated using a multi-disciplinary approach, including the expertise of otolaryngology, neurosurgery, and plastic surgery. To date, no large series describing the reconstruction of pediatric facial tumors has been reported in the literature.

Methods

From 2016 to 2018, fourteen patients aged 6 months to 16 years underwent resection and reconstruction for facial tumors. Eleven patients were reconstructed with microvascular free flaps, three received local flaps, and one patient received reoperation for tumor recurrence using a pedicled flap. Follow-up ranged from 1 month to 2 years. Reconstructive outcomes were analyzed post-operatively.

Results

Of the fourteen, six patients underwent free fibula reconstruction for maxillomandibular defects. One underwent free radial forearm reconstruction for an orbital exenteration defect. Three underwent free anterolateral thigh flap reconstruction for maxillectomy defects. One received a chimeric latissimus dorsi and serratus anterior free flap for a craniectomy defect. One patient with tumor recurrence received a reoperation using a pedicled sternocleidomastoid flap. The remaining three patients underwent rotational or advancement flaps for varied maxillary, palatal, or buccal defects. Thirteen of fourteen flaps were successful. One resulted in a flap failure with successful palatal healing by secondary intention. Another required flap salvage with saphenous vein graft due to venous thrombosis. One fibula flap resulted in bony malunion with partial osseous resorption and remains under careful surveillance. Two patients experienced minor wound dehiscence and one developed an oronasal fistula requiring buccal mucosal flap closure.

Conclusion

Reconstruction of the facial skeleton in the pediatric population requires special consideration for future growth, often requiring temporization in anticipation for skeletal maturity followed by subsequent reoperation at an appropriate age. Pediatric reconstruction creates additional

challenges with more limited donor sites, smaller anastomoses, and unpredictable post-operative compliance. Composite bony and soft tissue, as well as isolated soft tissue defects in children can be safely reconstructed using microsurgical techniques.

2:30 PM - 2:35 PM

RM97 The Use of Medial Femoral Condyle Free Flaps in the Pediatric Population Is Safe and Effective

David Colen, Philadelphia

Presenter: **David L. Colen, MD**

David L. Colen, MD(1), L. Scott Levin, MD(2), Marco Innocenti, MD(3) and Stephen J. Kovach III, MD(1)

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(2)University of Pennsylvania, Philadelphia, PA, (3)Careggi University, Florence, Italy

Background

The use of medial femoral condyle flaps (MFC) have steadily grown in popularity and are now regarded as a workhorse for reconstruction requiring free vascularized osseous or osteochondral defects throughout the body. To date, the utility of this technique has not been described for the pediatric patient population, likely due to infrequency of pediatric patients requiring this type of reconstruction, the relative nascence of the surgical technique, and/or fear of disrupting bone growth in skeletally immature patients. The purpose of this article is to present our series of pediatric patients who underwent an MFC based free flap skeletal reconstruction and demonstrate the safety and efficacy of this technique in the pediatric population.

Methods

A retrospective review of all patients 18-years-old or younger who required free MFC flaps for reconstruction of skeletal defects was undertaken. Charts were reviewed with attention paid to operative technique, radiographic and clinical outcomes. A novel technique was employed to identify and avoid injury to the distal femoral physis in which 2 kirschner wires were placed under fluoroscopic guidance. One wire was placed just proximal to the growth plate, marking the distal extent of corticocancellous bone harvest, and the second more proximal based on flap requirements with the intervening segment of bone harvested with osteotome. (Figure 1).

Results

Chart review included six patients, average age 13.7 years (range 8-18) with a mean follow-up of 16 months (range 3 – 40). Clinical and operative information, including outcomes can be found in Table 1. Five of 6 patients were skeletally immature at the time of MFC harvest, with the last patient having organic bone disease putting her at risk of pathologic fracture. All six patients achieved bony union and no patients suffered pathologic fractures or physeal injuries; zero patients developed femoral length discrepancy.

Conclusion

We present the first series of MFC free flaps in the pediatric population along with a novel technique to avoid injury to the physis in skeletally immature patients. This technique is effective for a variety of skeletal defects or nonunions and is safe for growing patients without causing physeal arrest or growth disturbance.

Table 1: Patient data and outcomes

Pt No.	Age	Sex	PMH	PSH	Recipient Site	Complications
1	15	M	R maxillary sinus teratoma	Right maxillectomy, anterior orbitotomy Right orbital floor reconstruction with titanium mesh; fat grafting to periorbital and malar region	Right orbital rim, orbital floor	Cellulitis
2	14	M	R humeral Ewings sarcoma	Right humeral resection Reconstruction with allograft-prosthetic composite, cancellous bone autograft combined with Grafton® Adjuvant XRT for positive soft tissue margin c/b osteonecrosis and distal allograft/humeral nonunion	Right mid-humerus	None
3	18	F	Idiopathic acute liver failure s/p transplant Post transplant lymphoproliferative disease Chronic rejection of transplanted liver Tacrolimus associated chronic renal disease Dialysis dependent Renal osteodystrophe	Pathologic distal tibial, fibular fractures secondary to renal osteodystrophy Chronic nonunion of distal tibial fracture	Right distal tibia	Delayed union
4	15	F	Kienbock's disease	n/a	Left wrist lunate	None
5	8	F	Enchondroma of right ring finger, middle phalanx	Excision of enchondroma	Interpositional bone flap in right ring finger middle phalanx	None
6	12	M	Cleft lip and palate, osteonecrosis of premaxilla	Cleft lip and palate repair	Premaxillary alveolus	None

Figure 1:



A



B

2:35 PM - 2:40 PM

RM98 The Effects of Intra-Operative Electrical Stimulation on Nerve Regeneration across Short Isografts in Rats

Washington University in Saint Louis School of Medicine, St. Louis

ASRM Medical Student Research Grant

Presenter: **Grace Catherine Keane, B.A.**

Grace Catherine Keane, B.A.(1), Deng Pan, BS(2), Lauren Schellhardt, BS(2), Susan E. Mackinnon, MD(3) and Matthew Wood, PhD(2)

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Background: Brief electrical stimulation (BES) of peripheral nerves following reconstruction has demonstrated positive outcomes facilitating axon regeneration and functional recovery in animal models. Presently, the majority of animal studies on the effects of BES to treat peripheral nerve injuries employ end-to-end repair following nerve transection. In clinical practice, however, nerve grafts are frequently employed to bridge the proximal and distal nerve ends during surgical reconstruction. We evaluated the effect of BES provided by a commercially available electrical stimulator to treat peripheral nerve injuries repaired using nerve isografts, the animal model equivalent of an autograft. We hypothesized that nerve isografts with BES would result in quicker motor function recovery and increased axonal regeneration in comparison to nerve isografts without BES.

Methods: Male Lewis rats were randomized into two experimental groups: Isograft with 1 hour of electrical stimulation (“E Stim”) and Isograft without electrical stimulation (“Control”). Both groups underwent a tibial nerve transection and immediate repair with a 1 cm isograft harvested from the sciatic nerve of a donor Lewis rat. Electrical stimulation at 0.5 mA was delivered proximal to the nerve graft by a Checkpoint® stimulator device during the operation. Walking track analysis was performed weekly postoperatively to assess motor functional recovery scored using the tibial functional index (TFI). At 21 weeks, nerve isografts were harvested for histology. In a separate cohort, nerves were harvested for immunohistochemical analysis of early axon regeneration at 14 days postoperatively.

Results: Motor function recovery, measured as a significant improvement in TFI compared to week 1 TFI values, occurred by 10 weeks in the “E Stim” group ($p < 0.05$). No significant TFI improvement has been observed in the “Control” group. Histological and gene expression analyses are ongoing.

Conclusion: Intra-operative BES following nerve reconstruction using a Checkpoint® stimulator device accelerated functional recovery in a graft model.

2:40 PM - 2:45 PM

RM99 Chylothorax Treated with Peripheral Lymphaticovenular Anastomosis, with More Than One Year Follow-Ups.

Motoi Kato, Tokyo

Presenter: **Motoi Kato, M.D.**

Motoi Kato, M.D.

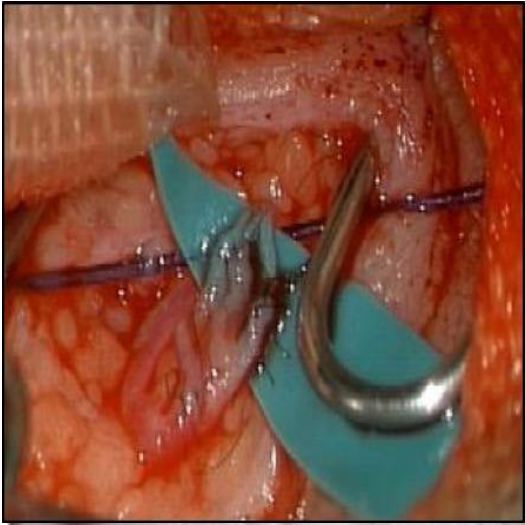
Asahi General Hospital, Asahi, Japan

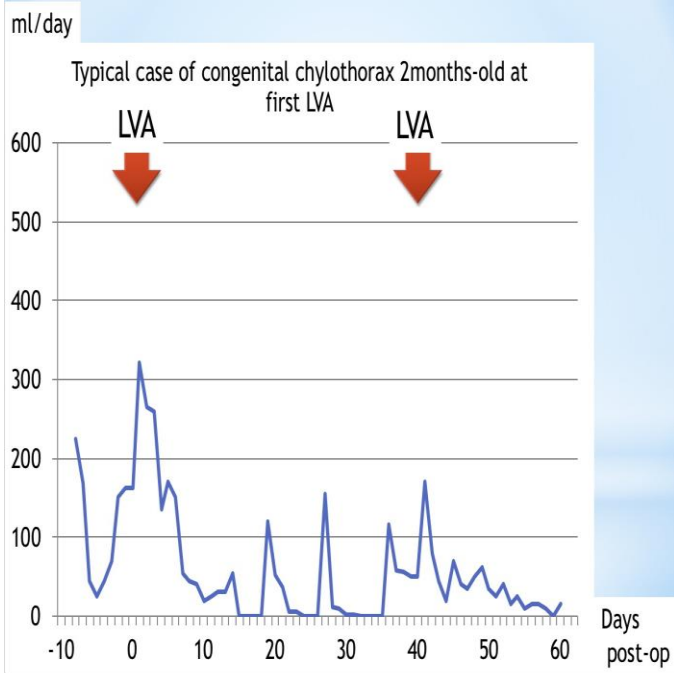
Background: Chylothorax could result in unsuccessful and refractory with medical treatments. The patients required long hospital stay, could be delayed developmentally, malnutrition and sometimes be critical. Recent rapid development of radiology revealed the etiology of the chylothorax as lymphatic vessel system problems such as recurrence, leaking, or related to stenosis or obstructions. These lymph vessel problems are similar to the peripheral lymph diseases which we analyzed lymph flow and treated with direct maneuver to the lymph vessels under microscope. Hence, we introduced these minimum invasive procedures to correct central lymph system, a modification of the lymphaticovenular anastomosis (LVA) which recently commonly used for the lymphedema surgery.

Methods: Twelve pediatric patients ages from 30 days to 2 years old were undergone LVA. Five patients were diagnosed with hereditary diseases other than cardiac anomalies. All were followed more than one year after LVA. The longest was performed more than four years previously. All cases preoperative medical treatments were applied resulted unsuccessful, such as fasting, medium-chain triglyceride (MCT) milk, steroids, fibrogammin, or octreotide.

Results: Six patients were completely cured from the lymphatic leakages, three required further treatment, and three died during the intensive care most frequently by respiratory distress. More than one year follow up, the initially edematous patients likely to be remained dermal backflow patterns with indocyanine green lymphography. The postoperative scars were unremarkable.

Conclusion: The peripheral LVA could successfully reduce the amount of chyle leakage of the thoracic cavity, result in cure in some cases. To our best knowledge, this is the first report of refractory chylothorax with LVA more than one year follow up. These treatments still limited in complicated patients, however the flow oriented novel approach to reconstruct the lymph flow, might be an alternative approach for the refractory chylothorax.





2:45 PM - 2:50 PM

RM100 The Masseteric Nerve for Facial Reanimation: Macroscopic and Microscopic Characteristics Regarding Axonal Load, Fascicle Structure, Diameter and Number of Branches in 106 Hemifaces

University Hospital Regensburg, Regensburg

Presenter: **Andreas Kehrer, MD**

Andreas Kehrer, MD(1), Marc Ruewe, Medical Student(2), Simon Udo Engelmann, Medical Student(2), Veronika Mandlik, M.D.(2), Christian Taeger, M.D.(2), Ernst Tamm, Prof.(2), Ronald Bleys, Prof.(3) and Lukas Prantl, Prof.(2)

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Background

Peripheral facial palsy causes severe functional, aesthetic and psychological impairments. In late cases free muscle transplants connected to the masseteric nerve may be performed. Early cases may be salvaged with masseteric nerve transfers restoring facial tone and dynamics. Surgical anatomy has been well described. Axonal load is of critical importance for adequate functional outcomes. The aim of our study was to attain a better understanding of the micro- and macro anatomy of the masseteric nerve with regard to fascicle structure, diameter and axonal load in a large series. Correlating axon capacity with cross sectional nerve diameter was performed to further facilitate donor nerve selection.

Methods

Microsurgical dissection was performed on 106 hemifaces of fresh frozen human cadavers. The number of respective nerve branches was noted distal to the incisura mandibulae. Nerve biopsies of both the masseteric main trunk and downstream branches were obtained. Specimens were PPD-fixed, sectioned, and stained for digital semi-automated axon quantification using ImageJ software. Cross sections were measured by two orthogonal vectors using Zeiss AxioVision software which was first calibrated with a micrometer scale.

Results

Of the 154 evaluated branches, 74 specimens were of the main trunk, 40 of the horizontal branch, 38 of the descending branch and 2 halves showed an additional branch, which was not included. Quality standards for semi-automated axon analysis were met by 117 specimens and 83 meeting the criteria for diameter measurements. The main trunk showed 1.71 ± 0.94 (n= 70; range, 1 to 4) fascicles, an axonal capacity of 2213 ± 957 (n=55; range, 266 to 5343), and a mean diameter of 1.3 ± 0.29 mm (n=44; range, 0.82 to 2.2). One millimeter in diameter correlated with 1890 ± 690 (n= 36; r= 0.25) axons. The horizontal branch demonstrated a mean capacity of 725 ± 714 axons (n= 30; range, 51 to 2500), a mean diameter of 1.1 ± 0.49 mm (n=40; range, 0.36 to 2.4 mm), and a correlation of 638 ± 531 axons per mm (n= 30; r= 0.43; p= 0.018). The descending branches showed an axonal capacity of 1562 ± 926 (n=30; range, 119 to 4394), a

mean diameter of 1.15 ± 0.34 mm (n=22; range, 0.62 to 2.02 mm) and a correlation of 1477 ± 428 (n= 18; r= 0.64; p= 0.004) axons per millimeter.

Conclusion

The descending masseteric branch demonstrated a high axonal capacity for nerve transfers or muscle transplants.

2:50 PM - 2:55 PM

RM101 Single Stage Neurotisation of the Weak Smile in Flaccid and Non-Flaccid Facial Paralysis

Ruben Yap Kannan, East Grinstead

Presenter: **Ruben Y Kannan, MRCSEd PhD FRCS(Plast) Dip(Otol)HNS**

Ruben Y Kannan, MRCSEd PhD FRCS(Plast) Dip(Otol)HNS, Catriona Neville, BSc, Tamsin Gwynn, BSc, Karen Young, BSc and Charles Nduka, MA MD FRCS FRCS(Plast) Queen Victoria Hospital, East Grinstead, United Kingdom

Background:

To evaluate the efficacy of selectively neurotising the specific facial muscles directly for smile reanimation, in patients with residual resting tone with or without a weak smile.

Methods:

In a prospective study over two years' (2016-18), we selected seventeen patients (n = 17) for this procedure; the ipsilateral masseteric nerve (V3m), cervical branch of the ipsilateral facial nerve (VIIc) or the contralateral facial nerve as a cross-facial nerve graft (CFNG). These were used to directly neurotise the the zygomaticus major (ZM), levator labii superioris (LLS) or the depressor labii inferioris (DLI), depending on the pre-operative smile vector analysis of the patient. All patients had a pre-operative HADS and Sunnybrook facial grading scale assessment as well as needle EMG studies to identify the target muscle group. Patients were followed up at three monthly intervals after surgery using the Sunnybrook scale and House-Brackmann scores alongside surface EMG tests over this period to measure clinical improvement.

Results:

The mean in-hospital stay was one day, with three complications reported due to reaction to the use of fibrin glue for neural coaptation. The masseteric nerve (n = 11), cervical branch of facial nerve (n = 5) and the CFNG (n = 1) were used for neurotisation while the fascia lata sling was used to improve the resting symmetry in selected cases. Patients were noted to have improved tone within three months while increased smile excursion was observed by six months post-op. The V3m-group showed an 81% smile activation rate and a 28 % increased risk of synkinesis while the VIIc-group reduced synkinesis in all cases but required longer to dynamize smile. Overall, this translated to improved Sunnybrook scores of up to 58% clinically.

Conclusion:

While masseteric nerve-powered smile augmentation required the use of the bite-smile to activate initially, by nine months' post-op spontaneous smile activation was evident while the CFNG case exhibited symmetrical movements but require longer to re-innervate (18 months). The VIIc-group was best suited for those patients with reduced smile excursion due to the antagonistic pull of the platysma, with a background of synkinesis. The cervical neurectomy performed as a result of the nerve transfer also helps reduce synkinesis. These procedures hence, represent the next step in the evolution of facial reanimation; simple and effective.