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Rehabilitation and Social Integration Commission
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DEAR READERS,

Issues of Rehabilitation, Orthopaedics, Neurophysiology and Sport Promotion – IRONS (formerly Issues of Rehabilitation Promotion) publishes the original papers, reviews, research reports and case reports from the fields of rehabilitation, physiotherapy, orthopaedics and neurophysiology as well as topics dealing with diagnostic and treatment of the sport related traumas. IRONS edits the scientific papers based on methods used in many medicine branches. IRONS is printed quarterly in Polish and English languages, both in printed journal and electronic versions. IRONS is dedicated to both advanced and experienced as well as young scientists.

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IRONS Editor in Chief
Prof. Juliusz Huber

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DEAR COLLEAGUES,

We are pleased to present the supplement volume of Issues of Rehabilitation, Orthopaedics, Neurophysiology and Sport Promotion – IRONS. It has been exclusively devoted to 10th International Poznań Course in Upper Extremity Surgery, Forearm, Wrist, Hand 2017 and especially the treatment of nerve injuries, hand traumas and other interesting topics as Dupuytren´s contracture or congenital diseases and contains abstracts and selected papers submitted for the main program lectures as well as complete abstracts presented during the poster session.

We appreciate authors' effort in preparing this content. We would like to give special thanks to IRONS Editor-in-Chief – Prof. Juliusz Huber, IRONS Scientific Secretary – Agnieszka Wincek dr Joanna Wałecka for contribution in preparation of the materials for printing in perfect form and schedule.

We are sure that content of the supplement will be great addition to presented lectures, good source of recent knowledge and remarkable remain of this extraordinary, jubilee meeting.

Prof. Leszek Romanowski
Chairman of the Course

dr Piotr Czarnecki
Course Secretary

SZANOWNI PAŃSTWO,
Z wielką przyjemnością przedstawiamy suplement kwartalnika Issues of Rehabilitation, Orthopaedics, Neurophysiology and Sport Promotion – IRONS. Został on w całości poświęcony tematyce 10 Międzynarodowego Poznańskiego Kursu Chirurgii Kończyny Górnej 2017, a w szczególności leczeniu uszkodzeń nerwów, zaopatrywaniu urazów ręki oraz innym istotnym tematom takim jak przykurcz Dupuytrena czy wady wrodzone. Wydanie zawiera przesłane streszczenia oraz niektóre artykuły z programu głównego kursu wraz z kompletem streszczeń prezentowanych podczas sesji plakatowej.

Doceniamy wysiłek autorów w przygotowanie treści artykułów i streszczeń. Szczególne podziękowania składamy Redaktorowi Naczelnemu IRONS – Prof. dr hab. n. med. Juliuszowi Huberowi oraz Sekretarzowi Naukowemu IRONS – Agnieszce Wincek jak i dr n. med. Joannie Wałeckiej, za przygotowanie wszystkich materiałów w odpowiedniej do druku formie.

Z całą pewnością treść wolumenu będzie doskonałym uzupełnieniem wygłoszonych podczas kursu wykładów, źródłem aktualnej wiedzy na poruszane tematy i cenną pamiątką z tego wyjątkowego, jubileuszowego, spotkania.

Prof. dr hab. med. Leszek Romanowski
Organizator Kursu

dr n. med. Piotr Czarnecki
Sekretarz Kursu

NERVE INJURY – CLINICAL EXAMINATION

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Peripheral nerves injuries in the upper extermity are common in every day practices and require a careful assessment. Damage to the peripheral nerves causes disorders such as sensibility deficits, loss of active motions, loss of reflexes, vasomotor deficits, secretory deficits, nutritious deficits. The aim of the clinical examination of nerve injury is to find which nerve is damaged, what are the nature and level of the damage? Clinical examination is a basic survey and begins with inspection for the presence of an open wound or scar, its location and pattern. Examination of loss of sensation should be marked at this point. To evaluate it, the two-point discrimination is determined at the finger tips, where the normal static value in adults is less than 6 mm. The Tinel's sign is used to verify if there are any regenerating axons or a neuroma. It is important to examine functional motor deficits which may be caused not only by the nerve injury but also they can be attributed to tendon or bone injuries. It is crucial to assess the intrinsic muscles when there is a suspicion of the motor branch injury.

CLASSIFICATION OF NERVE INJURIES

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The main classification of nerve injuries was described by Seddon.
He defined three groups of nerve lesions.

- Neuropraxia (Class I) – inhibition of nerve function without any anatomical interruption or with only local myelin damage. Rehabilitation leads to full recovery within several days to few weeks.
- Axonotmesis (Class II) – interruption of the continuity of the axon with preservation of epineurium. With a proper rehabilitation program the surgical treatment is usually not necessary.
- Neurotmesis (Class III) – the most severe nerve injury, with total disruption of the nerve trunk. The surgical treatment is essential. Very often some functional deficits occur in the outcome.

Sunderland widened Seddon's classification into five degrees:

- First degree (Class I) – Seddon's Neuropraxia
- Second degree (Class II) – Seddon's Axonotmesis – Axon injured, endoneurium, perineurium and epineurium are intact
- Third degree (Class II) – Seddon's Axonotmesis – Axon and endoneurium injured, perineurium and epineurium are intact
- Forth degree (Class II) – Seddon's Axonotmesis – Axon, endoneurium and perineurium injured, epineurium are intact
- Fifth degree (Class III) – Seddon's Neurotmesis – Total disruption of the nerve trunk

PHYSICAL THERAPY IN NERVE INJURIES

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Nerve injuries are commonly observed in clinical practice both in surgery and rehabilitation wards. Controversies exist if physical therapy, particular electrotherapy applications are useful in treatment of these cases. Most often described effects of nerve injuries are muscle weakness and pain sensation. Examples of clinically proved electrotherapeutic procedures which could be used successfully in patients with signs of nerve injury are presented in support of literature recommendations.

BONE LOSS IN THE HAND

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Bone loss is incomplete contact of destructed bone, leading to delayed bone healing, malunion, nonunion and failure of fixation. Every bone loss is associated with soft tissue damage. It can be generally divided into primary trauma bone loss, nonunion, osteomyelitis and tumors. Proper classification and evaluation guides the optimal treatment.

There are three steps of traumatic bone loss treatment (emergency treatment, reconstruction and rehabilitation). First step takes place at the Emergency Room and includes adequate exposure, debridement and stable skeletal fixation by spacewires, transfixation wires, ex-fix, bone cement or silicone spacer and bridging the plate fixation.

Second step includes reconstruction with bone grafting, osteosynthesis and soft tissue repair. Currently single stage surgery (all in one) is preferred. However, it is sometimes necessary to use staged reconstruction (e.g. Masquelette technique). The bone graft options include cancellous, cortical, cortico-cancellous and osteochondral bone. These can be either non-vascularized or vascularized, autografts, allografts or synthetic graft variants.

Presentation describes indications, advantages or disadvantages and graft implantation procedures. Treatment of the bone loss in the hand is a challenge for the patient and the surgeon. There are three steps for reconstruction, but most important step is the prevention of trauma itself.

DUPUYTREN´S CONTRACTURE – FASCIECTOMY

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Fasciectomy is still the most useful surgical procedure in the treatment of Dupuytren´s disease. There is no absolute or urgent indication for the open surgery. However, general indication is loss of the hand function, disease progression within a period of six months, 20–30° MPJ and 30° PIPJ flexion contracture and a painful nodule.

Optimal planning, which includes grading of the disease, management of skin, fascia and joints, leads to the selection of an optimal type of fasciectomy.

There are four types of fasciectomies: segmental, limited, radical and dermofasciectomy. Segmental and limited fasciectomy is currently preferred.

The presentation describes operation procedures step by step, including tips, tricks and pitfalls.

INJURIES AROUND CMC AND MP JOINT OF THE THUMB

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Injuries around CMC and MP joint of the thumb impair the thumb- a key part of grasping hand. Because of that it is important to establish the correct diagnosis followed by proper treatment. Injuries occur most often during everyday sport activities in young vital people. Therefore and because of the location, the damaged region involves joints with excessive movement – restoration of detailed anatomy is mandatory for future function. Not only precised case history and exact physical examination but also dedicated X-rays and a very popular in Poland sonografy can explain joints, bones and adjacent ligaments injury status. Computer tomography and magnetic resonance are less often needed for special cases. The aim of treatment is reestablish stable, painless joints with functional range of motion. For this reason, the operative treatment is preffered more often. It provides more anatomic tissue reconstruction and allows starting with rehabilitation earlier. Even old injuries around the thumb can be managed with promising results, long as treatment is proposed before joint arthritic changes occur.

AVASCULAR NECROSIS OF THE LUNATE

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Mechanism of avascular necrosis of the lunate is not clearly recognised. Multifactorial reason (bone compression, anatomical bone and vascularity variants or others) probably compromises lunate blood supply disturbing then physiological bone remodellig process managed by osteoblasts and osteoclasts. It causes comminution of bone structure, its weakness and fragmentation leading to a progressive wrist arthritis. Initial inflammation symptoms and dorsal wrist discomfort change with the time into permanent pain, weakness and wrist stiffness.

Previous radiological classification of the disease according to Lichtmann has been complemented by magnetic resonans examination and arthroscopic assesment of joints status and chondral lunate coverage („an envelope").

An orthopedic treatment is currently less popular except a very young not progressed people. Operative approaches for Kienboeck's disease rely on improvement of bone blood supply by decrease pressure of surrouding bones (bone decompression) and by direct lunate bone rewascularisation. Advanced changes with bone collapse and arthritis are proposed to be treated with nonanatomic procedures (proximal row carpectomy, arthrodeses, wrist denervation). Mechanism of Kienboeck's disease seems to be uncertain, therefore new theories and efforts of new ways of treatment are still considered.

SL LIGAMENT RECONSTRUCTION

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Scapholunate ligament injury is common and should be always taken into account with history of any wrist sprain. The spectrum of pathology which may develop secondary to scapholunate instability and rotatory subluxation of the scaphoid can be avoided with

an early recognition and treatment of the injury. Initial approach to the patient and decision making to perform a direct reconstruction of the dorsal scapholunate ligament or augmentation procedures is presented. Arthroscopic and open procedures of dorsal scapholunate ligament repair are discussed. Late reconstruction of static instability may result in the development of arthrosis and SLAC wrist, thus repair of the dorsal scapholunate ligament should be performed as early as possible.

CLASSIFICATION OF UPPER LIMB ANOMALIES

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Upper extremity anomalies are very various and can be caused by genetic, environmental and unknown factors. Each year about 5–30 babies for 10 000 newborns have such a deformity. Because of great diversity in anomalies, several classifications have been made. The most common used is Swanson's classification based on etiopathogenic pathways, accepted by ASSH and IFSSH. It includes 7 types of upper extremity deformities.
Type I: Failure of part formation
a. Transverse absence (congenital amputations)
b. Longitudinal absence (phocomelia, radial club hand, ulnar club hand, cleft hand)
Type II: Failure of differentiation
a. Soft tissue (syndactyly, camptodactyly, trigger thumb)
b. Skeletal (synostoses)
c. Tumor conditions
Type III: Duplication (polydactyly)
a. Pre-axial
b. Post-axial
c. Central
Type IV: Overgrowth
a. Macrodactyly
b. Hamartomas
Type V: Undergrowth (hypoplasia)
Type VI: Congenital constriction band syndrome
Type VII: Generalized skeletal abnormalities

SYNDACTYLY

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Syndactyly is one of the most common hand malformations. This pathology is characterized by the coalescence of two or more digits to each other. A variety of clinical features of this anomaly, as well as the large number of treatment approaches causes of certain surgical difficulties during surgery planning. Through the analysis of the published data and based on own practical experience, it was focused on the fundamental points concerning the planning and surgical treatment of the certain pathology.

WHAT'S NEW – IFSSH BUENOS AIRES

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Three medals for smart ideas introduced during IFESSH in Buenos Aires:

1. New technical devices for tendon passage in hand and orthopaedic surgery
2. Modification of dynamic tenodesis for SL instability (by Gracia Elias)
3. New algorithm for Kienbock Disease

Tendon grafts are used very often in reconstructive surgery both orthopaedic and hand surgery. Passage through bone tunnel is time consuming and requires additional suture. This takes time and destroys tendon graft ending. Moreover failure can be frustrating if a repetitive attempt is unsuccessful. Also in tendon injury it is easier to find its proximal stump and then pass through carpal tunnel or pulley system. So this device will make this procedure effortless. It can be used both in passage through bone tunnel and pulley system. The devise is simple reminds Chinese trap used in arthroscopy to mount fingers but with small diameter and its ending is like an elastic probe which allows the passage

Professor Garcia Elias and his biomechanics wrist studies are of paramount importance in understanding of wrist pathology. His modification on Brunelli's procedure in wrist instability is widely accepted and known. Using FCR tendon to pass through bony tunnel in scaphoid from palmar aspect to dorsal aspect was proposed. Proximal pole of scaphoid corrects flexion deformity of scaphoid. However we know that rotation deformity, which is the part of scaphoid migration is not corrected. Professor Elias proposed additional correction of rotation deformity by using ECRL tendon as a graft for tenodesis. Slip o ECRL is passed through STT joint to palmar aspect of the wrist and next through bony tunnel of the scaphoid is passed to proximal and dorsal aspect of scaphoid bone. This manover gives additional force to hold the scaphoid in anterior pronation posture.

David Litchman has proposed new algorithm for treatment of Kienbock Disease (KD). KD is still the fully unknown entity. The algorithm was gathered together Litchman osseous classification (extended with 3c) with perfusion classification (Schmitt) and articular cartilage classification (by Bain). The new algorithm incorporates current concepts of the AVN and other than objective factors such as general health, lifestyle, future demands and surgeon factors (skill set, equipment) must be considered.

THE STORY OF NERVE INJURIES TREATMENT – PAST, PRESENT AND FUTURE

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Introduction

The repair of critical nerve defects continues to be challenging. The current gold standard is an autograft repair leading to donor site morbidity. Therefore, search for new alternative methods continues.

Aim

We designed several studies to assess new techniques of peripheral nerve repair and enhancement of nerve regeneration using epineural patches and conduits supported with bone marrow stromal cells (BMSC)[1,2].

Material and methods

The application of epineural sheath conduit for repair of 2 cm long sciatic nerve gaps is discussed in rat model. Different experimental groups of conduits filled with saline and BMSC were tested and evaluated by standard neurosensory assessments methods such as: pin-prick, toe spread, somatosensory evoked potentials (SSEP) and gastrocnemius muscle index. Electron microscopy was used to confirm nerve regeneration and immunohistochemistry to test cell migration and dedifferentiation. After proof of concept study in small animal model epineural conduits were tested in 6cm long median nerve defects in sheep- the large animal model.

Results

Nerve conduction velocities and SSEP assessed functional recovery whereas electron microscopy and immunohistochemistry evaluated role of BMSC in nerve regeneration. Both rodent as well as large animal study functional assessment and electron microscopy studies confirmed supportive role of BMSC in nerve regeneration.

Discusssion

The next step in preparation to clinical trials was to test the efficacy of nerve regeneration after application of human epineural allograft3 in the experimental nude rat model. We are also teting allogenic neve transplantaion.

Conclusions

We have achieved encouraging results using human epineural sheath conduit and these results bring the promise of introducing epineural conduits into clinical trials for repair of both short and long nerve defects.

Keywords: nerve repair, epineural conduits, stem cells

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CLINICAL NEUROPHYSIOLOGICAL STUDIES – OUTLINE OF DIAGNOSTIC METHODS

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Introduction
Peripheral nerve injures are characterized by different location and degree of injury intensity. Clinical studies (subjective and objective as well as structural – MRI, USG) are often supplemented by functional studies such as electromyography (EMG), electroneurography (ENG) and becoming more and more popular motor evoked potential studies induced with magnetic field (MEP). All they aim with precise localization of injury the structures of brachial plexus at level of cervical spinal cord or in proximal or/and distal parts of upper extremity.
Aim
Presentation of methodological aspects of mentioned above clinical neurophysiology diagnostics for differential diagnosis of nerve injures.
Material and methods
Patients with symptoms of nerves injuries at different levels of upper extremity are considered. Needle EMG, M and F waves and SCV potentials recorded during ENG studies as well as MEP induced oververtebrally at cervical spine are most frequently used.
Results
Results can be useful for differential diagnosis of nerve injures located peripherally (proximally vs distally) or more centrally (at the level of C4- Th1 spinal ventral roots).
Conclusion
Neurophysiological studies in patients with symptoms of nerve injures can precisely indicate the site of pathology origin (single, double or even triple) in cases of syndromes overlapping. Moreover, results of ENG and EMG tests can indicate the advancement of pathology making possible to undertake a reasonable decision on finishing with conservative methods of treatment and introducing the surgical procedures.
Keywords: peripheral nerve injuries, ventral roots injuries, brachial plexus, cervical spine

CLINICAL NEUROPHYSIOLOGICAL STUDIES – PRESENTATION OF TWO CASES

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Introduction
Patients with typical compression mononeuropathy such a carpal tunnel syndrome (CTS) and complex brachial plexus injury (BPI) can overlap with symptoms detected during clinical evaluation and structural studies (USG and MRI may not show clearly the site of pathology in subclinical state).
Aim
Presentation of results of neurophysiological tests performed in one patient with CTS and one patient with BPI.

Material and methods

A patient with advanced loss of sensation in thumb, index, third and sometimes fourth fingers, pain in areas of forearm and hand especially at night, loss of motor function in hand and numbness sensation in hand was studied with complex M and F waves and SCV potentials recordings during electroneurographical (ENG) studies.

A second patient with advanced loss of sensation in all fingers, loss of motor function in hand, forearm and lack of extension in elbow was evaluated with the same set of neurophysiological tests.

Results

Patient with CTS: ENG study after stimulation of median nerve using electrical stimuli at pre-wrist area evoked M-wave potential with increased latency (in comparison to normative values) while SCV recordings from the same nerve indicated demyelinating changes at the level of wrist, pointing at slowing down nerve impulses transmission. Similar ENG studies of ulnar nerve had proper parameters of M-wave and SCV studies. F- wave studies of median or ulnar nerves did not show abnormalities, proving proper neural transmission in C6-C8 ventral roots. Patient with BPI: ENG study after stimulation of median, ulnar and radial nerves showed both decreased amplitudes of M-waves and slowing down the conduction velocity of nerve impulses in motor fibers of these nerves. SCV studies of sensory transmission in mentioned nerves showed pathological changes of mixed axonal – demyelinating type. ENG studies results of motor fibers transmission (M-waves) in axillar and musculocutaneous nerves were normal. F- wave studies of median or ulnar nerves are improper in most of patients with BPI. Needle EMG (electromyography) recordings from abductor pollicis brevis, interosseus dorsalis I, triceps brachii muscles at rest should show denervation spontaneous potentials in acute state while recordings during voluntary contraction should show signs of neurogenic changes in single muscle motor units.
Conclusion. Presented results of neurophysiological studies gave different pictures of pathological changes in nerves and muscles of upper extremity, making possible differentiation of two syndromes in patients – CTS vs BPI.

Keywords: carpal tunnel syndrome, brachial plexus injury, neurophysiological studies, differential diagnosis

PHYSIOTHERAPY IN NERVE INJURIES

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Introduction and general aim

Nerve injury is often combined with trauma of others structures. Early rehabilitation process combined with psychological and social support is crucial for patients recovery and life return. It is extremely important to educate the patient about the importance of forthcoming procedures and exercise responsibility. The principal aim of the rehabilitation process and physiotherapy is to stimulate the nerve regeneration and avoid biological disturbances which may delay the recovery process.

Results

Physiotherapy after nerve injuries should contain all types of nerve stimulation and soft tissue regeneration procedures. Movement therapy should contain passive and assisted exercises and if it is possible active motion of working body parts. If the limb is endangered

of trauma because of lack of sensation and lack of function specific methods of splinting should be used. Simultaneously the sensory reeducation exercises and mirror therapy shall be taken. Type of exercises and techniques should be considered due to patient's abilities and his condition. If the recovery is slow the therapy must be concerned with imaging and visualizations of touch and sensation. After first sensation recovery symptoms exercises with form and types of structures can be used. The proprioceptive exercises are also helpful with patient's regeneration and they give the opportunity to regain the proper joint equilibrium, function and increase of muscle capabilities.

Discussion

After nerve injury, regardless the type (*neuropraxia, axonotmesis, neurotmesis*) the rehabilitation process must get started. Crucial for patient's recovery and regeneration is proper and adjusted to their condition protocol which can be easily transformed and developed according to changes of nerve function. It is extremely important to build the patient awareness that the rehabilitation is long lasting process. The cooperation between the surgeon, physical therapist, nurses, psychologist and patient's family is essential and should be emphasized at each level of rehabilitation process.

Conclusions

The presentation will be related mostly with procedures and exercises which can be used during the therapy but also with new technologies adjusted for patients after nerve injuries. During the lecture basic scheme of proceedings will be presented with additional newest sensory reeducation and mirror home exercises examples.

Keywords: nerve injury, sensory reeducation, mirror exercises

PHYSICAL THERAPY IN NERVE INJURIES

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Introduction and general aim

Electrical stimulation has been practiced since ancient times to treat different locomotor disturbances. Pain decreasing has been a main target of this therapy. Nowadays we use electrotherapy procedures in physiotherapy or rehabilitation in nerve injuries cases not only for pain treatment but also for strengthening of weak muscles and for restoring of transmission of impulses via motor or sensory fibers of peripheral nerves. Beside of these examples, in damages of central nervous system, functional electrostimulation (FES) is widely used. However, electrotherapy is the constant element of complex rehabilitation in many clinical problems, its efficiency is still disputed by many authorities and practitioners. The aim of this study is approximation of contemporary theory and practice of electrotherapy to other than physiotherapy and rehabilitation specialists.

Method

Searching in database of MEDLINE was a research method. Keywords in following order were entered: upper extremity, nerve injury, electrotherapy. Only scientific papers from 2000 to 2016 were taken under consideration.

Results

Finally 33 papers have been found. Treatment of pain was described in 15 papers, procedures of muscle electrostimulation resulting in strength improvement were presented in 9 cases and studies of nerve repair were described in 9 papers.

Discussion

Different electrotherapy applications such as: direct current (DC), electrostimulations (altering current; AC), interferential current (IC), functional electrostimulations (FES) are used commonly in patients with nerves injuries treated conservatively. According to rules of Polish Concept of Rehabilitation, electrotherapy is only a part of complex treatment in this situation. It should be applicated only as a part with kinesiotherapy. In other countries, the electrotherapy procedures are used alone without kinesiotherapeutic support. In this situation, the estimation of electrotherapeutic efficiency in clinical categories is difficult and very often these methods of treatment are rejected. A few decades ago, in 70. and 80. years past century, many researches were published and efficiency of many kinds of electrotherapy was postulated basing on clinical observations. In recent years some interesting papers in the area of electrotherapy were published and often they were proved by neurophysiological studies, although clinical prooves still dominate.

Conclusion

At the beginning of XXI century according to concept of Evidence Based Medicine we need new approach for validation of electrotherapy. It is possible because new technologies and diagnostic tools like fRMI, EMG and ENG are available.

Keywords: upper extremity, nerve injury, electrotherapy

SPECIAL WOUND DRESSINGS, VAC AND FREE SKIN GRAFTS

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Introduction

The goal of the treatment of hand injuries is to heal the wounds as soon as possible and to regain the best possible function. In some cases it is not possible to reconstruct all the structures such as bones, tendons, nerves and to heal the wound simultaneously. In such cases the first step is to save the hand and heal the wounds. The other reconstructive procedures are postponed to the next step.

Aim

This review is focused on presentation of the contemporary types of dressings of the wounds. Application of the negative pressure wound therapy (NPWT) and skin grafts are also discussed.

Methods and results

The search of the literature was conducted. Traditional dressing usually consists of three layers. The first is the sterile single sheet of gauze impregnated with anti-adhesive substance. The next layer consists of the material, which absorbs the fluids and can compress the wound. The outermost part holds everything in place over the wound. The other types of dressing include foams, films, hydrogels, alginates and hydrocolloids. Those are usually indicated in more problematic cases such as infected wound, tissue loss and burns. The hydrocolloids absorb the fluids, wound exudates. Hydrocolloids stimulate angiogenesis and development of granulation tissue. The alginate dressings has absorptive properties, fills the wound with the gel like substance – sodium alginate. It provides moist environment for the wound healing. In case of hand trauma it is usually introduced the adjunctive therapy, a step before the final closure, coverage or reconstruction of the defect (negative pressure wound therapy – NPWT). NPWT is indicated in both acute and chronic wounds.

After fasciotomy NPWT can be used as a dressing before the final closure of the wound. This therapy can be used also to hold the skin graft in place. There are two major types of skin grafts – full thickness and split thickness. Full thickness grafts are taken from the donor region with use of surgical incision. The surgical wound reaches sub-dermal fat tissue – the graft involves the whole cross-section of the skin. The split thickness grafts are obtained with special dermatome and involve part of the skin cross-section. The full-thickness graft provides better quality coverage, can be used for small skin defects on the palmar surface of the hand and digits if closure of the wound with local or distant flaps is not indicated or possible. The split thickness grafts are usually suitable for the dorsal surface of the hand; the large surface can be covered. Commercially available collagen matrices can be used to cover the wound. Their structure allows the ingrowth of the vessels and revascularization. After that matrix it has to be covered with skin graft.

Conclusion

Different types of dressings, NPWT, skin grafts are the effective and widely available methods to improve healing and treatment of the wounds. It is important to remember that we usually can combine them in different configurations and sequence.

Keywords: wound dressings, negative pressure wound therapy, split thickness grafts

HAND THERAPY, KINESIOTHERAPY

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Introduction and general aim

Each hand trauma is concerned with several symptoms which rapidly influences patient's quality of life. Pain, edema and prolonged immobilization lead to range of motion restriction and in a near future, decrease of muscle function and strength. For proper selection of rehabilitation program, cooperation between the physical therapist/manual therapist and surgeon is crucial. It is also extremely important to take under consideration patients work type, sports and hobbies to adjust the rehabilitation protocol to his needs.

Results

According to type of dislocation and surgery relocation procedure the immobilization time may differ in time. General time of immobilization in a cast or splint is 4 -6 weeks with basic rehabilitation procedures. During early improvement (next day after surgery) the most important issue is to stabilize the relocated bone and adjacent joints to remain forces equilibrium. According to type of fracture, its location and type of stabilization (K wires, plate) immobilization time should be considered between 3 to 6 weeks. During early improvement most important are procedures concerned with passive, assisted and active exercises of free joints which influence the microcirculation and regeneration process. After 6 weeks more and more active exercises should be applied and according to patient's condition and abilities strengthening exercises should get started.

Discussion

There is a large amount of different types of wrist, metacarpals and phalanx dislocations and fractures but they altogether influence and reduce patients work capabilities and restrict everyday living activities. That's why the early rehabilitation process must start as fast as it is possible and should contain different types of activities such as: passive and active exercises, manual exercises, proprioceptive exercises, contralateral exercises,

core stability exercises, manual therapy and soft tissue techniques. If it is necessary the kinesiology taping applications such as muscle and fascia techniques may be applied to reduce the muscle tension and facilitate the joint movement. Specified proprioceptive and corrective applications may help with primary joint balance maintenance and improve patient's movement abilities.

Conclusions

The presentation will be related mostly with procedures and exercises which can be used during the therapy but also with new technologies adjusted for patients after hand and wrist fractures and bone dislocations. During the lecture basic scheme of proceedings will be presented with additional newest proprioceptive training and basic kinesiology taping applications.

Keywords: hand therapy, manual exercises, kinesiology taping

TRIANGULAR FIBROCARTILAGE COMPLEX INJURY

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Introduction and general aim

The distal radioulnar joint (DRUJ) is of vital importance for functioning of the wrist due to pronosupination movement and forces loading across the joint. The stability of the forearm bones is provided by osseous constraint (only 20%), pronator quadratus muscle, interosseus membrane and triangular fibrocartilage complex (TFCC). Disorders of DRUJ are common and complex, provide pain on the back and ulnar sided wrist, and spectrum of instability, often resulting in lower grip strength and limited range of motion. Symptoms are nonspecific. Examination should involve both wrist and standard X-ray examination. Around 25% of ulnar-sided wrist pain derives from extracapsular pathology. The DRUJ instabilities come from bony deformity (after wrist fracture), cartilage defect, extensor carpi ulnaris (ECU) instability or TFCC injury. The fourth group of problems can coexist in variable pattern and makes treatment of DRUJ difficult. TFCC lesion may be not the only pathology causing DRUJ instabilty and treatment modalities should take into account the possible other problems (4 clover leave algorithm).

Methods and results

TFCC lesion is diagnosed by arthroscopy the best. Lesion of TFCC can be derived from instability or without instability and the treatment should address the problem. Atzei *et al.* classified five types of TFCC lesion and proposed the treatment. Bony reinsertion of deep radioulnar ligament should be performed in case of instability. My indications for foveal attachment are: pain with or without click during pronosupination movement, positive instability (foveal sign, ulnocapral stress test), confirmed avulsion of TFCC on MRI or other radiological studies. Arthroscopically assisted of reinsertion is widely used however it has not been proven superiority to open the technique.

Conclusions

My personal preference is to use the open technique through trans ulnar styloid approach or 5th compartment approach. For the reinsertion bone the anchor is used. Open technique is preceeded by diagnostic arthroscopy to confirm a diagnosis.

Keywords: triangular fibrocartilage injury, treatment

REFERENCES
Atzei A, Luchetti R, Braidotti F. Arthroscopic foveal repair of the triangular fibrocartilage complex. J Wrist Surg. 2015; 4(1):22–30.

OUTCOME AFTER REPAIR OF DISTAL BICEPS TENDON RUPTURES USING THE ENDOBUTTON TECHNIQUE

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Introduction
The injuries of distal biceps tendon are relatively rare, with incidence of 1.2/100.000/year. Most ruptures are the effect of eccentric load during elbow flexion, which occur in men at 30–49 years of age.
Aim
The aim of the research was to assess outcomes of surgical repair of distal biceps tendon ruptures.
Material and methods
The research group consisted of 5 men ranged in age from 36 to 58 years. Injury concerned the right, dominant hand. Operations were performed by using a single incision technique and the endobutton fixation. All patients answered MEPS and PREE questionnaires. Afterwards patients underwent the physical examination and following data were assessed: range of motion (ROM) of elbow and appearance of hook test in both elbows. Additionally, the transverse distances of attachment to radial tuberosity of distal biceps tendon were measured by ultrasound.
Results were compared to unaffected side.
Results
After surgery, the mean ROM of previously injured elbows was not statistically different to healthy elbows. Results of PREE questionnaire, of both pain and function sections, were averagely lower for affected elbow, compared to the results of unaffected elbow. Mean MEPS score was 79, what responded for a good outcome. Mean width of distal biceps tendon at the level of insertion to the radial tuberosity was 0.93 cm and it was wider than on the opposite site. One patient was diagnosed with heterotopic ossification after surgery.
Conclusions
1. Very good clinical outcome after surgical treatment of ruptured distal tendon biceps muscle was obtained. 2. Subjective evaluation of patients was good. 3. Ultrasound examination was useful in diagnosis and in evaluation.
Keywords: distal biceps tendon rupture, treatment, endobutton technique

TREATMENT OF DUPUYTREN'S CONTRACTURE WITH COLLAGENASE: EFFECTIVENESS AND TECHNIQUE

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Introduction and general aim
Treatment for Dupuytren's contracture (DC) has varied considerably. Prior to the approval of collagenase (CCH) the vast majority of treatments for DC involve the open surgery.

For initial treatment of moderate DC limited fasciectomy is most popular operation, whereas dermofasietomy with skin grafting and more extensive excision of the palmrar fascia is more often used in recurrent or severe cases. Recently precutaneus needle fasciotomy and collagenase injection are increasingly used as less invasive treatmet alternatives.

Methods and results

More aggressive operative treatment is accompanied by a higher number complications rate. It was reported an average digital nerve injury rate of 3.4%, digital artery injury at 8%, would-healing complication at 23%, infection at 2.4%. It was reported that complications rate in recurrent disease treatment was more than 5 to 10-fold increase compared to primary surgery. The most common complications of collagenase injection are peripheral oedema, swelling, injection site ecchymosis, pain, skin laceration. Most of the side effects are self-limited, recovering within 2 weeks without surgical intervention. Most tested patients are positive for antibodies against collagenase but no notable allergic reactions or deaths occurred. Major complications included CRPS and flexor tendon ruptures or digital nerve damage which are reported accidentally.

Complications rates (own material, total number of cases N = 68)

Swelling and oedema	57 (83%)
Pain	61 (89%)
Skin laceration	23 (34%)
Injection site ecchymosis	47 (69%)
Major complications (digital nerve, tendon damage)	0

Conclusions

Long term effects of CHH treatment and overall recurrence rate are still being investigated. Clinical trials have shown both safe and effective results in treatment of DC. Mid-term results are similar to limited fasciectomy and significantly better from needle aponeurectomy. However, there are concerns in treatment of joint contractures. The treatment of DC is still largely surgical. After the introduction of CCH, the number of procedures grow steadily reaching 50% of all treatment procedures in DC (USA).

Keywords: Dupuytren's contracture, treatment methods, results

FLEXION FUNCTIONAL RECONSTRUCTION OF THE FOURTH FINGER OF THE HAND, AFTER PIP JOINT INFECTION AND STIFFNESS – CASE PRESENTATION

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Introduction

Bacterial infection is a devastating complication after an open joint dislocation. In finger joints it may result in manual impairment and may jeopardize a patient's career.

Aim

To present the finger flexion reconstruction possibilities in consequence of open joint dislocation, complicated with bacterial infection and stiffness.

Material and methods

27-years old man in May 2015 sustained an open dislocation of fourth finger in PIP joint, which was complicated with bacterial infection of PIP joint and loss of skin over volar aspect of PIP joint. In June 2015, the debridement of infected tissues was done and skin deficit was closed. As a consequence of infection, there was a destruction of the PIP and

extension contracture of the finger. The patient was proposed to have a vascularized toe joint transplantation. Preliminary condition for this procedure was tenolysis which was attempted in February 2016. During the operation we found scarring and destruction of the flexor tendons and thus, we released PIP, removed scars and tendon remnants, implanted Hunter silicone tendon spacer and applied Suzuki traction. After regaining the passive flexion of the finger, the second step of the reconstruction was performed in May 2016: PL autograft for FDP

Results

Functional flexion of the hand was restored and the finger was ready to vascularized toe joint transplantation. The patient was satisfied with a hand function and did not want any further operative treatment.

Conclusion

Staged flexor tendon reconstruction with Suzuki traction may be a useful treatment option in cases of infection and destruction of the finger PIP joint.

Keywords: PIP joint, flexor tendons, infection, reconstruction, finger function

OSTEOPATHIC APPROACH ON THERAPY FOR RADIAL NERVE'S NEUROPRAXIA

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Introduction

Radial nerve neuropraxia is a common complication after upper extremity injury, especially after shoulder bone fracture. Following this type of injury, paralysis of muscles responsible for forearm extension occurs, and also of fingers, giving a clinical view of so-called falling hand. In therapy of such cases, the osteopathic techniques are employed. They include comprehensive approach to the patient, in which through the manual work consisting of functional and direct techniques, biomechanical balance, through enablement of organism selfhealing and selfregulating processes are expected.

Aim

The aim of study was to show the osteopathic approach on radial nerve therapy after bony structures, with myofascial units, circulatory system and nervous system.

Material and methods

Due to breaking of patient's upper extremity radial bone, surgery of break reposition and stabilization with plate and syntheses screws were carried out. During the second week after operation, the patient was subjected to intensive rehabilitation, consisting of: physiotherapeutic treatments, (myofacial loosening, trigger points therapy), osteopathic methods (craniosacral therapy through work on dura mater C0-C1-Sacrum, BLT Balanced Ligamentous Tension – techniques of balancing ligament tensions of C4-TH2, GOT General Osteopathic Treatment and physiotherapy (electrostimulation, laser therapy and magnetotherapy).

Results

All hand lost functions have been recovered and all of neuropraxia symptoms have disappeared.

Conclusion

Multilevel actions, undertaken beyond the operated place, which included all of the radial nerve courses, in order to recover tissues' flexibility, improvement of blood circulation, nutritioning the nerve, self-neuromobilization gave positive effects, reducing the time of functional recovery, improving muscular strength and hand specific movements coordination.

Keywords: neropraxia, radial nerve, osteopathy, GOT, craniosacral therapy, neuromobilisation

HOLISTIC THERAPY OF PATIENT AFTER INJURED TENDONS OF FINGER'S EXTENSORS

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Introduction

The research describes a patient treatment after an entire disruption and surgical reconstruction of right hand's extensor tendons of IV and V fingers. After the surgery, the prognosis for functioning of the dominant hand was very unfavorable.

Aim

The main goal of the research was to show the significance of an early and complex physiotherapy as well as psychological therapy. The impacts of the therapy on the hand's functioning and on patient's quality of life after the injury were studied.

Material and methods

After the surgery the patient was equipped with a plaster cast for 6 weeks with recommendation of the hand immobility. During the second week, the magneto therapy was introduced. After the plaster cast was removed, the patient used whirlpool baths, neuro-muscular reduction exercises and kinesiology taping. During the following part of treatment, point laser therapy, hand's precision exercises, post isometric muscle relaxation, exercises with scar and transverse massage were introduced. During the final stage of therapy, the increase of muscular strength and small fingers movements were worked on. During the hospitalization the patient received psychological support.

Results

After two months of treatment the patient recovered his mobility, strength and hand's functionality. He returned to his job and past time activities.

Conclusion

Quickly introduced and complex physiotherapy, wide variety of surgeries, patient's motivation as well as optimal cooperation between the patient and physiotherapist lead to gaining the satisfactory efficiency and improving patient's standard of life. It is very promising, especially in cases of significant percentage of patients with injured extensor fingers tendons.

Keywords: holistic therapy, fingers extensor tendons, complex

SURGICAL TREATMENT OF MALLET FINGER FRACTURES

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Introduction

Mallet deformity of the finger involves avulsion of extensor aponevrosis from the base of the distal phalanx with a small osseocartilaginous fragment. The treatment options for mallet fractures of the distal phalanx range from splinting to surgical fixation using percutaneous pins, pull-out wires, or interosseous wires.

Aim

The aim of our study was to improve the treatment results in patients with mallet finger fractures of the hand.

Material and methods

We have analyzed surgical treatment results of 44 patients with avulsion fractures of the distal phalanx aged between 12 and 74 years. There were 29 males and 15 females. Forty one patients had closed fractures and 3 open injuries. Palmar fracture dislocation with instability of the distal interphalangeal joint due to avulsion of the large dorsal fragment (greater than one-third of the articular surface) was recognized in 37 patients. In 7 cases, small fragment was removed. Kirschner's wire fixation of the DIP joint were performed in all 44 cases and closed (open) reductions of the large fragment in 37 patients.

Results

Long-term results of the surgical treatment were studied after one year from the day of surgery. In all cases we have reached good and excellent results of the operative reconstruction in distal phalanges of the hand.

Conclusion

Surgical reconstructions of mallet fractures of the hand can be regarded as a highly effective and progressive treatment of these pathologies.

Keywords: mallet finger, avulsion fracture, surgical treatment

EVALUATION OF THE RESULTS OF REHABILITATION IN PATIENTS AFTER SURGICAL TREATMENT OF PERIPHERAL AND FINGER NERVES

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Introduction and aim

The total injury of peripheral nerves requires surgical treatment. Surgeon decides about the method of treatment – primary reconstruction, or cable transplant of the sural nerve, or implantation of neurotube. Rehabilitation assists the effects of treatment. The aim of this study is to assess the progress of rehabilitation after the surgical treatment of damaged peripheral nerves

Materials and methods

The study included 113 people treated in 2012–2016. 46 studied were patients after reconstruction of fingers nerves, 40 after the primary reconstruction of the nerves at wrist and forearm, 18 after cable transplant and 9 after implantation of neurotube. Each patient had applied physiotherapy, exercises in Peg-board system and mirror therapy. Sensory

improvement was evaluated in a two-point discrimination test and the improvement of hand function in ADL test. Each patient was examined at the beginning and at the end of the treatment. The average time of treatment was 12 weeks. Final examination was performed about 7 months after surgery.

Results

Most patients improved their sensory and hand function. The best results were observed in patients after the primary nerves reconstruction, and in ulnar nerve both after reconstruction as well as in other methods. However, after the use of neurotube and cable transplantation the results were similar.

Conclusions

The rehabilitation has a positive effect on the function of the upper extremity. The original reconstruction gives the best results in the shortest possible time after the injury. Patients after cable transplant and neurotube grafts require longer rehabilitation and observation.

Keywords: peripheral nerves, rehabilitation, injury

SURGICAL TREATMENT OF OSTEOARTHRITIS OF FIRST CARPOMETACARPAL JOINT IN THE THUMB

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Introduction

The problem of osteoarthritis of the first carpometacarpal joint of the thumb is important pathology of the hand surgery in the world. This is a chronic process accompanied by the persistent pain.

Aim

The goal of the study was to develop an algorithm of choice for the surgical tactics in disease of carpometacarpal joint of the thumb.

Material and methods

Follow-up results of 34 patients who underwent the surgical treatment in Hand Surgery Department of 6th City Clinical Hospital in Minsk have been studied. There were 6 cases of total arthroplasty and 6 cases unipolar prosthesis with simultaneous arthroplasty were performed. In 22 cases there were performed the trapezoid-metacarpal joint arthroplasties with partial or complete resection of the trapezium bone. In these cases we chose different types of stabilization the base of thumb and interposition arthloplasties by long palmar muscle tendon.

Results

There were 100% good and satisfactory long-term outcomes in group with arthroplasties of the first carpometacarpal joint.

Conclusion

The algorithm of surgical treatment for osteoarthritis of the first carpometacarpal joint in the thumb that has been developed allowed for obtaining the good functional results.

Keywords: osteoarthritis, first carpometacarpal joint, arthroplasty

TWO STAGE GRAFTING OF FLEXOR TENDONS IN ZONE II

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Introduction

Two-stage grafting of flexor tendons is preferred method for restoration of function in old cases of patients, as well as in polystructural injuries in zone II.

Aim

To analyze the results of flexor tendons after two-stage grafting in zone II.

Material and methods

During the period of 2006–2016 years we have operated 236 patients with the method of two-stage Hunter plastic. A hundred and eighty men and fifty six women were treated. Average age was 31.6 + 13.5 years. Period after injury was 8.5 + 24 months. First stage included: scars removing, reconstruction of annullar ligaments (A2 or A4), mobilization of interphalangeal joints, skin grafts. The time between first and second stage was 4.4 + 5.0 months (from 1 month to 3.4 years). Rehabilitation started on the second day after surgery by the Kleinart method with own modification. Modifications included the elimination of rubber rods action during active extension.

Results

Long-term results were randomized with Strickland in 76 cases from 1 to 40 months (6.8 + 8.6 months), recoveries from 0 to 100% (mean 36.9 + 24.7%). The influences of various factors on outcomes were estimated (gender, age, time from and severity of injury, the amount of restoration operations, type of autograft).

Conclusion

Two-stage flexor tendon grafting in zone II is the method of choice for secondary repair or managing the tendon repair complications.

Keywords: flexor tendons, two stage grafting

RESTORATION OF HAND FUNCTION AFTER BRACHIAL PLEXUS INJURIES

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Introduction

Impaired function of a hand after brachial plexus injuries (BPI) occurs when C8-T1 roots are involved.

Aim

To develop a restoration algorithm of hand grips after BPI, depending on conserving muscles resources and functional needs of patient.

Material and methods

During the period 2000–2016, 109 patients with consequences of traumatic BPI, which needed to restore hand function were treated. ENMG, and ultrasonography confirmed extreme degree of denervation, atrophy and fibrosis of affected muscles. Patients were divided into four groups. Group A included patients without restoration of any forearm muscle. Patients with up to 6 forearm muscles restored were included in Group B. Group C were patients with 7–11 appropriate muscles. Other patients with 12 or more forearm muscles restored made up a Group D. In Group A – we create a “doll’s hand”. In Group B –

wrist and carpo-metacarpo-phalangeal arthrodesis, and tendon transposition to create pinch grip was performed. In Group C – to patients of physical work – wrist arthrodesis and oponenodesis were performed, to patients of intellectual work after wrist arthrodesis – tendon transpositions were performed. In Group D – tendon transfers were performed.

Results

0 muscles – "doll's hand" reconstruction, 1–6 muscles – restoration of pinch grip, 7–11 muscles – tendon transfers or arthrodesis depends on patients occupation, 12 and more – tendon transposition.

Conclusion

According to the authors' opinion, the most rational approach to restore hand function should take into account the functional needs of the patient, in combination with number and effectiveness "of available drivers".

Keywords: hand function restoration, brachial plexus injuries, tendon transfers

INSTRUCTIONS FOR AUTHORS

Submitting text

Papers should be sent to Editorial Office at: redakcja@irons.com.pl,
juliusz.huber@neostrada.pl, agnieszka_wincek@wp.pl

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All submissions should be prepared with the following files:

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- Main text with figures legends in the end
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Authorship

According to the International Committee on Medical Journal Ethics (ICMJE), an author is defined as one who has made substantial contributions to the conception and development of a manuscript. Authorship should be based on all of the following: 1) substantial contributions to conception and design, data analysis and interpretation; 2) article drafting or critical advice for important intellectual content; and 3) final approval of the version to be published. All other contributors should be listed as acknowledgments. All submissions are expected to comply with the above definition.

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Conflict of interest

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Abbreviations should be defined at first mention, by putting abbreviation between brackets after the full text. Ensure consistency of abbreviations throughout the article. Avoid using them in the title and abstract. Abbreviations may be used in tables and figures if they are defined in the table footnotes and figure legends.

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The first page of the manuscript should contain the title of the article, authors' full names without degrees or titles, authors' institutional affiliations including city and country and a running title, not exceeding 40 letters and spaces. The first page should also include the full postal address, e-mail address, and telephone and fax numbers of the corresponding author.

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The abstract should not exceed 250 words and should be structured into separate sections: Introduction, Aim, Material and methods, Results and Conclusions. It should concisely state the significant findings without reference to the rest of the paper. The abstract should be followed by a list of 3 to 6 Keywords. They should reflect the central topic of the article (avoid words already used in the title).

The following categories of articles can be proposed to Issue of Rehabilitation, Orthopaedics, Neurophysiology and Sport Promotion – IRONS:

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Manuscripts in this category describe the original results from the field of rehabilitation, physiotherapy, orthopaedics and neurophysiology as well as topics dealing with diagnostic and treatment of the sport related traumas. The manuscript should be presented in the format of Summary (250-word limit) and Main text (Title page, Summary, Introduction, Aim, Material and methods, Results, Discussion, Conclusions, Acknowledgments, Conflict of Interest, References and Figure Legends). In the Discussion section, statements regarding the importance and novelty of the study should be presented. In addition, the limitations of the study should be articulated. The abstract must be structured and include: Introduction, Aim, Material and methods, Results and Conclusions. Manuscripts cannot exceed 2700–3000 words in length (excluding title page, abstract and references) and contain no more than a combination of 8 tables and/or figures. The number of references should not exceed 45. This type of article should include statistical procedures.

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Manuscripts in this category may present results of studies involving small sample sizes, introduce new methodologies, describe preliminary findings or replication studies. The manuscript must follow the same format requirements as full length manuscripts. Brief reports should be not less than 2000 words (excluding title page, abstract and references) and can include up to 3 tables and/or figures. The number of references should not exceed 25. This type of article should include statistical procedures.

Case Studies

This guide examines case studies, a form of qualitative descriptive research that is used to look at individuals, a small group of participants, or a group as a whole. Researchers collect data about participants using participant and direct observations, interviews, protocols, tests, examinations of records, and collections of writing samples. Starting with a definition of the case study, the guide moves to a brief history of this research method. Using several well documented case studies, the guide then looks at applications and methods including data collection and analysis. A discussion of ways to handle validity, reliability, and generalizability follows, with special attention to case studies as they are applied to composition studies. Finally, this guide examines the strengths and weaknesses of case studies. The manuscript must follow the same format requirements as full length manuscripts. Case Studies should be up to 2700 words (excluding title page, abstract and references) and can include up to 3 tables and/or figures. The number of references should not exceed 25.

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Guidelines

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Acknowledgements

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Artykuł z czasopisma:

Elhassan, B., Bishop, A., Shin A., Spinner, R. (2010) *‘Shoulder tendon transfer options for adult patients with brachial plexus injury.’* J Hand Surg Am., 35 (7), str. 1211–1219.

Książki:

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