May 2025

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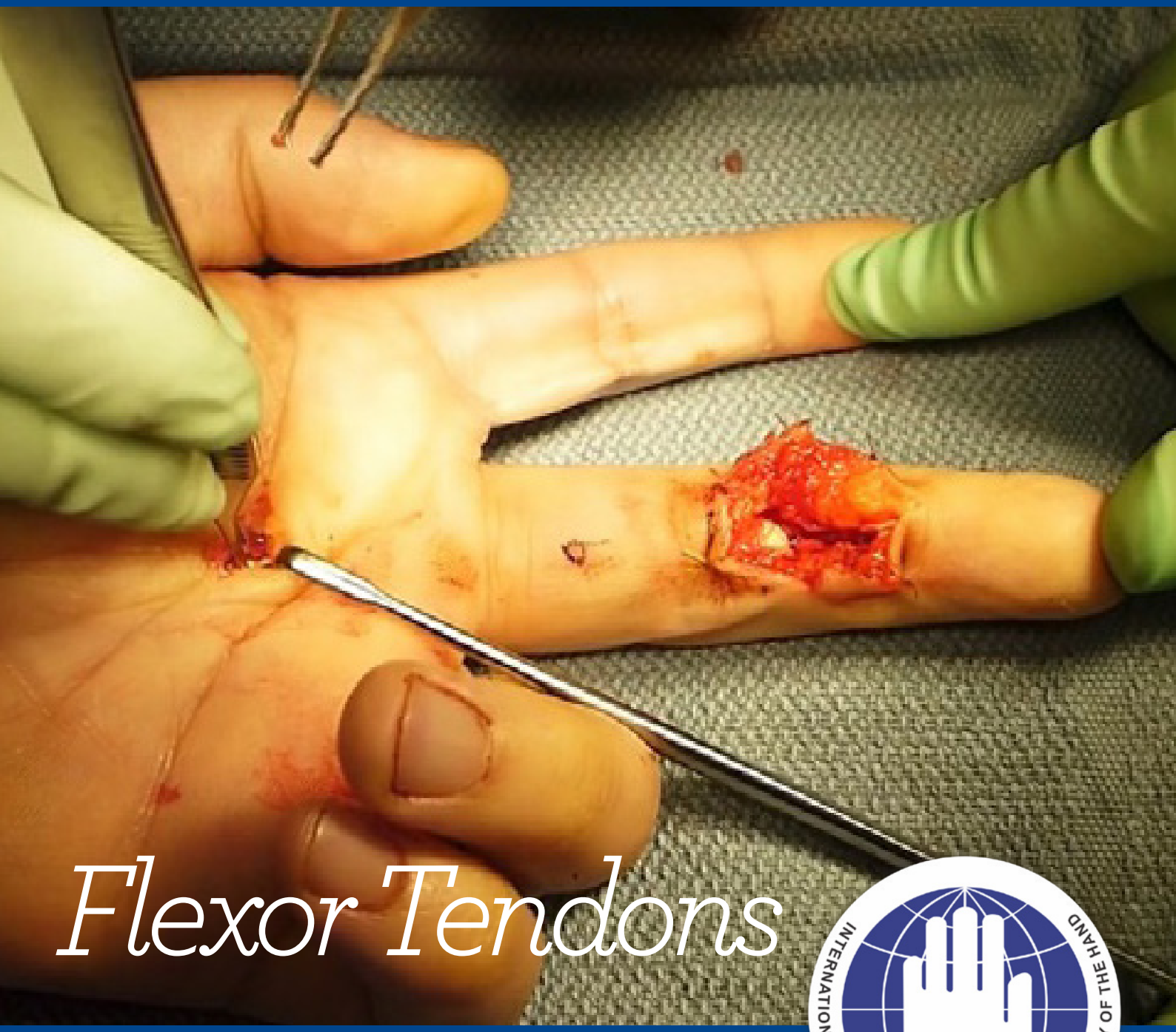
CONNECTING OUR GLOBAL HAND SURGERY FAMILY

PRIMARY FLEXOR TENDON REPAIR

EXPERT GUIDELINES OF MANAGEMENT

GUEST EDITORIAL



Flexor Tendons

FEDERATION & MEMBER SOCIETY REPORTS

IFSSH/IFSHT CONGRESS REPORT | HAND SURGERY RESOURCE

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contents

Guest Editorial - 100 Words

TAMARA D. ROZENTAL , MD
ASSH President

It was an honour for the ASSH to host the IFSSH-IFSHT Triennial Congress (March 2025) in Washington, D.C. USA. In a world that feels increasingly divided—by borders, by politics, by circumstances beyond our control—it was particularly poignant to be together. Meetings like this remind us that collaboration is not just beneficial—it is essential.

Over the last week, we shared knowledge freely. We challenged each other. We pushed boundaries, not for ourselves, but for the patients who depend on us. And in so doing, we reaffirmed our commitment to one another as colleagues and as a global community. Beyond the science and innovation, I encourage you to take a moment to appreciate the simple power of being in the same room with friends and colleagues from around the world. Thank you for being part of this extraordinary gathering.

EDITOR:
We republish with permission the 100 Words editorial by ASSH President Tamara D. Rozental in the 'ASSH Weekly Member Update' of 28 March 2025, which reflects on the importance of co-operation, sharing and respect.

In the same vein it is sad to notice the official order by some leaders to cancel DEI [diversity, equity, inclusion] policies. DEI aims to give everybody the same opportunities. At the IFSSH we celebrate diversity, equity, and inclusion as some of our core principles.

Thank you, Tamara.

President's Message

Dear Colleagues,

I am very grateful and humbled to be elected as the 21st President of our Federation. A brief look into the list of the past Presidents and the legacy they have left behind makes me aware of the responsibilities that I have to fulfill. I am confident that with all our cooperation, we will help raise the stature and increase the effectiveness of the efforts of the IFSSH.

I think the term of three years provides a President and his team of office bearers a good enough time to do something meaningful to further the goals of the Federation. The IFSSH was formed in 1966 for the purpose of coordinating the activities of the various Societies for Surgery of the Hand throughout the world and in this way to increase and spread knowledge of surgery of the hand. I have articulated an audacious goal of **'Providing quality hand surgical care to the millions who are less privileged'**, as the theme for this triennium. This can happen only when there are adequate skilled personnel to deliver the care at the places of need, and an infrastructure and logistics that supports the effort. Spreading knowledge and capacity building will be our main thrust areas of work. The initiatives also require funding and for that we have established the IFSSH Patron of Hand Surgery programme. We hope that the programme, initiated in 2024, will reach the target by 2028 or earlier.

The members of the council and myself are ever willing to listen to your views and ideas to take things forward. Please feel free to write to me at rajahand@gmail.com or to our Administrative Secretary at administration@ifssh.info. I look forward to hearing from you.

S. RAJA SABAPATHY
President: IFSSH

SECRETARY-GENERAL REPORT

Secretary-General Report

Dear Colleagues,

After our 16th triennial IFSSH/IFSHT Congress in Washington DC. USA. 24-28 March 2025, we realise that we are living in a changing world. Although the missions of our Federation remain the same; our approaches to fulfil our missions are expanding. The scientific standard and scope of this Congress set hand surgery and therapy on a new level.

The 2nd triennial IFSSH Congress was also held in the USA. Forty-two years ago in Boston 16-21 October 1983. Dr Richard Smith was the Congress Chairman.

I extend huge thanks to James Chang the Congress Chairman and his organising team, the Surgical Program Committee led by Jeffrey Friedrich and Jeffrey Yao, and the host Societies (American Society for Surgery of the Hand and American Association for Hand Surgery) for this magnificent and splendid meeting. The stunning cherry blossoms in the streets as well as in the Tidal Basin during the National Cherry Blossom Festival added to the splendour of our experience in Washington.

I want to say to Jim: the program was perfect, the social events were perfect, and timing was perfect!! Everybody I have met voiced satisfaction and expressed gratitude to the hosts. A huge thanks to Jim and the whole team!

During the past three years, we had the largest number of IFSSH sponsored educational projects approved by the Committee of Educational Sponsorship. The new educational initiative, the IFSSH Mid-Term Course in Hand Surgery, was launched with great success. The IFSSH Patron of Hand Surgery program was launched in 2024, aiming to empower the education of IFSSH in the years to come.

The IFSSH is very grateful for the Delegates and Executive Committee members who served from 2022 to 2025 for their selfless dedication and their time, efforts and vision to the ever-growing IFSSH family. Without the dedication and contribution from you, our Federation will not be able to grow.

A personal note to the IFSSH Members and Member Societies. It has been a great pleasure to work with you during my past 6 years on the Executive Committee. I look forward, as the next Secretary-General, hearing from you and working with you about any matter, especially the need in your country or region. Your suggestions are valuable to improve the functioning of our Federation.

2025 IFSSH Pioneers of Hand Surgery

The IFSSH honoured 41 Pioneers of Hand Surgery at the Opening Ceremony in Washington, D.C..We pass our thanks to these hand surgeons for their national and international contributions to hand surgery, and the inspiration that they continue to provide to future generations of hand surgeons.

1. Hüseyin Bayram - Turkish Hand Society
2. Moroe Beppu - Japanese Society for Surgery of the Hand
3. Richard A. Berger - American Society for Surgery of the Hand
   American Association for Hand Surgery
4. Rolfe Birch - British Society for Surgery of the Hand
5. Hugo F. Caloia - Argentina Association for Surgery of the Hand
6. Alain Carlier - Belgian Hand Group
7. Massimo Ceruso - Italian Society for Surgery of the Hand
8. Rodolfo Cosentino - Argentina Association for Surgery of the Hand
9. Miguel Cuadros Romero - Spanish Society for Surgery of the Hand
10. Luc De Smet - Belgian Hand Group
11. Rui Ferreira - Brazilian Society for Surgery of the Hand
12. Alberto Garay - Argentina Association for Surgery of the Hand
13. Julien Glicenstein - French Society for Surgery of the Hand
14. Graham J. Gumley - Australian Hand Surgery Society
15. Vincent R. Hentz - American Society for Surgery of the Hand
16. Steven Hovius - The Netherlands Society for Surgery of the Hand
17. Leung Kim Hung - Hong Kong Society for Surgery of the Hand
18. Fuminori Kanaya - Japanese Society for Surgery of the Hand
19. Hermann Krimmer - German Society for Hand Surgery
20. Sridhar Krishnamurthy - Indian Society for Surgery of the Hand
21. Donald Lalonde - Canadian Society for Surgery of the Hand
22. Antonio Landi - Italian Society for Surgery of the Hand
23. Terry Light - American Society for Surgery of the Hand
24. Riccardo Luchetti - Italian Society for Surgery of the Hand
25. Pedro Marquina Sola - Spanish Society for Surgery of the Hand
26. József Nyárády - Hungarian Society for Surgery of the Hand
27. Naoyuki Ochiai - Japanese Society for Surgery of the Hand
28. Alfredo Edgardo Olazabal - Argentina Association for Surgery of the Hand
29. Turker Ozkan - Turkish Hand Society
30. Adriana Beatriz Pemoff - Argentina Association for Surgery of the Hand
31. Guy Raimbeau - French Society for Surgery of the Hand
32. Mario Rodriguez Sammartino - Argentina Association for Surgery of the Hand
33. Jose Maria Rotella - Argentina Association for Surgery of the Hand
34. Luis Scheker - Dominican Republic Society for Surgery of the Hand
35. Minoru Shibata - Japanese Society for Surgery of the Hand
36. Paul Smith - British Society for Surgery of the Hand
37. Paupan Songcharoen - Thai Society for Surgery of the Hand

38. Somprasong Songcharoen - Thai Society for Surgery of the Hand
39. Satoshi Toh - Japanese Society for Surgery of the Hand
40. Ian Trail - British Society for Surgery of the Hand
41. Eduardo Rafael Zancolli - Argentina Association for Surgery of the Hand

Further information is available about the Pioneers on the IFSSH website. The 2025 booklet is accessible through this webpage and includes a biography of each recipient.

2025 IFSSH Delegates' Council Meeting

The annual IFSSH Delegates' Council Meeting was held during the 2025 IFSSH-IFSHT Congress. We had excellent attendance, with 54 of our 64 member societies represented. We thank all the Delegates (and nominated proxies) for taking the time away from Congress sessions to join us and provide input into the future activities of the IFSSH.

We welcome the Jordanian Group for Hand and Upper Limb Surgery to IFSSH membership. This increases the IFSSH membership to 65 Societies from 63 countries, with more Societies currently corresponding about membership application.

We congratulate the Italian Society on winning the rights to host the 2nd IFSSH Mid-Term Course in Hand Surgery, and the Brazilian Society for their successful bid to host the 2031 IFSSH-IFSHT Congress.
The end of the IFSSH triennium also means the 2022-2025 Executive Committee and Nominating Committee terms came to a close. The 2025-2028 Committees were elected as follows:

Executive Committee
President: S. Raja Sabapathy, India (automatic succession)
President Elect: David Warwick, United Kingdom (automatic succession)
Immediate Past President: Daniel Nagle, USA (automatic succession)
Secretary-General: Jin Bo Tang, China
Communications Director: Aida Garcia Gomez, Colombia

Members-at-Large:
Asia-Pacific: Satoshi Ichihara, Japan
Europe/Africa: Ilse Degreef, Belgium
Europe/Africa: Jonathan Hobby, United Kingdom
North/Central America: Steven Moran, USA
South America: Fidel Cayon, Ecuador

Nominating Committee
Immediate Past President: Daniel Nagle, USA (Chair)
Past President: Marc Garcia-Elias, Spain
President: S. Raja Sabapathy, India
Member-at-Large: Roland Hicks, Australia
Member-at-Large: Nash Naam, Egypt

We look forward to working with the new Committees.

A full report of the IFSSH Delegates' Council will be made available on the IFSSH website: www.ifssh.info.

Future Meetings

A detailed list of national and regional hand surgery meetings is available on the IFSSH website. The triennial IFSSH Congresses are as follows:

17th IFSSH – 14th IFSHT Congress
Singapore
23rd – 27th October, 2028

18th IFSSH – 15th IFSHT Congress
Rio de Janeiro, Brazil
2031 (dates TBC)

Email: administration@ifssh.info
Web: www.ifssh.info
X/Instagram: @IFSSHand

JIN BO TANG ,
Secretary-General: IFSSH

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CONNECTING OUR GLOBAL HAND SURGERY FAMILY

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Past Pres. and Pioneer: IFSSH

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Past Pres. and Pioneer: IFSSH

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IFSSH/IFSHT CONGRESS REPORT

IFSSH/IFSHT Congress Washington, USA

Thank you very much for coming to the IFSSH/IFSSH Triennial Congress in Washington DC this past March. We hope that you and your friends had a phenomenal experience in the United States Capitol. This has been an uncertain time for the entire world, so we very much appreciate all of the international hand surgeons and therapists who traveled long distances to join us for the week. It has meant a lot to us.

Over 2600 hand surgeons, hand therapists, and allied health professionals were able to come to Washington DC. They were rewarded with perfect weather, fine accommodations without need for extended transportation to the meeting, free museums and landmarks within walking distance, and the absolute peak of the cherry blossom bloom!

These factors added greatly to the excitement and camaraderie of the meeting. We loved seeing fun social media posts from attendees smiling and laughing at famous sites around the city.

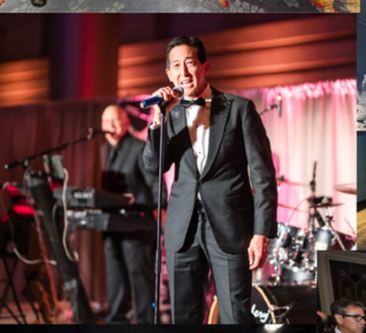
The opening ceremony began with a surprise act very relevant to Washington DC. The United States of America was born in 1776 after the American revolution. One revolutionary leader, Alexander Hamilton, who was recently revitalized in the hit Broadway show “Hamilton”, was introduced to the audience in a medley of songs performed by Broadway actors and actresses! The presidential address was given by IFSSH President Dan Nagle, and then the IFSSH Pioneers were honored in a very moving ceremony. The opening reception immediately after was a wonderful time for everyone to meet new people or to get reacquainted with old friends and colleagues.

IFSSH/IFSHT CONGRESS REPORT





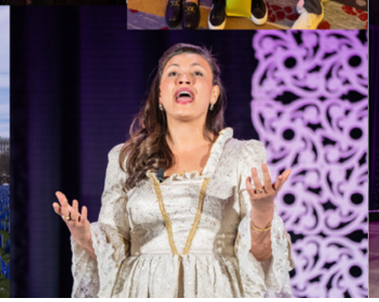


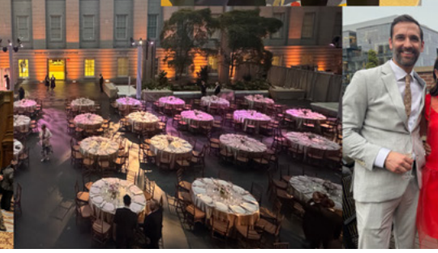










The hand surgery scientific meeting included 9 pre-courses, 76 symposia, 21 instructional course lectures, and 70 different paper sessions on a variety of topics. We received very positive feedback about the pairing of each symposium with scientific papers on the same topic. The hand therapists also had a busy and comprehensive program with 38 symposia, 22 instructional course lectures, and 26 paper sessions. Amongst these were 10 very popular combined surgeon/therapist joint symposia. Eighty-six countries were represented in the final program, with over half of the papers by our international colleagues. This was indeed the world's largest hand conference with the widest distribution of perspectives on hand reconstruction and therapy.

Our keynote speakers were Anthony Smith, who along with Steve McCabe, just completed a personal biography of Sterling Bunnell. He took us along their personal journey to discover the peak experiences that formed the life of the father of American hand surgery. The Swanson Oration was delivered by Fu Chan Wei, who regaled the audience with his unparalleled experience in complex microsurgical hand reconstruction in Taiwan.

As in London, the United States hosted 20 young talented hand surgeons as IFSSH Traveling Fellows. They spent the weeks before the meeting visiting top East Coast hand training programs. It was wonderful to see the Traveling Fellows come together at the meeting to form friendships and collaborations that will surely last a lifetime.

We were especially proud of the social events that filled the nights of Congress week.

On Tuesday night, the IFSSH delegates from each country joined the leadership of the American hand surgery and therapy societies in a formal dinner at the Spy Museum. Along with a rooftop view of the city, the guests had full access to the exhibits. Wednesday night was hosted by program chairs Jeff Yao and Jeff Friedrich at SPIN, a fun bar with ping pong and interactive games. All of the traveling fellows and IFSSH leadership were present for additional interactions and networking. The Gala Dinner on Thursday was held at the National Portrait Gallery. This was an incredible event with a cocktail reception in the Great Hall and a private viewing of all of the official presidential portraits. The dinner and gala party were held in the museum courtyard, a spectacular setting. Washington DC's hottest band Onyx kept the international crowd on the dance floor until midnight!

Congress week went extremely fast. It is our hope that our international guests had an engaging and educational time in Washington DC. Personally, I would like to thank the IFSSH and IFSHT for giving the United States the honor and opportunity to host this Congress, and all the American colleagues and ASSH staff who had been so involved in the six year process of organising this meeting. My belief is that if over 2600 hand surgeons and hand therapists from around the world can come together and have such a glorious week, there is still hope for the world.

JAMES CHANG MD
ASSH Congress Chair

IFSSH Patron of Hand Surgery messages

WITH THANKS TO INSPIRATIONAL FRIENDSHIP AND LEADERSHIP

I had the privilege to train as a Kleinert-Kutz hand fellow in Louisville in 1988. As a Duke University plastic surgery resident, I spent time in Louisville with Harold Kleinert, Joe Kutz, Tsu Min Tsai, Erdogan Atasoy, Luis Scheker, Warren Breidenbach, Tom Wolff and Robert Acland. This time was transformative and inspiring. 37 years later and after 35 years as an attending surgeon performing Hand and Microsurgery, training students, residents and fellows and contributing in my own way to the magnificent specialty of surgery of the hand -I listened to the words of Sharon Kleinert as she spoke in Washington this past March about her husband and my teacher Harold Kleinert. Sitting in the lecture hall, I reflected on my co-fellow relationship and profound respect for Raja Sabapathy as well as my personal and professional interactions with Daniel Nagle over many decades. All of us trained in Louisville, and all of us have always respected the life lessons and philosophies of what we were taught - and knew what was expected of us as we entered into practice after fellowship.

The opportunity to contribute to the Patron program of IFSSH provided a way for me to 'Pay it Forward" and honor the legacy of Harold Kleinert, acknowledge the outstanding IFFSH leadership of Daniel Nagle, and to recognize Raja Sabapathy's lifetime commitment to education and humanitarian efforts in India and around the globe as our next IFSSH President.

Supporting this vital IFSSH program is a unique and meaningful way to say "thank you" for the gifts I have received - during training, in the practice of hand surgery and the joy of educating those that seek knowledge and the ability to provide hand care around the world. I encourage all IFSSH members to think about the impact that such a gift can make on our collective future.

L. SCOTT LEVIN MD FACS
USA

A DONATION FROM ONE BENEFITS MANY

As a member of the international hand surgery community, I was truly honored to contribute to the IFSSH Patron of Hand Surgery Fund, and I encourage you to join me in supporting this invaluable initiative. The Patron Fund helps provide travel grants and educational opportunities for young hand surgeons from less resourced countries, enabling them to attend international meetings and gain critical exposure to world-class hand surgery education.

These grants not only allow recipients to learn from leading experts but also foster lasting relationships with mentors, ultimately helping them provide better care for their patients for years to come. By contributing to this fund, you are giving someone the opportunity to advance their knowledge, exchange ideas, and improve the global practice of hand surgery.

The impact of your donation extends far beyond the individual recipient. In countries like Cambodia and Kenya, travel grants have enabled surgeons to access cutting-edge techniques and resources, transforming the quality of care available to patients in underserved regions. Additionally, the fund supports the dissemination of knowledge through our publication Ezine, scientific meetings, and online resources, ensuring that hand surgery education is available to doctors around the world. Your gift contributes to the broader mission of increasing the availability of hand surgery, promoting cooperation among medical professionals, and advancing surgical care for conditions like burns, infections, and trauma.

This is an opportunity to make a real, lasting difference in the lives of patients and surgeons alike. Please consider donating to the IFSSH Patron of Hand Surgery Fund and help us continue this vital work, one grant at a time.

STEVEN MORAN MD
USA

The IFSSH Patron of Hand Surgery Program

We acknowledge the generous donations to date and thank the donors for their commitment to furthering the work of the IFSSH:

Super Platinum
Dr S. Raja Sabapathy - India
Platinum
Dr Francisco del Pinal – Spain
Dr Qing Zhong Chen – China
Prof David Warwick – United Kingdom
Dr Daniel Nagle – USA
Prof Gregory Bain - Australia
Gold
Dr Praveen Bhardwaj - India
Dr L. Scott Levin – USA
Silver
-
Bronze
Name withheld – New Zealand
Dr Steven Moran - USA

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Alfredo Quintana Montero 16/8/1926 – 4/11/2000

Alfredo Quintana Montero was born on 16 August 1926 in Spain. He studied medicine at the University of Santiago de Compostela from 1944 to 1951, and from 1952 to 1953 worked as an assistant of Dr. Epeldegui Fernandez in Madrid, Spain. After completing his degree in Traumatology and Orthopaedic Surgery he became Professor of Anatomy and worked in the Provincial Hospital "Nuestra Señora de Gracia" in Saragossa.

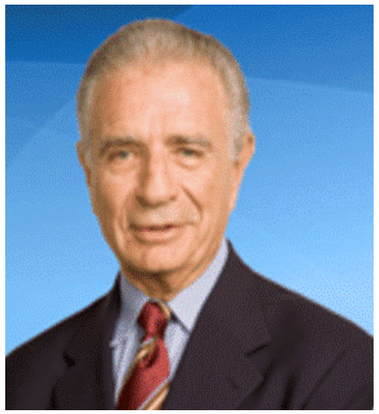
In 1957 he was the orthopaedic surgeon at the Clinic of the National Insurance for Work Accidents in Saragossa. He held several senior positions in various clinical services as an orthopaedic surgeon and in 1963 until the end of the 1970s was Chief of Orthopaedic and Trauma Surgery in Saragossa.

Dr. Quintana Montero was one of 12 founding members of the Spanish Society for Surgery of the Hand (SECMA) which was established on 11 April 1969 and became its first secretary. He was the founder of the "Revista Española de Cirugìa de la Mano" (Spanish Journal of Surgery of the Hand) in June 1973, and was editor until 1999, when the Journal became the official journal of SECMA, which then became "Revista Ibero-americana de Cirugìa de la Mano" (Latin-American Journal of Surgery of the Hand).

In 1974 he became the president of SECMA and organised a course "The hand in industry" at the "Instituto Fernando El Católico" of the Council of Scientific Investigations in Saragossa. The aim was to discuss work related hand injuries and how to treat them. Prominent hand surgeons from all over Europe were speakers. The next year he presided over the First Meeting of the French, Italian and Spanish Societies for Surgery of the Hand. Alfredo Quintana was an enthusiastic supporter of specialised units for hand surgery and became the Chief of Hand Surgery Service at the Red Cross Hospital in Saragossa in April 1976. This Service became the referral hand service for Aragon. He established a microsurgery teaching laboratory at the Polyclinical Institute San Antonio of Saragossa which enabled surgeons to perform the first toe-to-hand transfer in Spain on 29 January 1980. He obtained his doctoral thesis titled: "Contribution to the study of palmar aponeurosis contractures"
SECMA made Antonio Quintana an Honorary Member in 1995 and an Honorary President in 1997.
He was a member of many Societies in Spain and Europe. The Spanish Red Cross awarded him the Golden Medal in 1983.

In 2010, at the 11th Triennial Congress of the International Federation of Societies for Surgery of the Hand in Seoul, Korea, Antonio Quintana Montero was honoured as "Pioneer of Hand Surgery"

Julio Taleisnik 24/8/1934



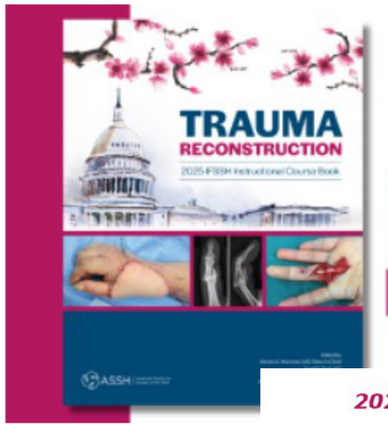
Julio Taleisnik was born on 24 August 1934 in Ceres, Santa Fe, Argentina. He completed his medical training at the Buenos Aires Medical School (1951-1957). He worked in various hospitals in Buenos Aires from 1957 until 1960, as well as in the Anatomy Institute where he was influenced by Ricardo Finochietto, who advised him to continue his post graduate studies in the USA. Taleisnik did his Orthopaedic Residency at the Mayo Clinic, Rochester, Minnesota from 1961 to 1966, followed by a 6 month Hand Fellowship with Joseph H. Boyes in Los Angeles, California, USA. He then joined a busy practice in April 1966 at the St. Joseph Medical Plaza in Orange, California. He was appointed Chief of Hand Surgery Services at the University of California, Irvine from 1967 to 1977, and in 1986 became Clinical Professor in the Department of Surgery (Orthopaedic) at the same University.

Julio Taleisnik was interested in the wrist from very early on and published his classical articles " The extraosseous and intraosseous blood supply of the scaphoid bone" in the Journal of Bone and Joint Surgery 48-A, 1125-1137, 1966, and "The ligaments of the wrist" in the Journal of Hand Surgery 1, 110-118, 1976. In 1985 he published his famous book: "The Wrist" (Churchill Livingstone). He published another 36 articles and 18 book chapters.

Taleisnik was member of numerous organisations and committees in the United States of America, Mexico, Argentina, Colombia, Venezuela, Brazil, and Europe. He was President of the American Society for Surgery of the Hand (1993-1994) and Vice-President of the American Foundation for Surgery of the Hand (1995-2010). He was editor of four journals.

Julio is married to Chela, a dentist, and together they have 3 children.

The International Federation of Societies for Surgery of the Hand at its 11th Congress in Seoul, Korea in 2010, honoured Julio Taleisnik with the title: "Pioneer of Hand Surgery"



NEW RELEASE

from the 2025 IFSSH/IFSHT Congress

Available in print or eBook for $50.

Trauma Reconstruction:
2025 IFSSH Instructional Course Book

Edited by:
Warren C. Hammert, MD, Editor-in-Chief
David S. Ruch, MD
Fraser J. Leversedge, MD
S. Raja Sabapathy, MS, MCh, DNB, FRCS

This **expert-led resource**, developed as an extension of the 2025 IFSSH/IFSHT Instructional Courses, is available to all—whether you attended the Congress or not—for just **$50** while supplies last.

It offers practical guidance on the **acute and delayed management of bone and soft tissue injuries** in both adults and children. Organized anatomically for quick reference, it's a valuable tool designed to support collaborative, outcome-driven care.

Key features include:

✅ **Contributions from international experts** who have made notable advancements in the subject matter

✅ **State-of-the-art** management of **acute fractures**, **dislocations**, and **post-traumatic reconstruction**

✅ **Detailed guidance** for the management of **tendon**, **nerve**, and **soft tissue injuries**, as well as the **mutilated hand**

✅ The **latest information** to manage **stiffness** and **tendon imbalances** caused by trauma

✅ **Pediatric sections** highlighting strategies for traumatic **osseous** and **soft tissue injuries**, with emphasis on differences from adult care

✅ **Pearls and pitfalls** that may influence outcomes for each condition

✅ **Key points and references** in each of the **15 chapters** to guide readers to more in-depth information

Whether you're in the OR or clinic, this is a must-have reference to elevate your practice.

BUY NOW

Download the table of contents and sample chapter.

Art Exhibit #23

Almudena Romero

The first colour photography processes were devised in the 1840s using plant-based photosensitive materials and plant-based solutions, substances later substituted for harsh reactive chemicals. Spanish artist Almudena Romero is presently experimenting and exploring this early technique using sustainable materials across the photographic process and printing directly onto plants.

Primary flexor tendon repair - expert guidelines of management

Jin Bo Tang, Donald Lalonde, Carlos Henrique Fernandes, Ahmed Fathy Sadek, Inga S. Besmens

Because of the remarkable advances and evolution in concepts, methods, and outcomes in primary flexor tendon repairs during the past three decades, a panel was formed to summarize current best recommendation guidelines.

The consensus team:

Jin Bo Tang, Professor, Department of Hand Surgery, Affiliated Hospital of Nantong University, Nantong, China. Tendon Committee chair and project leader: jinbotang@yahoo.com

Donald Lalonde, Professor of Surgery, Division of Plastic Surgery, Dalhousie University, Saint John, Canada

Carlos Henrique Fernandes, Professor, Orthopedic Surgery Department, Federal University of São Paulo, São Paulo, Brazil

Ahmed Fathy Sadek, Professor of Orthopaedic Surgery, Minia Hand and Microsurgery Unit, Faculty of Medicine, Minia University, Minia, Egypt

Inga S. Besmens, Consultant, Hand Institute Zurich, Zurich, Switzerland

*We acknowledge that the chapter on flexor tendon repair in the book "Current Practice in Hand Surgery" (Elsevier), editor Jin Bo Tang, forms the basis of these latest guidelines.

*Additional information and consultation were obtained from Koji Moriya (Japan), Giovanni Munz (Italy), and David Elliot (UK).

Zones and subzones

The 5 zone systems proposed by Verdan and Kleinert[1] should be used for classifying and documenting flexor tendon injuries. The subzones of zones 1 and 2 are recommended for documentation of treatment outcomes and for discussion of treatment methods (Figure. 1), because the treatment and outcomes are significantly different in these subzones.[2] Zone 1 is divided into 3 subzones as proposed by Elliot, and zone 2 is divided into 4 subzones as proposed by Tang. These subzones have been used for 30 years and are accepted in the literature and clinical outcome reports.

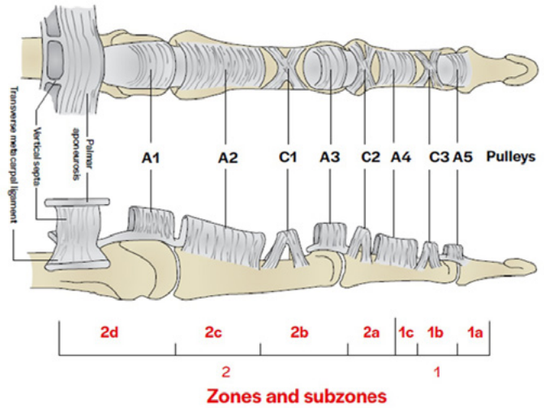


Fig.1: Zone 1 and 2 and their subzones (3 subzones of zone 1 and 4 subzones of zone 2) in the fingers (From Chen J, Tang JB, Lalonde DH, Chapter 8. Update on tendon injuries of the hand and wrist, in: Trauma Reconstruction, edited by Warren C. Hammert, etc, ASSH, 2025).

Timing of primary repair

We consider direct repair (end-to-end repair) as primary repair. The timing of a primary repair is regarded as from immediately to about 4 weeks after trauma. The outcomes of repair in this time frame are generally similar. Even though the longer the time elapses, the more difficult the surgery can be, any primary flexor tendon repair can be done within 4 weeks after trauma.[2] When possible, it is preferable to have the tendon repaired within 1 or 2 weeks after injury. Theoretically, repair done on the day of the injury is the best and easiest, but in the real world, this may not always be possible. An experienced surgeon may not be available. It is of key importance that the repair is done by an experienced surgeon rather than rush to get it done within hours after injury by an un-experienced surgeon.

Surgical incisions

A long Bruner incision has been a common approach, but recently more surgeons use a smaller non-Bruner incision, usually 2-3 cm long, which is only an oblique extension of the transverse laceration after trauma (Figure. 2).

This incision should only be as long as is needed to expose the tendon. The extension incision should be made distal to the traumatic skin laceration, since the tendon is usually cut with the digit in flexion, resulting the tendon end being distal to the skin laceration. Retraction of the flexor tendons is common if the repair is done a few days or weeks after the trauma. In that case, we suggest a separate small incision in the palm to 'push' the proximal retracted tendon distally in the sheath for it to emerge from the laceration/incision in the digit using two forceps as shown in Figure 2.

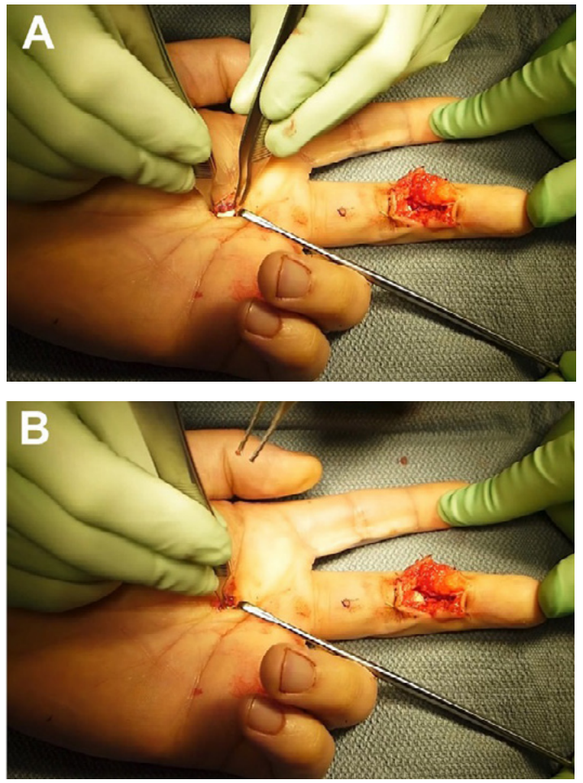


Fig. 2: A separate incision in the palm to deliver the retracted FDP tendon. Delivery of the retracted FDP tendon by making a separate small incision in the palm. (A) Two sets of forceps were used to grasp the tendon in the palm through an incision in the distal palm. (B) The proximal forceps pushed the FDP tendon to the incision in the finger distally. (Courtesy of Jin Bo Tang, MD)

Avoid a lengthy proximal extension in the digit which leads to edema and causes postoperative resistance to active gliding of the repaired tendon. The shorter the incision, the less scarring there will be. In addition, it may be wise to repair only the FDP tendon if both tendons are retracted, as repair of both tendons is more difficult, causes more handling trauma, results in a bulkier suture site and is often unnecessary regarding finger function.

Surgical repair methods

Always use a multi-strand repair. The following principles should be followed in any repair:

At least 4-strands in a core suture method are recommended (Figure. 3). Considering the significant increase in the repair strength of a 6-strand core suture and based on our collective experience with very low rupture rates using a 6-strand core suture method, we strongly urge our colleagues to use 6-strand core sutures. (Figure. 4).[2,3] This will make early active motion even less risky with a greater safety margin against rupture.

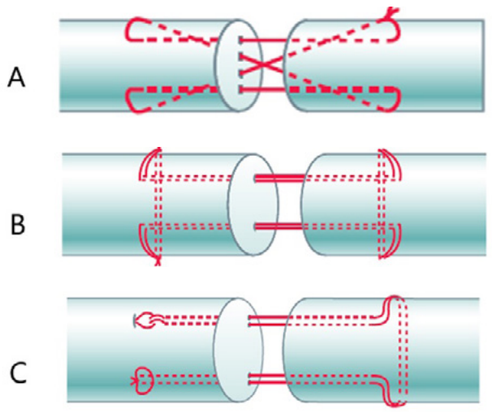


Fig. 3: Commonly used 4-strand repair methods. A. Cruciate, B. Double Kessler with looped suture (one needle carrying two sutures) and knots outside the tendon. A double Kessler repair can also be made with two separate sutures. C. U-shaped repair made with one looped suture.

We recommend adding enough tension when making the core suture so that there is slight bulkiness of the repair site to reduce the chance of gapping and rupture.[2,3] The suggested bulkiness is about 20-30% increase in tendon diameter at the repair site (Figure. 5). At the same time, we suggest that the repair site should not be too bulky to avoid resistance to tendon gliding and too much shortening of the tendon.

Peripheral sutures are usually needed if a 4-strand repair is used. In a slightly bulky 6-strand repair, peripheral sutures are not required,[3,4] but 2-3 simple stitches with 5-0 or 6-0 sutures can be added to close any small gaps (Figure. 5). We recommend adding only sparsely located simple interrupted epitenon sutures to the sites where peripheral approximation is not smooth to promote primary epitenon healing.[2,5]

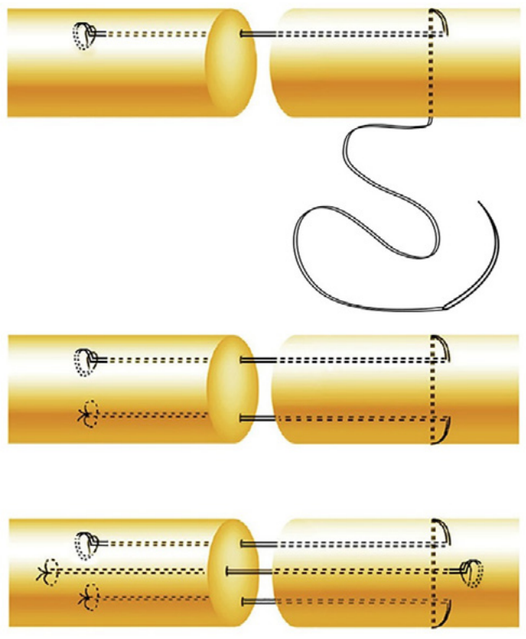
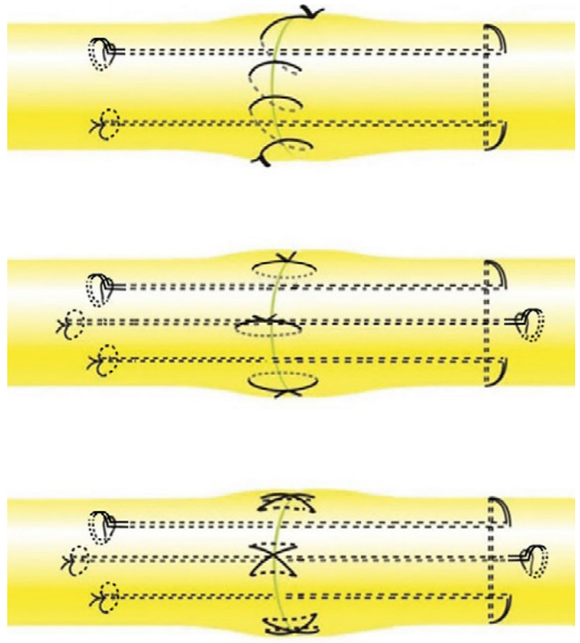


Fig. 4: Making a six-strand M-Tang repair with two groups of looped sutures to form a 6-strand repair. Triple Kessler repair (knots outside the tendon) can also make a 6-strand core repair.



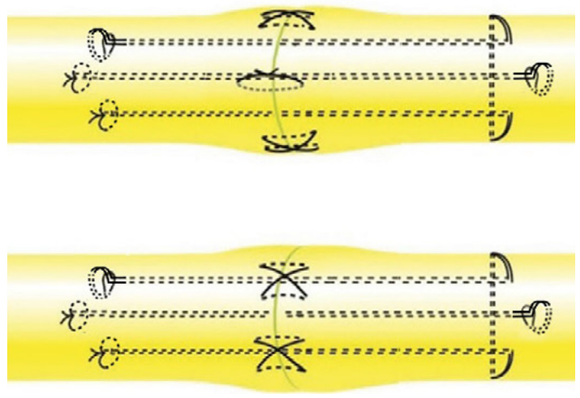


Fig. 5: Sparsely located sutures in epitenon with a 6-strand core suture repair. Note the tendon junction is slightly bulky, made with slightly tensioned 6-strand core sutures. (From Tang JB, Pan ZJ, Munz G, Besmens IS, Harhaus L. Flexor tendon repair techniques: M-Tang repair. Hand Clin. 2023;39:141-149).

Core suture purchase should be at least 7 mm and even better if you can get 10 mm from the cut end.. A shorter suture purchase has very small grasping or locking powers and should be avoided.

Any suture method which follows the above basic rules in repairing a flexor tendon may work well. Methods include double Kessler (knots placed on the tendon surface), triple Kessler, Tang (triple Tsuge), M-Tang, cruciate, Strickland, etc. The authors prefer a 6-strand core method made with a 3-0 or preferably 4-0 non-braided (monofilament or monofilament-like) suture, and the peripheral sutures made with 5-0 or 6-0 monofilament suture when required (Figure 5).[2-6]

Venting a critical pulley

We suggest carefully assess the need and length of pulley venting. The A2 pulley can be vented to its half, 2/3, or occasionally the entire length. The A4 pulley can be vented through its entire length, as the A4 is narrow (5 mm wide). A general guideline is that the total length of the venting of a pulley with adjacent sheath should be less than 2 cm in an average adult finger.[6]

An alternative guideline is to vent the repair excursion distance, which is the length necessary to allow free full-range motion of the tendon repair site from the proximal unvented pulley to the distal unvented pulley with intraoperative full fist flexion and extension testing. The method of venting is a midline or lateral longitudinal cut of the pulley.

Wide-awake surgical settings

Wide awake patient active motion of the repaired tendon during surgery provides the best assessment for the length and range of pulley venting because we can see if the repair gliding is impaired by an unvented pulley.[8] Active testing is also the best method to validate the quality of tendon repair to rule out gapping. This is why we recommend wide-awake surgery if possible. If the patient refuses the wide-awake approach, a brachial plexus block or sedation with local anesthesia can be used. In the latter case,

the digit is moved passively with extension-flexion testing to validate the quality of the repair and sufficiency of pulley venting.

In both awake (active) or sedated/tourniquet (passive) situations, the extension-flexion test should be used before completion of the surgery. This is an essential quality-check step of this surgery. If the repair is weak or loose, which is indicated by gapping during the test, this repair should be revised and strengthened. If the pulley is not sufficiently vented, the pulley venting needs to be longer.

Postoperative protection and exercise

The hand is protected with a forearm-based splint or hand-based short splint.[8, 9] The wrist position can be in mild flexion, neutral, or comfortable extension. The splint extends distally to the fingertip. Mild flexion of the MP joint is recommended, but PIP and DIP joints can be fully extended or with mild flexion in a protective splint.[8, 9]

There is no need to do motion exercises in the first 3 or 4 days after surgery.[8,9] Movement during the first two days after surgery is likely to cause bleeding in the wound which will add to more swelling and scar formation. It is better to wait until the likelihood of bleeding has stopped, the swelling has settled, and painless movement can happen after 4-5 days of hand elevation and immobilisation.

After the initial period of elevation and immobilisation, partial-range active flexion exercise may start (Figure 6).[2, 8, 9] There are different versions of the current active flexion exercises. However, we consider active flexion exercise a key. Out of splint exercises are encouraged in reliable patients. The number of sessions can vary, ranging from 4-6 sessions a day (each session lasting about 15 -20 minutes with 40-60 runs of active digital flexion, plus full-range passive digital motion), depending on various factors such as swelling, pain, co-operation, progress, etc.. However, one key point is enough runs in each session.

There is no evidence to show that larger number of runs (eg. 40-60 runs) per session would have a greater risk of repair rupture. Ten runs in each exercise session is very conservative, and in fact may not be effective.

We do recommend passive warm up exercises to warm up the joints and to decrease finger stiffness before the active flexion exercises. Collectively, we do not recommend the use of “place and hold” as an alternative to true active flexion exercises.

Full range active flexion exercise is recommended 3-4 weeks after surgery. Passive motion can be increased as the repair gets stronger to supplement the active flexion exercises. There is usually no need to use a protective splint full time after week 5 or 6.

With the above guidelines, the rupture rate can be less than 2- 5%. Unfortunately, there are patients who do not follow instructions or use their hand too aggressively in the early weeks after repair who are going to rupture. Immediate re-repair is performed if a repair is ruptured. The surgical principles and methods and postoperative motion are the same as for primary repair.

In later weeks, if adhesions form, a ‘relative motion extension splint’ which keeps the MP joint of the injured finger in more extension than the MP joints of the uninjured fingers, will often get the FDP out of the scar area with daily active finger use.

Fig. 6: Partial range active flexion exercise after surgery is used by all of us and is recommended. Figure 6 A and B is an example of out-of-splint motion in the first 3 to 4 weeks after repair with very mild edema. (A) Full extension of the finger and (B) partial range active flexion. (Courtesy of Jin Bo Tang). One of us (AS) places a cylinder in the palm to prevent full flexion of the finger during the motion.

Tenolysis

If the above guidelines are followed, the rate of tenolysis will likely be less than 5%. In some reports in which the above guidelines were used, it is only 2-3%. Adhesion and stiffness are always present in some patients, but exercise should continue for months, and tenolysis is not indicated if the exercise has not lasted for at least 3-6 months. Most patients do not need tenolysis with initial mild adhesions, but in severely traumatized patients or if patients do not follow the guidelines, tenolysis may be needed, if there is no improvement with the prescribed exercises.

Active motion through the full range is necessary after tenolysis. We treat tenolysed tendons like freshly repaired tendons, with 4-5 days of rest and hand elevation to prevent internal bleeding and let swelling come down to counter collagen formation before early protective movement starts.

References

1. Kleinert HE, Verdan C. Report of the committee on tendon injuries. J Hand Surg Am. 1983; 8: 794–8.
2. Tang JB, Lalonde D, Harhaus L, Sadek AF, Moriya K, Pan ZJ. Flexor tendon repair: recent changes and current methods. J Hand Surg Eur Vol. 2022;47:31-39.
3. Giesen T, Calcagni M, Elliot D. Primary flexor tendon repair with early active motion: Experience in Europe. Hand Clin. 2017;33:465-472.
4. Giesen T, Reissner L, Besmens I, Politikou O, Calcagni M. Flexor tendon repair in the hand with the M-Tang technique (without peripheral sutures), pulley division, and early active motion. .J Hand Surg Eur Vol. 2018;43:474-479.
5. Sadek AF. Flexor digitorum profundus with or without flexor digitorum superficialis tendon repair in acute Zone 2B injuries. J Hand Surg Eur Vol. 2020;45:1034-1044.
6. Tang JB, Zhou X, Pan ZJ, Qing J, Gong KT, Chen J. Strong digital flexor tendon repair, extension-flexion test, and early active flexion: experience in 300 tendons. Hand Clin. 2017; 33:455-463.
7. Lalonde DH, Martin AL. Wide-awake flexor tendon repair and early tendon mobilization in zones 1 and 2. Hand Clin. 2013;29:207–213.
8. Tang JB. New developments are improving flexor tendon repair. Plast Reconstr Surg. 2018;141:1427-1437.
9. Tang JB. Rehabilitation after flexor tendon repair and others: a safe and efficient protocol. J Hand Surg Eur Vol. 2021;46:813-817.

FEDERATION AND MEMBER SOCIETY REPORTS

Federation & Member Society Reports

ASIAN-PACIFIC FEDERATION OF SOCIETIES FOR SURGERY OF THE HAND

Office Bearers for 2023-2025
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President Elect: Fuminori Kanaya
Secretary-General: Alphonsus Chong
Treasurer: Hyun Sik Gong
Immediate Past President: S Raja Sabapathy
Editor-in-Chief: Sandeep Sebastin Muttath (from 1 Jan 2024)

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2. Emmanuel Estrella
3. Jeremy Prakash
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5. Margaret Fok
6. Michael Boland
7. Pankaj Ahire
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9. Toshiyasu Nakamura
10. Yuwarat Monteerarat

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2. Hong Kong
3. India
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5. Japan
6. Malaysia
7. Philippines
8. Singapore
9. South Korea
10. Taiwan
11. Thailand
12. New Zealand
13. Bangladesh
14. Nepal
15. United Arab Emirates

Subcommittees
1. Finance
2. Education
3. Communications (Newsletter, Website, Social Media)
4. Membership
5. Diversity

This has been a year of consolidation of the many activities undertaken by the APFSSH. Our membership has been increasing with the Nepal Hand Surgery Society and the Emirates Hand Surgery Society joining the Federation. We have also accepted Associate Membership from 2 surgeons from Vietnam.

In August last year the APFSSH in conjunction with the FESSH Academy and the Malaysian Society for Surgery of the Hand ran the first Foundation Course in Hand Surgery. This 3 day course was very well attended with 85 registrants from 16 different countries. The reviews from the registrants were all excellent. We thank Jonathan Hobby for his excellent guidance with this first course. The next Foundation Course will be run in Hong Kong with the help of the Hong Kong Society for Surgery of the Hand from 4-6 march 2026.

Our Education Committee has been very active with a number of applicants for the APFSSH Travelling Fellowship and Visiting Professorship programs. We have also recently introduced the APFSSH Advanced Training Fund. This will provide financial support for two young surgeons from a member society to attend a specialized course offering advanced training in areas such as brachial plexus surgery, microsurgery, congenital hand surgery, arthroscopy, and related fields.

Planning for the 14th APFSSH meeting in Mumbai from 10th to 13th September 2025 is progressing well. This again will be held in conjunction with the 48th ISSHCON, 10th APFSHT, 9th APWA and SHTI meetings. The theme for this meeting will be Progress with Purpose. The organising committee chairman, Dr Ahire is developing an excellent program and I would encourage everyone to attend.

The next APFSSH meeting will be in Japan in 2027.

Anthony Berger
President: APFSSH

INTERNATIONAL FEDERATION OF SOCIETIES FOR HAND THERAPY

IFSHT President, Peggy Boineau (PB)-- Activities since June 2024
- Updated the Congress agreement with host society, effective beginning with the 2031 Congress.
- Implemented new process for Congress bids.
  - Consider joint bids first
  - If no joint bids are acceptable to the IFSHT (i.e. no established hand therapy society that can host), then standalone bids will be considered
  - For joint bids, the therapy society will be required to have a strong written and signed agreement with the surgery society and must demonstrate ability to financially support the Congress.

13th IFSHT Triennial Congress / 16th IFSSH Triennial Congress, 2025, Washington, D.C., USA
- Successfully completed the plans for the Congress

14th IFSHT Triennial Congress / 17th IFSSH Triennial Congress, Singapore
- IFSHT obtained confirmation from the Singapore Hand Therapists, indicating they have a signed agreement with the Singapore Hand Surgeon Society for collaboration on the Congress.
- IFSHT has signed agreement with Singapore Hand Therapy Association for hosting the Congress

IFSHT Membership:
- 62 total
- New this triennial period:
  - Full: Malaysia
  - Associate: Malawi, Ethiopia, Vietnam
  - Corresponding: Bhutan, Costa Rica, Kuwait
- Attrition: Removed Egypt as Corresponding due to failure to correspond and failure to pay dues

Web-based Communication with Hand Therapists Globally:
- REACH newsletter
- Website (www.ifsht.org)
- Facebook and Instagram
- IFSHT contribution to IFSSH Ezine

IFSHT Grants and Awards:
IFSHT Evelyn Mackin Congress Grant: sponsorship of therapists from developing countries to attend triennial congress.
- Raised 37,690 USD
  - Includes 20,000 USD from anonymous donor
  - Includes 10,000 USD from IFSSH, for which we are very thankful
- Awarded 9 grants
  - 7 accepted: Bangladesh, Vietnam, Papua New Guinea, Ghana, Ethiopia, Bhutan, Malawi
  - 2 declined due to unable to obtain visa: Ukraine, Rwanda

IFSHT/IFSSH Triennial Congress Grant:
- Raised 15,752 USD and for partial Congress attendance
  - Includes 5,000 USD from IFSSH for which we are very thankful
- Supported 25 therapists from 15 countries.

IFSHT-IFSSH International Hand Therapy Teaching Awards.
- Grants up to 1500 USD are available to support therapists teaching hand therapy in less-developed countries.
- Awarded 1500 USD to a UK hand therapist to travel to Sierra Leone to teach about hand therapy.
- Awarded 1500 USD to a UK and a Swiss hand therapist to travel to Sri Lanka to teach about hand therapy

Cristina Alegri Award for Innovation in Hand Therapy: to be awarded 24 March 2025.

IFSHT Lifetime Achievement Award:
7 to be awarded 24 March 2025

DYNAMOMETER PROGRAM:
- Program has concluded as of February 2025
- 25 years
- 102 units
- 34 countries

Respectfully submitted,

Peggy Boineau
IFSHT President (2022-2025)

LATIN-AMERICAN FEDERATION OF SOCIETIES FOR HAND SURGERY (FLACM)

The management of FLACM held the following events during 2024-2025:

On 18-20 2024 July in La Paz, the **1st Combined Congress with the Bolivian Society of Hand Surgery** was held with great success.

The event was attended by their President, Dr. Jorge Terrazas, and FLACM President Dr. Sergio Daroda, along with prestigious guests such as Drs. Fernando Menvielle, and Carlos Martínez from Argentina, Samuel Ribak from Brazil, Fabio Suárez and Luis Náquira from Colombia, Amy Moore and Alejandro Badia from USA, and physical therapists Mariana Asseff (Argentina) and Nancy Chee (USA).

On 19 September 2024 the **FLACM Virtual Session** was organised, hosted by the Mexican Association and the Mexican Society of Hand Surgery, led by Drs. Luis Felipe Náquira and Fabio Suárez from Colombia.
The session featured presentations of four original techniques by Drs. Miguel Angel Hernández, Joaquín Díaz, Luis Sánchez Gutiérrez and Francisco García Lira.

On 17-19 October 2024, the **2nd Congress of the Peruvian Society of Hand Surgery** was successfully held in Asunción, in collaboration with FLACM. The event was attended by their president, Dr. Bruno Pietrapianna, and featured presentations by Drs. Sergio Daroda, Fernando Menvielle, Miguel Capomassi, Fernado Juarez Cesca, Matías Sala from Argentina, Carlos Sáez from Brazil, Luis Náquira from Colombia among other speakers.

FLACM joined the **Argentinian Hand Surgery Congress** held in Mar del Plata, Argentina on 6 November 2024. They coordinated a Flexor Tendon Symposium with a panel of experts from numerous countries in the region: Drs. Sergio Daroda, Fernando Menvielle and Álvaro Muratore (Argentina), Antonio Costa (Brazil), Juan Ramón Bonfil (Mexico), Victoria Hernández (Uruguay), Alejandro Badía (USA), and PT Fernanda Coscueta (Argentina).

On 21-22 November 2024, in Guatemala City, the **1st Combined Congress** with the Guatemalan Society of Hand Surgery was held with great success. The event was attended by their President, Dr. Juan Carlos González Morales, and FLACM President Dr. Sergio Daroda, along with the prestigious presence of Dr Eduardo Zancolli. Other renowned specialists such as Drs. Fernando Menvielle, and Agustín Donndorff from Argentina, Luis Náquira from Colombia, Fernando Romero from Guatemala, Joaquin Díaz, Francisco García Lira and Efraín Farías from Mexico, and Fidel Cayón from Ecuador were present.

The following activities are scheduled for the next FLACM Congress in Buenos Aires:

- 8-10 May 2025, San José, Costa Rica. **1st Costa Rican Congress of Hand Surgery**
- April 2025, Online Session with the **Chilean** Society of Hand Surgery.
- August 2025, Online Session the **Brazilian** Society of Hand Surgery.

We'll finish our present FLACM management term, transferring the Presidency to Dr Fabio Suárez from the Colombian Association of Surgery for the Hand (ASOCIMANO) for the period 2026-2027 at the **XX CONGRESS OF THE LATIN-AMERICAN FEDERATION OF HAND SURGERY** in Buenos Aires, Argentina, 15-17 October 2025.

Sergio Daroda
President: FLACM

Eduardo Zancolli
FLACM IFSSH Representative

FEDERATION AND MEMBER SOCIETY REPORTS

TURKISH SOCIETY FOR SURGERY OF THE HAND AND UPPER EXTREMITY

The Turkish Society for Surgery of the Hand and Upper Extremity was established in 1977. Hand Surgery was officially accepted as a subspecialty by our Ministry of Health in 2009. And since 2012, there has been a subspecialty education fellowship program to become a “Hand Surgery Specialist”. Orthopaedic Surgeons, Plastic and Reconstructive Surgeons and General Surgeons are allowed to enter the fellowship exam and the surgeons who pass the exam begin the 2-year education program. After completing the requirements, the surgeon may use the title “Hand Surgeon” and receives a diploma and license number given by the Ministry of Health.

At the FESSH Congress in Rotterdam Prof. Dr. Türker Özkan received the FESSH Giant award. Prof. Dr. Türker Özkan and Prof. Dr. Hüseyin Bayram have been named IFSSH Pioneer of Hand Surgery at the IFSSH and IFSHT Congress in Washington DC. in March 2025.
The Turkish Society had a very active year. The following are some of our 2024 and 2025 highlights.

18th Prof. Dr. Rıdvan Ege Advanced Hand Surgery Course 9-10 February 2024.
The scientific program and workshops of this annual course attract nationwide attention.

Cadaver Upper Extremity Trauma Course 16 March 2024.
The aim of our course was to learn surgical approaches and apply surgical fixation methods in selected anatomical areas from the fingertip to the elbow region on cadavers.

Upper Extremity Winter Symposium 9-12 January 2025.
This symposium was performed with the participation of the Shoulder and Elbow Surgery Society, and the Reconstructive Microsurgery Society.

19th Prof. Dr. Rıdvan Ege Basic Hand Surgery Course 21-22 February 2025.
The scientific program and workshops of this annual course attract nationwide attention.

Hatay Regional Meeting 15 March 2025,
This meeting was hosted by Mustafa Kemal University Research and Training Hospital, and the subject was “Distal Radius Fractures.”

Travelling Hand Surgery Course 10-14 March 2025.
Participants joined selected surgeries with experienced instructors in different hospitals

Travelling Hand Surgery Course

Hatay Regional Meeting

Cadaver Hand Wrist Arthroscopy, Thumb CMC Joint Arthroscopy and Endoscopic Carpal Tunnel Surgery Course 11-12 April 2025.
The course includes practical and theoretical training on cadavers.

19th National Hand and Upper Extremity Surgery Congress 16-19 May 2025.
The 19th National Hand and Upper Extremity Surgery Congress will be held in Bodrum. During the Congress, we will aim to prepare a scientific program that would allow the sharing of new scientific and technological developments, as well as discuss current diagnosis and treatment approaches with contributions by experienced speakers from the national and international arena.

19th Prof. Dr. Rıdvan Ege Basic Hand Surgery Course

National Congress Announcement

Dr. Özgün B. Güntürk
Turkish Hand Society IFSSH Delegate

THAI SOCIETY FOR SURGERY OF THE HAND

We are excited to share the highlights from our 40th Annual Meeting, held 20-21 March 2024, in Bangkok, Thailand. This year's gathering was particularly momentous as it marked the first time we combined our efforts with the International Bone Research Association (IBRA). The theme, "Upgrade to the Next Level," encapsulated our commitment to advancing hand surgery practices and fostering collaboration among global experts in the field.

The meeting featured an impressive lineup of keynote speakers, workshops, and panel discussions that provided attendees with a platform to explore the latest advancements in hand surgery. Participants engaged in stimulating discussions on emerging techniques and technologies, bringing together diverse perspectives from across the world. This collaboration with IBRA enriched our agenda, enabling seamless knowledge transfer and networking opportunities among surgeons with varying specialties.

The highlights from the meeting include:

- Honorary Lectures: The event featured inspiring honorary lectures, including a special address on “Brachial Plexus Surgery—Some Historical Aspects” by Prof. Panupan Songcharoen, under the IFSSH ‘Pioneer of Hand Surgery’ theme.

- Interactive Sessions: The agenda showcased in-depth updates in protocols for radial nerve problems, practical points in Electro-diagnostic study interpretation, 3D printing for custom-made prostheses.
- Panel discussions on traumatic wrist and elbow problems with our local and international speakers including Prof. Eugene Ek from Melbourne and Prof. Hyunsik Gong from South Korea.
- Academic Training Programs: A range of sessions focused on fellowship opportunities beyond Thailand—with presentations on programs in Japan, the USA, and Australia—emphasizing our commitment to global education and collaboration.

In addition to our academic endeavors, we proudly celebrated the graduation of new hand surgeons during the meeting. This ceremony recognizes the hard work and dedication of our recent graduates, who represent the future of hand surgery. Their achievement underscores our ongoing commitment to education and excellence within the field.

As we move forward, the Thai Society for Surgery of the Hand remains dedicated to elevating standards and education in hand and upper limb surgery. We are grateful to all our members, speakers, and participants for their contributions to making this event a resounding success. Together, we are poised to make significant strides in the field, and we look forward to our next annual meeting with renewed enthusiasm and commitment to excellence in hand care.

Y.J. Lu
Secretary-General: Thai Society for Surgery of the Hand

FEDERATION AND MEMBER SOCIETY REPORTS

SOUTH AFRICAN SOCIETY FOR SURGERY OF THE HAND

The South African Society for Surgery of the Hand (SASSH)) has had a successful year with a congress, refresher course, micro-surgical course and a wrist arthroscopy course. We also had a delegation attend the FESSH congress in Rotterdam.

Our annual Congress was held in Cape Town at the Lagoon Beach hotel in Bloubergstrand, Cape Town. Although the weather was terrible, we had fantastic lectures by our international guest speakers, Dr Praveen Bhardwaj, Dr Jorge Orbay and Dr Simon Hadlow. These were complemented by excellent scientific papers presented by local hand surgeons. Our Keynote lecture, the "AC Boonzaier lecture" was given by Mr Rob Caskie on "Shackelton" which was a riveting experience.The next annual Congress will take place in 29-31 August 2025 in Gauteng.

In March 2024 we ran a Micro-surgical Skills Course in Johannesburg. This comprehensive basic course is very popular and welcomed international delegates for the first time.

The faculty were all very experience micro surgeons and with a one to two ratio of faculty to participants there was great learning and supervision during the course. Many budding new Microsurgeons were fostered under the care of the excellent teachers.

The facility is now equipped with 10 double header microscopes allowing faculty to interact much more closely with trainees. The course is run yearly with the aim of training surgeons in South Africa and sub-Saharan Africa in the skills of microsurgery utilizing an easily reproducible chicken simulation model. The next course will be held in June 2025.

In February 2025 we ran another very successful IWAS Wrist Arthroscopy Course in Cape Town. This course is run under the auspices of the international IWAS group and is set at a very high standard. Together with Dr Jan-Ragnar Haugstvedt from Norway and Dr Adriaan Smit they put on another very comprehensive course. Dr Martin Wells who has guided this course for many years, is handing over the organisation of the course to Dr Ian Koller and Dr Pieter Jordaan.

Several South African surgeons and therapists attended and presented at the FESSH Congress in Rotterdam last year. It was a great experience with excellent learning and interaction with international colleagues. The Netherlands was beautiful at that time of the year. The Dutch food and especially cheese was sampled adequately and everybody really enjoyed the trip.

Lastly several surgeons headed over to the IFSSH Congress in Washington which was an amazing Congress and they returned with knowledge which they can impart to our colleagues at future local congresses.

Dr Grant Biddulph
SASSH President

BASIC MICROSURGERY COURSE

Training by surgeons for surgeons

6 -8 March 2024

Zeiss Head Office, 363 Oak Avenue, Ferndale, Johannesburg

ZEISS

Register online at www.sassh.co.za

COURSE OBJECTIVE: The course is intended for trainee and qualified plastic and orthopaedic surgeons.
It is an intensive 3 day basic microsurgery workshop, with 10 participants and 5 faculty members.
The state of the art Zeiss Academy facility is equipped with double header microscopes allowing faculty to teach each participant at their own station.
The course aims to teach the basic skills of microsurgery and to foster ongoing practice of the skill through the easy to use model.

The faculty includes experienced microsurgeons from around South Africa.


Chetan Patel


Himal Sooka


Roger Nicholson


Mahendra Daya


Marshall Murdoch

SWISS SOCIETY FOR SURGERY OF THE HAND

Schweizerische Gesellschaft für Handchirurgie
Société Suisse de Chirurgie de la Main SSCM
Società Svizzera di Chirurgia della Mano SSCM

All for one, one for all (Tutti per uno uno per tutti) was the motto of the last annual congress, emphasizing unity and teamwork, taken from "the 3 musketeers" by Alexandre Dumas.

SGH Congress in Lugano with Belgium guest society
The 57th Swiss annual Hand Surgery - and the 25th Hand Therapy - Congress took place on 28th/29th of November 2024 in Lugano, hosted by the president Ivan Tami in his first term. Over 533 participants (241 Hand surgeons, 292 Hand therapists) visited the congress and shared their interdisciplinary knowledge, and with the industry. The main topic of the congress was "all for one, one for all" One of the highlights were the scientific but also the social contributions of the invited guest Hand Surgery Society from Belgium.

We shared not only great discussions during the scientific program but had also great fun socially. The battle of the masters included different methods of treating Dupuytren's disease and endoscopic versus mini-invasive carpal tunnel release. The 2 ladies and and the 2 men had to fight against each other. There were no losers.

CH: Stephan Schindele and Esther Vögelin against BE: Michiel Cromheecke and Ilse Degreef participated at the battle of the masters

Council weekend at the lake of Lugano
In March, the Executive Board met for a two-day retreat at the lake of Lugano to discuss topics such as the recognition of foreign specialist titles and the focus on hand surgery as an additional qualification, as well as the development of tariffs. A new reimbursement system will be introduced for the entire healthcare system in Switzerland in 2026. Another topic was the situation surrounding the Strategy Committee, which was set up a few years ago, and its continued value were also discussed with the board members. A committee for sustainability will be set up within the SGH in the future, making the SGH the first surgical society in Switzerland to address this issue.

The next annual congress will take place in the home town of President Ivan Tami in Lugano (Canton Ticino in the south of Switzerland) on 26-28.11.2025 and includes the main motto: L'Unione FA LA Forza (Unity is strength). We look forward to welcoming our colleagues from Spain as guest society (Sociedad Española de Cirurgía de Mano and Asociación Española de Terapeutas de Mano y Extremidad Superior).

The Swiss Council Board with President Ivo Tami, in the middle of the first row (4th from the left)

10 Years of Hand Surgery Specialist Title
In 2015, the independent specialist title of hand surgery was adopted, making Switzerland one of the few countries in the world, where this specialist title is also politically recognized and practiced (alongside Finland, Sweden and Hungary). The Swiss Society will celebrate its 10th anniversary at its annual congress in Lugano in 2025.

Ten years ago, the Swiss Society for Surgery of the Hand managed to establish a fully-fledged national medical specialist in hand surgery. Since then, an average of 10 doctors have received their medical specialist degree each year, and the proportion of women is exactly 50%. Continuing education and training is strictly regulated and controlled. Most training centers have joined together, to form networks so far, in which candidates are trained up for the Hand Surgery specialist title.

10 Years
Specialist title
Hand surgery

FESSH Academy Week
After 4 years of training, the European Board of Hand Surgery examination has to be passed and is unique in Europe to get the Hand Specialist title. To be optimally prepared for the FESSH Examination, there is a very good option to attend the FESSH academy week – a training week – for candidates who want to take the FESSH examination. Experts are teaching theoretical and practical aspects of Hand Surgery and cases are discussed. This is very popular. Over the last years around 4-6 Swiss Hand Surgeons take advantage of this offer.

FESSH Congress of Surgeons and Hand Therapists, Basel 03.-06.06.26
Furthermore, we like to announce the XXXIst joint FESSH Congress of Hand Surgeons and Therapists in Basel, Switzerland on 3rd-6th of June 2026. The last European Congress of FESSH in Switzerland was a virtual meeting in June 2020 due to Covid. The last live Congress of FESSH in Switzerland was held in Lausanne in 2008.

Esther Vögelin, Stephan Schindele, Ivan Tami,
President SGH

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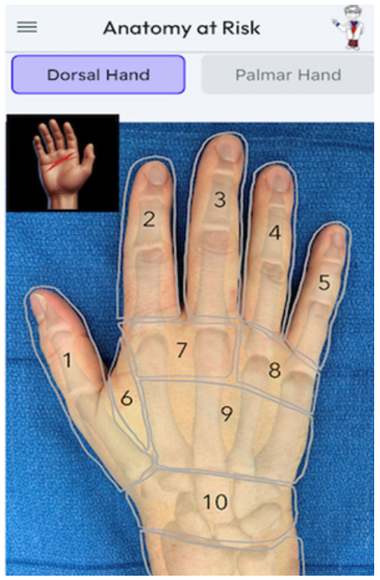
VOLUME 9, NUMBER 2

TRANSFORMING HAND SURGERY EDUCATION: LAUNCH OF THE "ANATOMY AT RISK" APP

The International Federation of Societies for Surgery of the Hand (IFSSH) and its educational team, Hand Surgery Resource are thrilled to announce the release of its latest new free mobile application, "Anatomy at Risk." Developed in collaboration with Mobileware, Inc., this innovative educational resource is now available for download on the Apple App Store and Google Play.

Key Features of "Anatomy at Risk":

- 40 concise educational videos covering dorsal and palmar hand/wrist anatomy and functional assessments.
- Detailed explanatory text enhanced with high-quality images, diagrams, and references.
- Hyperlinks to related Hand Surgery Source sections for extended learning.
- An anatomical abbreviations list for quick reference.



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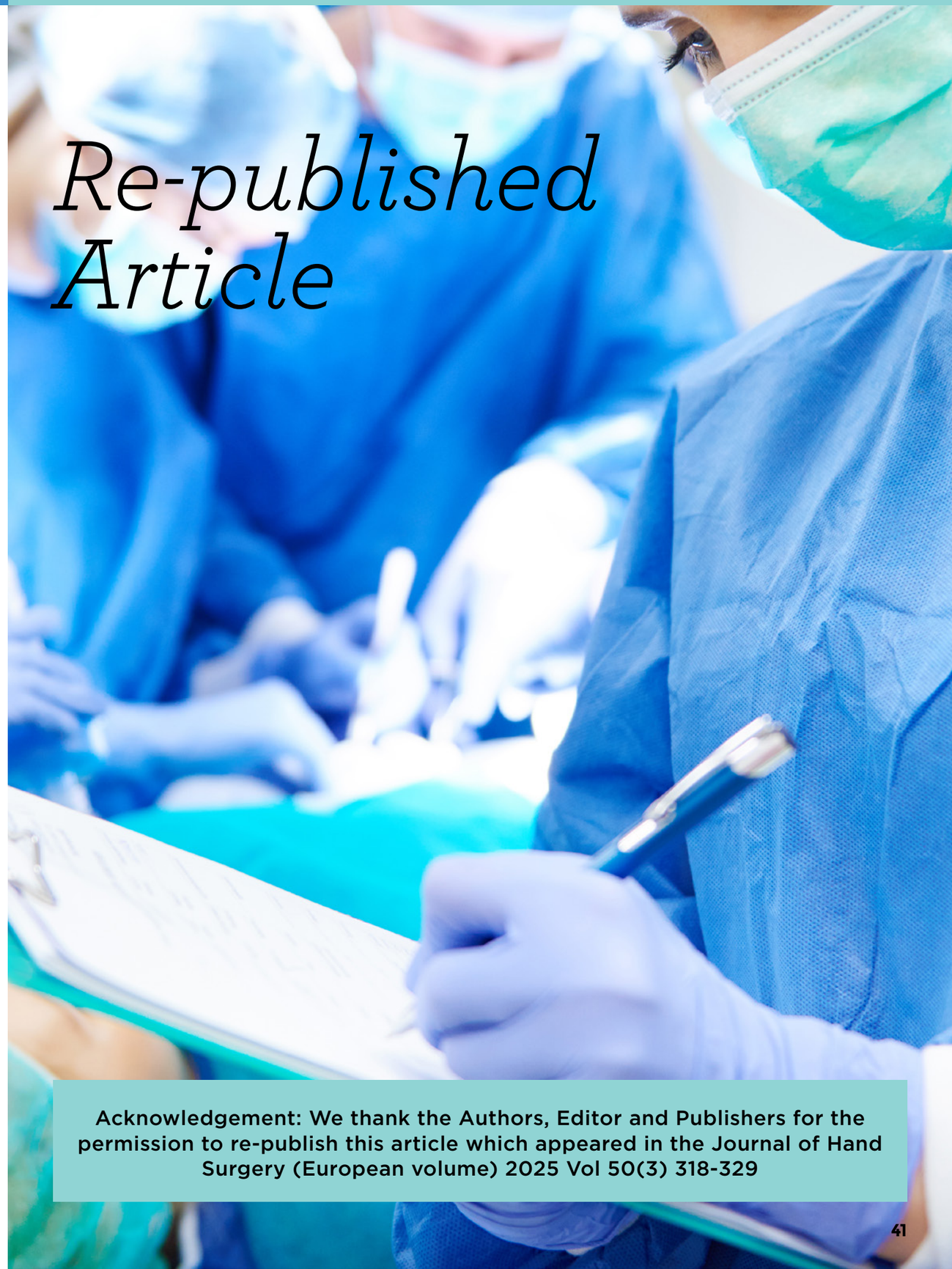

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Zone-specific pitfalls in flexor tendon rehabilitation: management and prevention

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Abstract

Despite significant advancements in flexor tendon repair techniques and rehabilitation strategies, achieving complete restoration of digital motion remains a formidable challenge. The most prevalent complications associated with tendon repair are the development of tendon adhesions and joint contractures. Left unaddressed, these complications can further lead to secondary pathomechanical changes, resulting in fixed deformities significantly affecting hand function. This review of zone-specific considerations in flexor tendon rehabilitation provides an in-depth analysis of the dynamics of tendon motion after repair and strategies to minimize common secondary complications.

Keywords

Flexor tendon rehabilitation, flexor tendon pitfalls, flexor tendon complications, tendon adhesions

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Introduction

Over the past 80 years, flexor tendon repair and rehabilitation have evolved significantly. In the 1940s, immobilization after repair for 3 weeks was standard due to weak repair techniques (Gelberman et al., 1980; Mason and Allen, 1941). In the 1970s, passive flexion regimes gained popularity, improving range of motion (ROM) without compromising repair integrity (Duran and Houser, 1975; Kleinert et al., 1975). Focus then shifted to minimizing adhesions in the late 1980s and 1990s, with synergistic wrist motion (SWM) proving to offer the greatest tendon excursion with minimal load placed through the repair (Cooney et al., 1989; Hitchcock et al., 1987; Savage, 1988). The 'Indiana Protocol' introduced this concept as a rehabilitation regime, with subsequent studies confirming its efficacy in achieving improved ROM compared to early passive regimes (Topa et al., 2011; Trumble et al., 2010).

Recent advancements explore true active flexion, allowing for greater tendon excursion with lower load on repairs (Tanaka et al., 2004; Tang, 2018; 2021). The Wide-awake Local Anesthesia No Tourniquet (WALANT) technique in tendon repair allows intraoperative confirmation that no gapping occurs with true active flexion, ensuring the repair's durability for the chosen rehabilitation programme (Higgins and Lalonde, 2016). However, WALANT also highlights that place-and-hold exercises cause tendon buckling during passive flexion, producing tendon jerking instead of gliding, predisposing the repair to rupture (Meals et al., 2019). These innovations have led clinicians to favour active mid-range flexion exercises over 'place-and-hold' exercises used during postoperative rehabilitation (Meals et al., 2019). Despite these advances, a recent Cochrane review found insufficient evidence to determine the most effective rehabilitation approach

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(Peters et al., 2021). The aim of this paper was to provide a comprehensive overview of zone-specific rehabilitation strategies to minimize postoperative complications and enhance functional outcomes.

Principles of flexor tendon rehabilitation

Rehabilitation after tendon repair focuses on optimizing tendon excursion while minimizing repair stress. The choice to implement a true active flexion regime is contingent upon the type and quality of the repair. Current literature supports the use of at least a four-strand repair with or without an epitendinous suture (Dy et al., 2012; Rudge and James, 2014). These common repair methods used in North America can tolerate controlled true active mid-range flexion regimes (Gibson et al., 2017; Savage, 1985). It has been suggested that hand therapy be initiated 3–7 days after surgery to allow oedema to plateau and decrease the overall work of flexion (WoF) (Cao and Tang, 2005). Early interventions aim to minimize the formation of motion-limiting adhesions, which can progressively increase gliding resistance. SWM includes a modality of exercises that maximizes tendon excursion while placing minimal load through the repaired tendon (Tanaka et al., 2005) (Figure 1). Finally, rehabilitation programmes are typically structured into three phases aligned with the stages of wound healing.

Rehabilitation for flexor tendon injuries is not a one-size-fits-all approach due to the unique anatomy and considerations of different zones of injury. Generally, zone I and II injuries are placed in a protective dorsal blocking orthosis (DBO) with the wrist in 30°–45° of extension and the MCP joints in 50° of flexion to ensure minimal active tension is placed through the flexors during true active flexion exercise (Higgins and Lalonde, 2016; Savage, 1988) (Table 1). However, other zones require distinct positioning to safeguard the repair, highlighting the importance of tailoring rehabilitation strategies based on the injury zone to mitigate complications. To minimize complications, the therapist should create a custom-tailored rehabilitation approach based on the injury zone. Although there are some uniform foundational principles applicable to all zones, therapists must understand the implications of wrist and MCP joint positioning and their effect on the resistance provided by the antagonist muscle when performing true active flexion during phase 1 of rehabilitation (Cao and Tang, 2005; Wu and Tang, 2014). Moreover, therapists must know how to safely and progressively increase forces through the repair to facilitate tendon gliding when adhesions have formed despite our best efforts to prevent this early in rehabilitation (Groth, 2004; Pettengill and Van Strien, 2012).

Protective orthoses

Over the past decade, there has been debate in the literature on whether the wrist should be included in

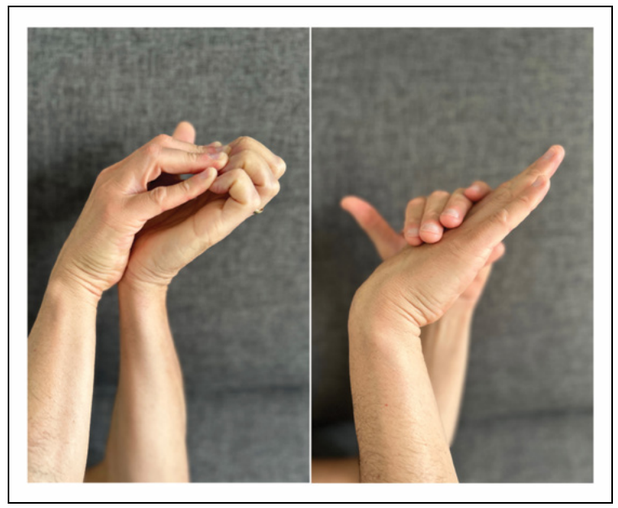

Figure 1. Synergistic wrist motion exercise: (a) active wrist extension and passive hook finger flexion to facilitate maximum FDS and FDP proximal excursion and differential gliding; (b) active wrist flexion and active finger extension for distal excursion of the FDS and FDP tendons. FDP: flexor digitorum profundus; FDS: flexor digitorum superficialis.

Table 1. General flexor tendon rehabilitation guidelines (Roth|McFarlane Hand and Upper Limb Centre, London, Ontario, Canada)

Phase/timeline	Exercises	Orthosis
Phase 1: protective (0–6 weeks after repair)	1. Warm-up series: passive composite flexion and active extension within DBO (3–10×/session) 2. SWM out of DBO (Figure 1) (Supplementary Online material, Video 6): Part I: actively flex the wrist allowing fingers to passively extend; 'lock' wrist in full flexion to actively extend the fingers Part II: actively extend the wrist while passively flexing fingers Part III: passively extend the MCP joints with the IP joints maintained in passive flexion (intrinsic-minus position) while the wrist is maintained in extension (10×/session) 3. True active mid-range flexion: 1/3 to 1/2 a fist within the confines of the orthosis (10×/session) (Figure 2)	0–4 weeks: • orthosis worn full-time day and night • orthosis positioning: – wrist at 30° of extension – MCP joints at 50° of flexion – IP joints in extension 4–6 weeks: • orthosis continues to be worn full-time • orthosis position modified: – wrist at 30° of extension – MCP joints changed to 30° of flexion Digital straps can be removed during the day to frequently perform gentle active two-thirds to full fist active flexion and extension exercises Protective orthosis is discharged
Phase 2: active (6–8 weeks after repair)	• Light use of the hand • Tendon gliding exercises: Full fist → hook fist → straight fist • Isolated joint motion: blocking exercises (as needed)	
Phase 3: strengthening (8–12 weeks after repair)	• Resisted exercises to enhance long finger flexors excursion: Resisted composite flexion; resisted hook fist; resisted isolated joint motion • Graduated loading of repaired tendons	Orthoses to facilitate movement and manage secondary complications as required: • MCP joint flexion blocking orthosis • PIP joint extension blocking to minimize hyperextension • DIP and/or PIP joint extension orthosis to address flexion contractures • MCP extension blocking orthosis to minimize hyperextension

DIP: distal interphalangeal; MCP: metacarpophalangeal; PIP: proximal interphalangeal; SWM: synergistic wrist motion.

protective orthoses (Peck et al., 2014). The potential advantages of active over passive wrist extension positioning have yet to be thoroughly investigated (Novak and Von der Heyde, 2015). Despite this, a recent survey conducted among hand surgeons and therapists from France and Switzerland revealed that a notable percentage of practitioners opt to exclude the wrist from protective orthoses (Bigorre et al., 2018). The Manchester short orthosis (Peck et al., 2014) allows 45° of wrist extension, relaxing the extensor mechanism to help reduce the WoF during active mid-range flexion exercise (Savage, 1988). While this orthotic approach permits unrestricted wrist flexion and extension throughout daily activities, a retrospective review employing this rehabilitation regime yielded mixed outcomes, with 51% of patients reporting fair to poor results at the 12-week post-repair mark, as evaluated using the Strickland grading scale (Peck et al., 2014). Despite these observations, others have started integrating this rehabilitation regime (Higgins and Lalonde, 2016). Further research is necessary to determine the efficacy of incorporating this approach into routine practice.

Over the last 5 years the concept of relative motion flexion orthoses (RMFO) applied during phase I of rehabilitation for zone I–III injuries has gained attention in the literature (Henry and Howell, 2020; Newington et al., 2021; Öksüz et al., 2023). These orthoses have been applied to single-digit repairs with the wrist in variable positions, including slight flexion to 15°–20° of extension. The rationale is that

by using differential positioning of the MCP joints, tendon excursion can be reduced to offload the repaired tendon, theoretically reducing excursion of the profundus tendon (Merritt, 2014; Merritt and Howell, 2021). A cadaveric biomechanical experiment found that the RMFO reduced tendon elongation in zone III but provided no clinical data for zone I and II injuries (Chung et al., 2019). In its present state, biomechanical and clinical data are lacking for this form of postoperative rehabilitation in all zones. Despite introducing these innovative techniques, a significant percentage of surgeons and hand therapists adhere to Duran-type rehabilitation methods (Bigorre et al., 2018).

Zone-specific pitfalls in rehabilitation

General factors

The most common complication after tendon repair is adhesion formation and joint stiffness (Reito et al., 2019; Tang, 2018). Many factors contributing to pitfalls are often beyond the clinician's control, including the mechanism of injury, ethnicity and age (Reito et al., 2019; Taras et al., 1994). Surgical details and innovations will not be discussed as they have been extensively covered in the literature. If there are any intraoperative challenges, such as a tenuous repair, or any anatomical variations, including Linburg's and flexor digitorum superficialis (FDS) deficiency, these should also be carefully documented as they facilitate close communication between surgeons and therapists to create customized rehabilitation programmes. In our practice, we have observed various complications within the different zones of injury and highlighted alterations that can be made to rehabilitation to optimize outcomes.

Zone I and II common complications

Injuries to the flexor digitorum profundus (FDP) tendon in zone I are caused by tendon transection or avulsion. The amount of tendon retraction depends upon the mechanism of injury, consequently affecting the surgical repair and outcome. Complications associated with zone I include limited or no active DIP joint flexion, DIP joint flexion contracture, and combined PIP and DIP joint flexion contractures. For zone II, complications discussed extensively in the literature include loss of bidirectional excursion of both tendons in the fibro-osseous sheath, reduced differential tendon motion, PIP joint flexion contractures, quadriga, lumbrical plus phenomenon and paradoxical extension caused by FDP rupture (Jo and Dy, 2023; Momeni et al., 2010).

All of these complications (except for paradoxical extension) are commonly observed with postoperative management using passive flexion tendon mobilization techniques. Failure to recognize these complications can lead to secondary pathomechanical changes, e.g. a decreased tendon excursion with resultant compensatory MCP joint hyperflexion due to reduced proximal excursion of the repaired flexor tendons (Supplementary Online material, Video 1). This can also lead to lumbrical hyperactivity as well as a quadriga effect. In addition, pathomechanical changes may include MCP joint hyperextension due to PIP joint flexion contracture and secondary swan-neck deformity from FDS rupture or sacrifice during tendon repair near the A-3 pulley.

Prevention and management of adhesions in zone I and II injuries

Adhesion formation in zones I and II is common and accounts for a significant portion of all flexor tendon complications in the range of 5%–20% (Civan et al., 2020; Dy et al., 2012; Svingen et al., 2022; Tang, 2018). Zones I and II include a complex anatomical arrangement to ensure efficient tendon excursion to maximize finger flexion (Chinchalkar et al., 2016; Tang, 2007) In zone II, the FDS orientation changes in relation to FDP; within the proximal zone II region, the FDS is superficial to FDP, coursing lateral to it, and then becoming posterior to FDP as it inserts into the middle phalanx (Chinchalkar et al., 2016; Tang, 2007). This intricate anatomy suggests that the slips of FDS function similarly to a pulley optimizing FDP excursion during finger flexion. Due to adhesion formation between each tendon and the fibro-osseous sheath, differential excursion between the two tendons is reduced (Strickland, 2000; Tang and Shi, 1992). If maximum differential tendon excursion is not restored during the early healing phases, the interphalangeal joints will exhibit incomplete active flexion (Supplementary Online material, Video 2).

Hand therapy management strategies to reduce adhesions. Implementing true active flexion regimes is imperative to minimize intratendinous adhesions. A useful technique to facilitate adequate tendon glide is to instruct patients to place the three (or two for small finger) fingers from the uninjured hand into the palm of the injured hand along the distal palmar crease, achieving a quasi-perpendicular alignment and flex the involved finger(s) consistently to the

same linear distance whenever exercising (Supplementary Online material, Video 3). During the first 4 weeks after repair, patients are guided to flex their fingers to touch the index finger and gently perform a 'scratching' motion on the dorsum of the index finger towards the middle finger. This technique encourages FDP engagement and fosters differential tendon glide (Pettengill and Van Strien, 2012). Adjustments should be made for the small finger by instructing patients to touch the middle finger and scratch toward the ring finger (Figure 2).

If passive motion consistently surpasses active motion, suggesting tendon tethering, it is crucial to implement additional strategies to facilitate differential tendon glide. One strategy is to implement lateral DIP joint blocking within a range of 10°–40° (Figure 3) (Osanami et al., 2021). This exercise allows for approximately 1.25 mm of FDP excursion per 10° of DIP flexion and can be implemented once profundus tethering is observed. The exercise must be done gently and, on average, places under 7 N of force through the repair, which is well below the gapping threshold (Osanami et al., 2021; Tanaka, et al., 2004).

If adhesions persist into phase 2 of rehabilitation, the 'active phase', adding an MCP flexion-blocking orthosis to the exercise regime should be considered. This can be worn intermittently throughout the day with the dual purpose of increasing excursion of the long flexor tendons while mitigating the risk of excessive MCP joint hyperflexion resulting from compensatory actions of the intrinsic muscles. It is worth noting that MCP hyperflexion tends to be particularly pronounced in the two ulnar-most digits and can significantly impede interphalangeal flexion due to hyperactivation of the intrinsic muscles responsible for extending these joints. Consequently, during phase 2, therapists can also combine the MCP flexion-blocking orthosis with neuromuscular stimulation (NMES) in the therapy clinic in patients who demonstrate cortical difficulty activating the long flexor muscles. As rehabilitation progresses into phase 3, the 'strengthening phase', resisted interphalangeal joint flexion can be added both in and out of the MCP joint blocking orthosis to encourage greater muscle fibre recruitment ensuring strong contractions to promote tendon pull-through (Chinchalkar et al., 2016).

Surgical intervention should be considered when adhesions and limited flexion persist for 6 months after repair despite these applied interventions. This approach allows for a more direct and targeted resolution with rehabilitation commencing immediately after surgery (Civan et al., 2020; Svingen et al., 2022).

Figure 3. Isolated lateral distal interphalangeal joint flexion within the orthosis to optimize flexor digitorum profundus gliding.

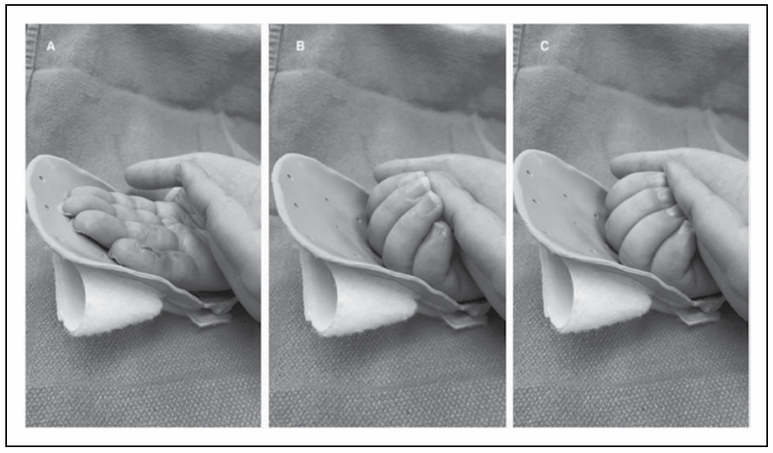

Figure 2. Active mid-range flexion – little finger: (a) extended fingers to dorsal block hood of the orthosis; (b) active mid-range flexion (three-finger distance) and (c) gentle slide to lower finger to activate flexor digitorum profundus function.

Prevention and management of flexion contractures in zone I and II injuries

The development of PIP and DIP joint flexion contractures is frequently encountered. The causes are often multifaceted, ranging from tissue handling during surgery to inadequate position of the interphalangeal joints in the immediate postoperative and early rehabilitation stages, when fibroblastic activity is particularly heightened. Furthermore, late contractures may arise as a secondary consequence of adhesion formation of the flexor tendons, restricting distal excursion of these tendons during finger extension.

Hand therapy management strategies for the PIP joint. During phase 1, ensuring proper extension of the interphalangeal joints within the DBO is crucial to prevent early contracture formation. Using high-density or open-cell foam on straps around the fingers effectively maintains IP joint extension, worn during waking hours and slightly loosened during sleep to prevent flexion against tight restraints (Chinchalkar et al., 2016; Skirven and DeTullio, 2023). Targeted exercises encouraging isolated extension of the PIP joint while wearing the DBO have also proven effective in mitigating contractures (Chinchalkar et al., 2016).

To address persistent flexion contractures, particularly in cases with hypertrophic scarring, we suggest applying silicone sheeting held in place with compression wrap along with a volar gutter orthosis worn within the DBO at night. These measures can minimize scar formation and prevent further progression of contractures. Treatment often extends past the protective phase, involving the use of dynamic and static progressive orthoses during the day to provide intermittent stretching. A prefabricated LMB orthosis can gradually improve extension, while a serial static finger extension orthosis can be applied overnight for additional support (Chinchalkar et al., 2016, Skirven and DeTullio 2023).

Persistent PIP joint flexion contractures can lead to a pseudo-clawing deformity. This is typically more prominent in the ulnar-most digits due to compensatory MCP joint hyperextension. The small finger presents a challenge in these situations due to its unique anatomy. The metacarpal head of the small finger is angulated by 15° in a volar direction and has a relatively greater dorsal, volar and medial curvature (Braakman, 1996; Dubousset, 1981). This architectural configuration will cause a much greater MCP joint hyperextension tendency compared to the adjacent digits (Figure 4). If left untreated, this can result in structural issues, such as sagittal band and triangular ligament attenuation, volar migration of lateral bands, and tightness in the volar plate and collateral ligaments (Supplementary Online material, Video 4). This complex condition poses a significant challenge for hand therapists to reverse. The daytime use of an MCP joint extension-blocking orthosis is crucial to prevent irreversible deformities by promoting the advancement of the sagittal bands and relocating the lateral bands dorsally relative to the axis of rotation at the PIP joint (Figure 5).

Hand therapy management strategies for the DIP joint. DIP joint flexion contracture in zone I is a common complication that may lead to a secondary swan-neck deformity (Figure 6(a)) (Chinchalkar et al., 2010) (Supplementary Online material, Video 5). Once established, DIP joint flexion contractures are

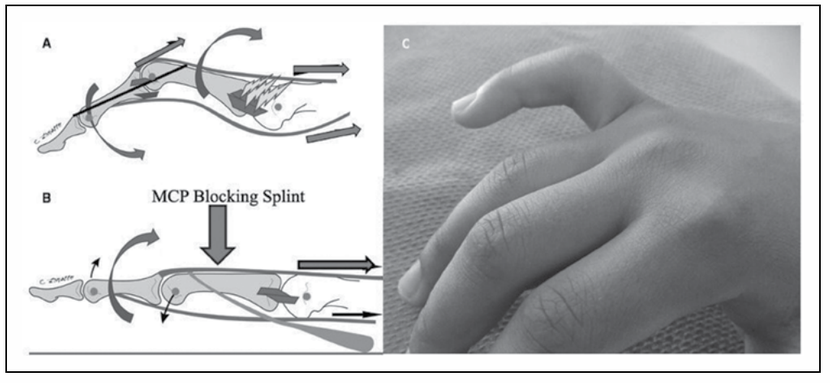

Figure 4. (a) Flexion contracture of the small finger exhibiting MCP joint hyperextension; (b) diagrammatic presentation of MCP joint hyperextension secondary to PIP joint flexion contracture and (c) MCP joint hyperextension blocked either in neutral or slight flexion in an orthosis to increase PIP extension. MCP: metacarpophalangeal; PIP: proximal interphalangeal.

challenging to address. One strategy is serial static extension orthosis application at night. In addition, therapists should consider the implementation of a PIP joint extension-blocking orthosis worn during the day (Figure 6(b)) when patients transition to phase 2 of the rehabilitation programme (Chinchalkar et al., 2010)

Zone III injuries

The tendons within this region move more freely without the confines of the fibro-osseous sheath. This allows surgeons more space to use bulky and stronger repairs, permitting early active motion (Al-Qattan, 2011; Athwal and Wolfe, 2005). Complications within this zone will depend on the precise location of the injury. Zone III injuries often have associated injury to the lumbricals and neurovascular structures. For this reason, it has been suggested that this zone be divided into proximal and distal injuries (Chinchalkar et al., 2015).

Figure 5. Metacarpophalangeal joint extension block splint (relative motion orthosis) to facilitate central slip excursion to correct proximal interphalangeal joint flexion contractures.

Distal zone III injury

The distal zone III region begins at the lumbrical origin from the FDP. It has been observed that lumbrical adhesions to the flexor tendon proximal to the A1 pulley limit distal excursion, producing PIP joint flexion contractures (Figure 7) (Chinchalkar et al., 2015). In addition, the ulnar two bipinnate lumbricals originate from the adjacent FDP tendons. Adhesions that form between the lumbrical and tendons of the ring finger proximal to the A1 pulley influence the full extension of the adjacent long finger (Supplementary Online material, Video 7). Similarly, lumbrical adhesions to the tendons of the little finger can affect the extension of the ring finger.

To minimize these complications, our preferred management is to protect the repair in a DBO with the wrist at 30° of extension with the MCP joints at 40°–60° of flexion. During the first 4 weeks, the MCP joint position is altered weekly, increasing extension by 10°. This allows the repair to rest distal to the lumbrical, preventing adhesions between these structures. The exercise regime should include passive finger flexion-active extension as a warmup exercise. This is followed by SWM; however, it is key to perform active composite digital extension with the wrist flexed to allow differential excursion between the flexor tendon and lumbrical muscle. True active mid-range flexion should be performed during the first 3 weeks, progressing to full flexion at week 4 and beyond.

Proximal zone III injury

The proximal region comprises eight digital flexor tendons and the flexor pollicis longus as they emerge from the distal carpal canal, diverge and traverse towards their respective insertions. This cluster of nine tendons is situated closely together,

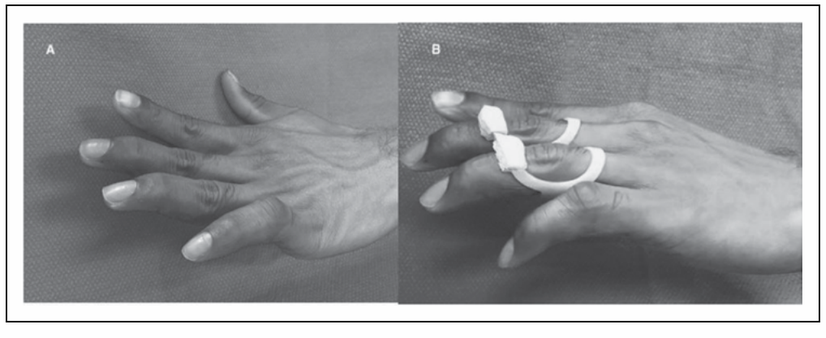

Figure 6. (a) Secondary swan-neck deformity caused by DIP joint flexion contractures and (b) PIP joint extension-blocking orthosis. DIP: distal interphalangeal; PIP: proximal interphalangeal.

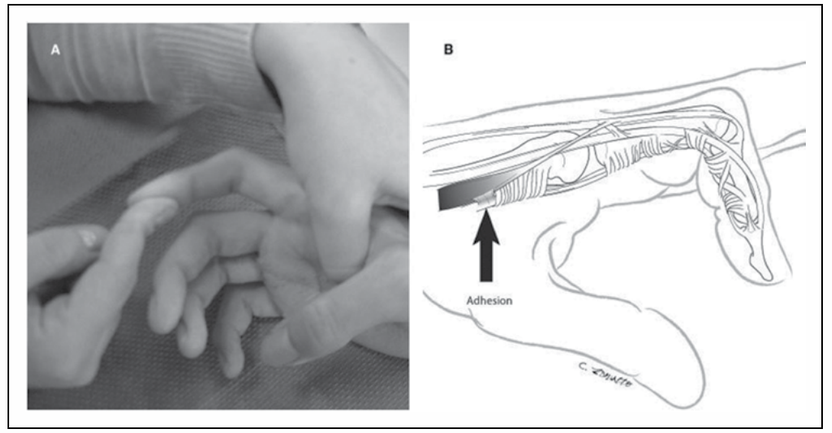

Figure 7. (a) Loss of digital extension due to adhesion formation between the first lumbrical muscle and the flexor digitorum profundus tendon of the index finger limiting distal excursion through the A1 pulley in a distal zone III injury and (b) illustration demonstrating this complication.

making multiple tendon lacerations a common occurrence. In such instance, we have observed that traditional rehabilitation tends to form a one-wound-one-scar tendency. Notably, the tendons of one digit are likely to adhere to adjacent tendons (Supplementary Online material, Video 8), particularly when tendon mobilization is inadequate. This results in significant limitations in active digital flexion because of restricted proximal excursion between adherent tendons and the flexor retinaculum.

If more conservative rehabilitation is preferred, our approach in phase 1 of rehabilitation is to limit wrist extension to 30°–45° during SWM, minimizing tension to the repair. In addition, independent passive digital flexion and active extension exercises are performed. This permits isolated proximal and distal excursion between adjacent tendons. In phase 2, active digital flexion and extension exercises are performed in differing wrist positions, both in flexion and extension, to maximal proximal and distal excursion.

It has been suggested to release the carpal tunnel during tendon retrieval in proximal injuries and use a robust repair (Al-Qattan, 2011). In such cases, wrist extension should be limited to 15° within the DBO, preventing tension to the repair. Rehabilitation in phase 1 includes passive digital flexion and active extension exercise. SWM is performed within the confines of the DBO. True active mid-range flexion/extension is also performed, similar to the rehabilitation of zone II repairs. However, a key modification is to perform isolated independent digital mid-range flexion exercises to ensure bi-directional tendon excursion between adjacent tendons. If limitations in isolated digital flexion persist despite these adjustments, the incorporation of resisted digital extension exercises during phase 3 is recommended. To optimize differential excursion, isolated resisted extension of each digit is performed, while adjacent digits are maintained in passive flexion facilitating maximal distal tendon excursion.

Zone IV and V injuries

Zone V injuries occur more frequently than zone IV injuries. The division of multiple tendons in this region has a severe one-wound-one-scar tendency, especially with delayed tendon mobilization or traditional rehabilitation. A mass of adhesions can form proximal to the transverse carpal ligament (TCL), leading to significant limitations with independent digital motion or combined wrist and digital motion (Figure 8). Despite their relatively frequent occurrence, there are few reports that examine outcomes of zone V injuries (Bal et al., 2011; Kabak et al., 2002; Yüksel et al., 2002). Available reports demonstrate that recovery of an active composite fist is typical (Kabak et al., 2002, Stefanich et al., 1992). However, intertendinous adhesions can adversely influence the amount of differential excursion recovered making the hand mainly FDS dependent (Stefanich et al., 1992; Yii et al., 1998).

Hand therapy management strategies

The Massachusetts General Hospital regime was introduced to minimize intertendinous adhesions (Wilhelmi et al., 2005). If a robust four or more

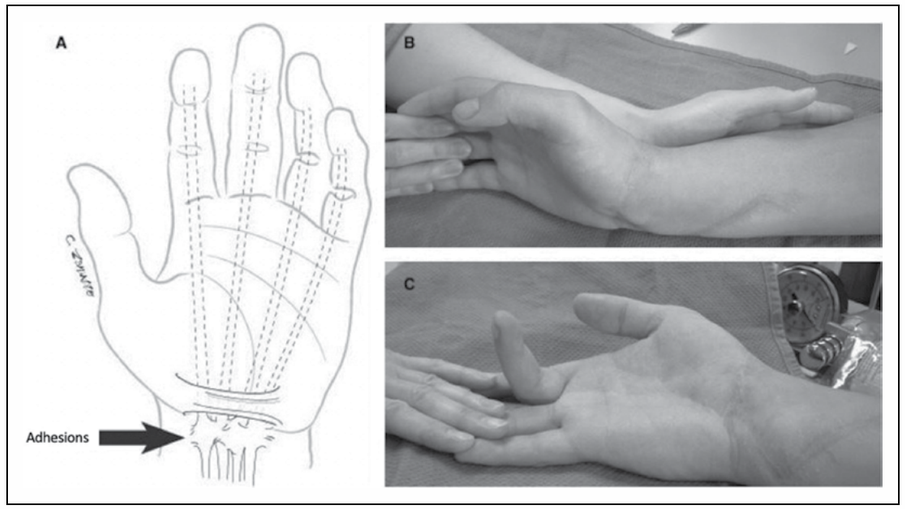

Figure 8. (a) Illustrative demonstration of adhesions between repaired and intact tendons; (b) clinical demonstration of adhesions in zone V injury limiting combined wrist and digital extension and (c) clinical demonstration of limited independent digital flexor digitorum superficialis glide.

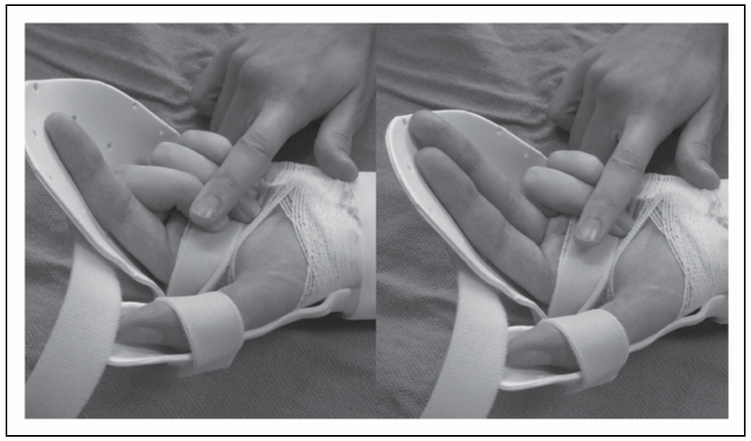

Figure 9. Isolated passive flexion-active extension to each digit to maximize differential distal excursion between adjacent digital flexor tendons.

strand repair was used, we prefer protective positioning within the DBO placing the wrist in 0°–30° of flexion with the MCP joints in 45°–60° of flexion. If the median nerve was repaired, the thumb would also be included to minimize tension to the nerve repair. In addition, if the flexor carpi ulnaris or flexor carpi radialis tendons was involved, then the wrist position should be altered. Otherwise, wrist extension can be serially adjusted within the orthosis by 10° weekly. Depending on repair strength, wrist extension can vary up to 30° in robust repairs and may be restricted to neutral in weaker repairs. The aim is to facilitate increased distal tendon excursion beneath the TCL during exercise. Phase 1 of rehabilitation involves adapting the warm-up routine used for zone I and II repairs, with modifications akin to proximal zone III injuries, including isolated passive digital flexion coupled with isolated active extension

to stimulate digital differential tendon excursion (Figure 9) (Supplementary Online material, Video 9). This is followed by a true active mid-range flexion-extension exercise. At 3 weeks postoperatively, the wrist and MCP joint positions are adjusted according to the wound-healing status. SWM is integrated as exercise tolerance improves with isolated independent active digital extension during full wrist flexion being employed to promote differential distal excursion of each tendon. At 4–6 weeks, active mid-range flexion/extension is performed with varying degrees of wrist extension to encourage differential excursion. In phase 2, wrist tenodesis paired with isolated PIP and DIP joint-blocking exercises is executed to enhance independent tendon gliding. Phase 3 involves the continuation of digital extension with variable wrist extension positions while introducing resistance to further augment proximal excursion of the flexor tendons relative to wrist position (Supplementary Online material, Video 10).

Other specific complications

Quadriga

The quadriga phenomenon is a rare tendon condition characterized by diminished flexion capacity in adjacent non-injured digits. This restriction in ROM is attributed to either excessive advancement of the injured tendon (>1 cm) or adhesions hindering movement in the affected digit. Anatomically, the phenomenon stems from the common muscle belly shared by the FDP tendons of the middle, ring and small fingers (occasionally the index finger), where effective muscle contraction relies on normal excursion of each tendon. Quadriga phenomenon may occur across various flexor tendon zones, particularly in areas prone to adhesions such as zones I, II and IV (Jo and Dy, 2023; Lilly and Messer, 2006).

While surgery may be necessary for cases of excessive tendon shortening, early interventions focusing on maximizing differential tendon excursion are pivotal, particularly in adhesion-related quadriga cases. Therapeutic emphasis should be placed on exercises promoting maximal tendon excursion early in rehabilitation, especially SWM. Moreover, therapists should incorporate isolated finger flexion and extension exercises, especially for repairs in proximal zones where intertendinous adhesions are common. The quadriga phenomenon typically becomes evident during attempts at full active flexion, typically 4–6 weeks postoperatively. Techniques described previously for managing adhesions in different zones should be implemented accordingly. MCP joint flexion-block orthoses are worn during exercises and intermittently with daily activities with the aim to facilitate differential tendon gliding after discontinuation of the DBO. In addition, isolated FDP gliding exercises mitigate adhesions along the course of this tendon. At 8–10 weeks after repair, resistance combined with differential gliding techniques, such as resisted hook flexion, proves effective in addressing FDP tendon adhesions (Schreuders, 2012).

Lumbrical plus

Lumbrical plus is a challenging clinical scenario. This deformity produces paradoxical IP joint extension when attempting forceful digital flexion (Parkes, 1971). Lumbrical plus can occur in the following cases: transection of the FDP is distal to the lumbrical origin; the repaired FDP becomes tethered to surrounding structures within the fibro-osseous sheath; FDS is deficient combined with FDP tethering within zones I–III; and after inappropriate graft length after two-stage reconstruction (Chinchalkar et al., 2016; Jo and Dy, 2023; Lilly and Messer, 2006). This strong tendency of PIP and DIP joint extension during digital flexion contributes to loss of grip strength and inability to use the hand in confined areas. This makes the involved finger susceptible to further injury. This extension tendency also reduces the excursion of the adjacent FDP tendon, which can also cause a secondary quadriga effect.

Based on our clinical experience, conservative therapy techniques can include therapeutic ultrasound applied over the involved tissues used to precondition the tissues. Immediately after this, an MCP flexion-blocking orthosis can be worn while electrical stimulation is applied to the long flexors for the purpose of enhancing tendon excursion. Outside of the therapy setting, triple buddy taping allowing for the flexion of three fingers can be used to minimize over-strengthening of the involved lumbricals (Chinchalkar et al., 2016).

Conclusion

Despite notable advancements in flexor tendon surgery and rehabilitation, clinical outcomes continue to be challenged by a high incidence of complications. Hand therapists are tasked with a meticulous understanding of injury specifics and repair nuances to diligently anticipate potential complications inherent to each injury zone. The aim of this paper was to present a comprehensive overview of therapeutic interventions tailored to address zone-specific complications, with the goal of enhancing overall outcomes.

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References

Al-Qattan MM. Flexor tendon repair in zone III. J Hand Surg Eur. 2011, 36: 48–52.
Athwal GS, Wolfe SW. Treatment of acute flexor tendon injury: zones III-V. Hand Clin. 2005, 21: 181–6.
Bal S, Oz B, Gurgan A et al. Anatomic and functional improvements achieved by rehabilitation in zone II and zone V flexor tendon injuries. Am J Phys Med Rehabil. 2011, 90: 17–24.
Bigorre N, Delaquaize F, Degez F, Celerier S. Primary flexor tendons repair in zone 2: current trends with GEMMSOR survey results. Hand Surg Rehabil. 2018, 37: 281–8.
Braakman M. Normal radiographic angulation in the 4th and 5th metacarpal: a reference guide. Eur J Radiol. 1996, 22: 38–41.
Cao Y, Tang JB. Investigation of resistance of digital subcutaneous edema to gliding of the flexor tendon: an in vitro study. J Hand Surg Am. 2005, 30: 1248–54.
Chinchalkar SJ, Lanting BA, Ross D. Swan neck deformity after distal interphalangeal joint flexion contractures: a biomechanical analysis. J Hand Ther. 2010, 23: 420–5.
Chinchalkar S, Larocerie-Salgado J, Suh N. Pathomechanics and management of secondary complications associated with tendon adhesions following flexor tendon repair in zone II. J Hand Microsurg. 2016, 8: 70–9.
Chinchalkar SJ, Pipicelli JG, Agur A, Athwal GS. Zone III flexor tendon injuries – a proposed modification to rehabilitation. J Hand Ther. 2015, 28: 319–23.
Chung B, Chiu DTW, Thanik V. Relative motion flexion splinting for flexor tendon lacerations: proof of concept. Hand (N Y). 2019, 14: 193–6.
Civan O, Gürsoy MK, Cavit A, Özcanlı H, Karalezli MN. Tenolysis rate after zone 2 flexor tendon repairs. Jt Dis Relat Surg. 2020, 31: 281–5.
Cooney WP, Lin GT, An KN. Improved tendon excursion following flexor tendon repair. J Hand Ther. 1989, 2: 102–6.
Dubousset OF. The digital joints. In: R Tubiana (Ed.) The hand. Philadelphia, WB Saunders, 1981, Vol. I: 191–201.
Duran RE, Houser RG. Controlled passive motion following flexor tendon repair in zones two and three. In: *The American Academy of Orthopaedic Surgeons: symposium on tendon surgery in the hand*. St. Louis, MO, Mosby; 1975: 105–14.
Dy CJ, Hernandez-Soria A, Ma Y, Roberts TR, Daluiski A. Complications after flexor tendon repair: a systematic review and meta-analysis. J Hand Surg Am. 2012, 37: 543–51.
Gelberman RH, Menon J, Gonsalves M, Akeson WH. The effects of mobilization on the vascularization of healing flexor tendons in dogs. Clin Orthop Relat Res. 1980, 153: 283–9.
Gibson PD, Sobol GL, Ahmed IH. Zone II flexor tendon repairs in the United States: trends in current management. J Hand Surg Am. 2017, 42: e99–e108.
Groth GN. Pyramid of progressive force exercises to the injured flexor tendon. J Hand Ther. 2004, 17: 31–42.
Henry SL, Howell JW. Use of a relative motion flexion orthosis for postoperative management of zone I/II flexor digitorum profundus repair: a retrospective consecutive case series. J Hand Ther. 2020, 33: 296–304.
Higgins A, Lalonde DH. Flexor tendon repair postoperative rehabilitation: the Saint John protocol. Plast Reconstr Surg Glob Open. 2016, 23: e1134.
Hitchcock TF, Light TR, Bunch WH et al. The effect of immediate constrained digital motion on the strength of flexor tendon repairs in chickens. J Hand Surg Am. 1987, 12: 590–5.
Jo S, Dy CJ. Flexor tendon repair: avoidance and management of complications. Hand Clin. 2023, 39: 427–34.
Kabak S, Halici M, Baktir A, Türk CY, Avşarogullari L. Results of treatment of the extensive volar wrist lacerations: 'the spaghetti wrist'. Eur J Emerg Med. 2002, 9: 71–6.
Kleinert HE, Kutz JE, Cohen MJ. Primary repair of zone 2 flexor tendon lacerations. In: American Academy of Orthopaedic Surgeons: Symposium on tendon surgery in the hand. St. Louis, MO, Mosby; 1975: 91–104.
Lilly SI, Messer TM. Complications after treatment of flexor tendon injuries. J Am Acad Orthop Surg. 2006, 14: 387–96.
Mason ML, Allen HS. The rate of healing of tendons: an experimental study of tensile strength. Ann Surg. 1941, 113: 424–59.
Meals C, Lalonde D, Candelier G. Repaired flexor tendon excursion with half a fist of true active movement versus full fist place and hold in the awake patient. Plast Reconstr Surg Glob Open. 2019, 7: e2074.
Merritt WH. Relative motion splint: active motion after extensor tendon injury and repair. J Hand Surg Am. 2014, 39: 1187–94.
Merritt WH, Howell JW. Relative motion orthoses: the concepts and application to hand therapy management of finger extensor tendon zone III and VII repairs, acute and chronic Boutonniere deformity, and sagittal band injury. In: T Skirven, A Osterman, J Fedorczyk, E Shin (Eds.) Rehabilitation of the hand and upper extremity, 7th Edn. Philadelphia, Elsevier 2021: 1496–510.
Momeni A, Grauel E, Chang J. Complications after flexor tendon injuries. Hand Clin. 2010, 26: 179–89.
Newington L, Ross R, Howell JW. Relative motion flexion splinting for the rehabilitation of flexor tendon repairs: a systematic review. Hand Ther. 2021, 26: 102–12.
Novak CB, von der Heyde RL. Rehabilitation of the upper extremity following nerve and tendon reconstruction: when and how. Semin Plast Surg. 2015, 29: 73–80.
Öksüz Ç, Arslan ÖB, Baş CE, Ayhan E. Early active movement with relative motion flexion splint for the management of zone 1–2 flexor tendon repairs: case series. Physiother Theory Pract. 2023, 39: 2420–6.
Osanami Y, Aoki M, Shirato R et al. Tensile load on the flexor digitorum profundus tendon during palmar and lateral blocking exercises: influence on blocking force and distal interphalangeal joint flexion angle. J Hand Ther. 2021, 34: 555–60.
Parkes A. The "lumbrical plus" finger. J Bone Joint Surg Br. 1971, 53: 236–9.
Peck F, Roe A, Ng C et al. The Manchester short splint: a change to splinting practice in the rehabilitation of zone II flexor tendon repairs. Hand Therapy. 2014, 19: 47–53.
Peters SE, Jha B, Ross M. Rehabilitation following surgery for flexor tendon injuries of the hand. Cochrane Database Syst Rev. 2021, 1: CD012479.
Pettengill K, Van Strien G. State of the art flexor tendon rehabilitation. In: JB Tang, P Amadio, J-C Guimberteau, J Chang (Eds.) Tendon surgery of the hand. Philadelphia, Saunders, 2012: 405–14.
Reito A, Manninen M, Karjalainen T. The effect of delay to surgery on major complications after primary flexor tendon repair. J Hand Surg Asian Pac. 2019, 24: 161–8.

Rudge WBJ, James M. Flexor tendon injuries in the hand: a UK survey of repair techniques and suture materials: are we following the evidence? ISRN Plastic Surg. 2014, 2014: 687128.
Savage R. In vitro studies of a new method of flexor tendon repair. J Hand Surg Br. 1985, 10: 135–41.
Savage R. The influence of wrist position on the minimum force required for active movement of the interphalangeal joints. J Hand Surg Br. 1988, 13: 262–8.
Schreuders TA. The quadriga phenomenon: a review and clinical relevance. J Hand Surg Eur. 2012, 37: 513–22.
Skirven TM, DeTullio LM. Therapy after flexor tendon repair. Hand Clin. 2023, 39: 181–92.
Stefanich RJ, Putnam MD, Peimer CA, Sherwin FS. Flexor tendon lacerations in zone V. J Hand Surg Am. 1992, 17: 284–91.
Strickland JW. Development of flexor tendon surgery: twenty-five years of progress. J Hand Surg Am. 2000, 25: 214–35.
Svingen J, Wiig M, Turesson C, Farnebo S, Arner M. Risk factors for reoperation after flexor tendon repair: a registry study. J Hand Surg Eur. 2022, 47: 1071–6.
Tanaka T, Amadio PC, Zhao C et al. Gliding characteristics and gap formation for locking and grasping tendon repairs: a biomechanical study in a human cadaver model. J Hand Surg Am. 2004, 29: 6–14.
Tanaka T, Amadio PC, Zhao C, Zobitz ME, An KN. Flexor digitorum profundus tendon tension during finger manipulation. J Hand Ther. 2005, 18: 330–8.
Tang JB. Indications, methods, postoperative motion and outcome evaluation of primary flexor tendon repairs in Zone 2. J Hand Surg Eur. 2007, 32: 118–29.
Tang JB. New developments are improving flexor tendon repair. Plast Reconstr Surg. 2018, 141: 1427–37.
Tang JB. Rehabilitation after flexor tendon repair and others: a safe and efficient protocol. J Hand Surg Eur Vol. 2021, 46: 813–7.
Tang JB, Shi D. Subdivision of flexor tendon "no man's land" and different treatment methods in each sub-zone. A preliminary report. Chin Med J (Engl). 1992, 105: 60–8.
Taras JS, Gray RM, Culp RW. Complications of flexor tendon injuries. Hand Clin. 1994. 10: 93–109.
Topa I, Tamas C, Pertea M et al. Flexor tendon repair in "no man's land": postoperative management. Clin Anat. 2011, 10: 396–400.
Trumble TE, Vedder NB, Seiler JG 3rd et al. Zone-II flexor tendon repair: a randomized prospective trial of active place-and-hold therapy compared with passive motion therapy. J Bone Joint Surg Am. 2010, 92: 1381–9.
Wilhelmi BJ, Kang RH, Wages DJ, Lee WP, May JW Jr. Optimizing independent finger flexion with zone V flexor repairs using the Massachusetts General Hospital flexor tenorrhaphy and early protected active motion. J Hand Surg Am. 2005, 30: 230–6.
Wu YF, Tang JB. Recent developments in flexor tendon repair techniques and factors influencing strength of the tendon repair. J Hand Surg Eur. 2014, 39: 6–19.
Yii NW, Urban M, Elliot D. A prospective study of flexor tendon repair in zone 5. J Hand Surg Br. 1998, 23: 642–8.
Yüksel F, Peker F, Açikel C, Cellköz B. Secondhand management of "spaghetti wrist": do not hesitate to explore. Ann Plast Surg. 2002, 49: 500–4.

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