

Science and storytelling are not competitors, although they are uneasy allies.

The History of Storytelling

Repository for:

- Wisdom
- History
- Explanation



Ever since mankind developed language and imagination, storytellers were revered as the repository of accumulated wisdom and history. They were also called upon to explain confusing events, such as storms, tidal waves, fires, disease, and death

Pictorial Stories



Every culture identified itself as a unique group through its historical stories that moved from cave art to pictorial symbols.

Oral Tradition



For thousands of years only the spoken word existed. This collective wisdom was passed down orally to each generation. Homer's *Iliad and Odyssey* were preserved by priests dedicated to memorizing and reciting the works for centuries, until a Greek alphabet was developed.

**Oldest
Written
Story**

GILGAMESH



2750 BC

The oldest surviving tale is the epic Gilgamesh, the story of a Sumerian king's travels to find the world of death and bring back his friend from the dead. However, oral teachings continued to dominate over the written word, as most of the world remained illiterate.

Oral Teachings

Court Jester

Traveling Minstrels

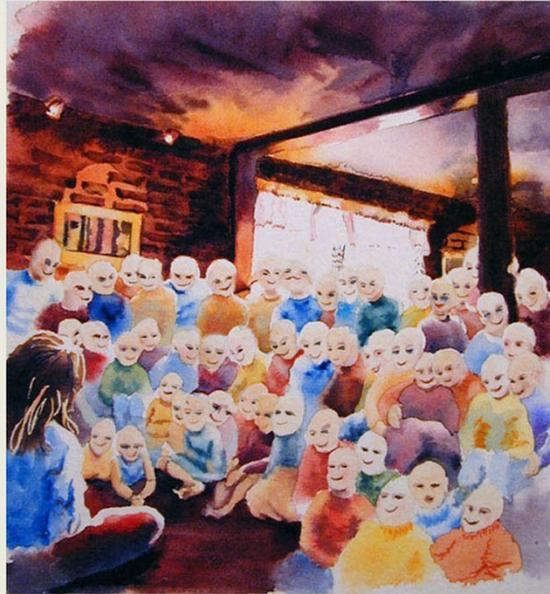
Morality Plays



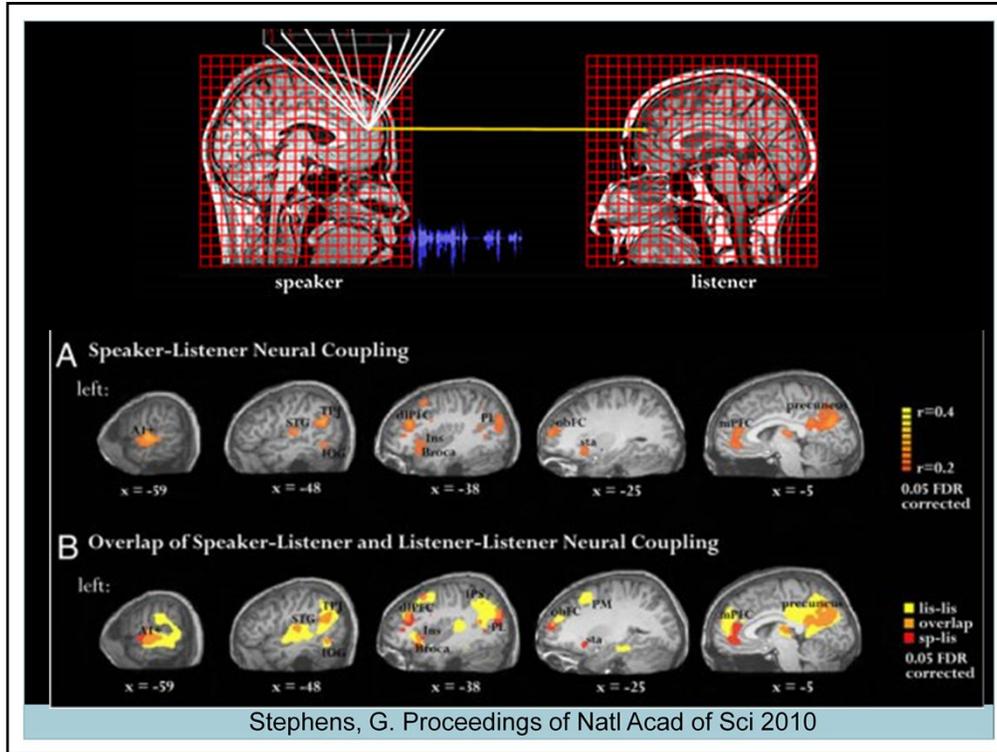
Court jesters, travelling minstrels, and morality plays all served to orally communicate culture, morals, and the consequence of breaking these taboos to the illiterate populace.

Power of Stories:

Frighten
Control
Inspire
Challenge
Teach



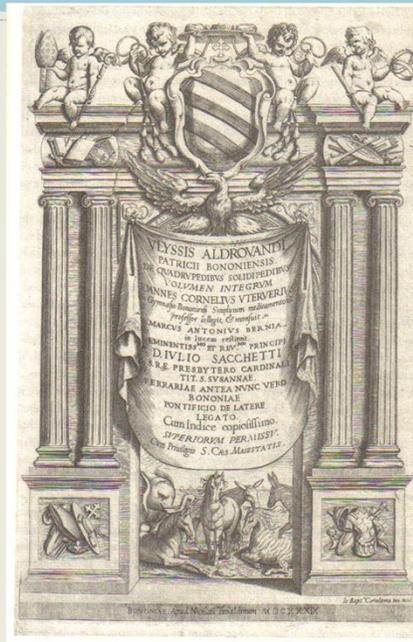
Stories have both negative and positive power. They can frighten and control, or inspire, challenge, and teach. Their ability to persuade others, makes storytelling a powerful evolutionary milestone for the homo sapiens species. As the stories became more complex, so did the culture.



There is a mental interaction between the teller and the listener, unique to oral communication. I may be talking and you may be listening, but our brains begin to look very similar as a speaker-listener neural coupling occurs. When this mirror activation occurs, there is a connection between the two; so, "I am now in your head"!

The Ancients

- All accumulated knowledge
- Facts + Stories



Four Footed Beasts 1639

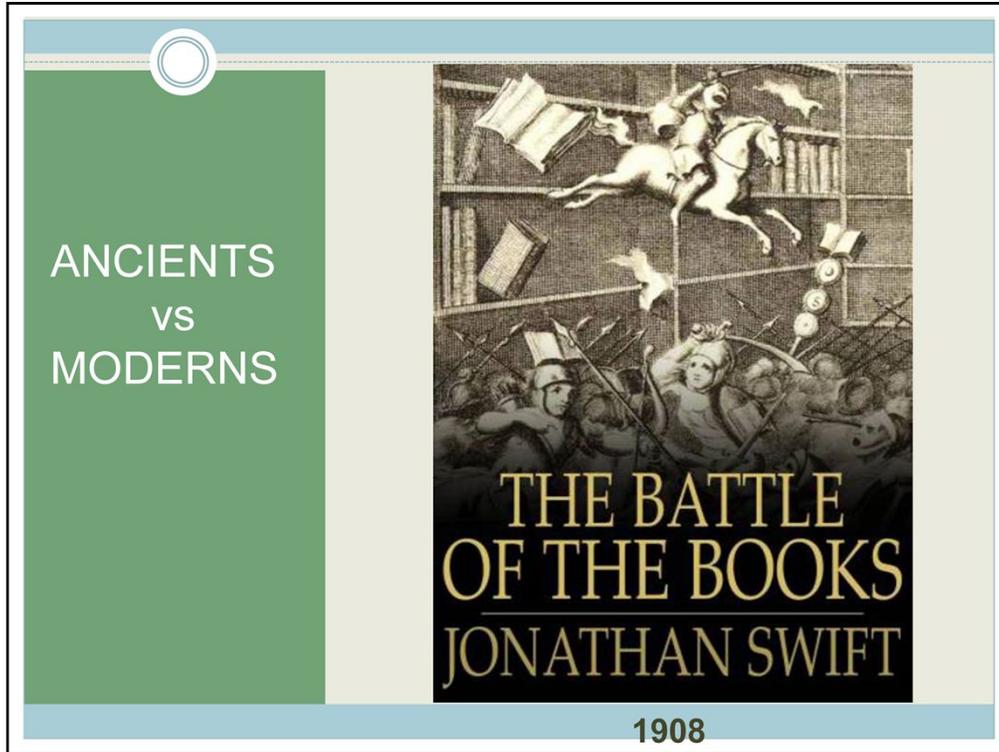
Early writers believed a comprehensive text on life should include *all* accumulated knowledge, be it facts or stories. This scholarly text, *Four Footed Beasts* included mythical unicorns, seen reclining on the lower left, as they existed in oral tradition.

The Moderns

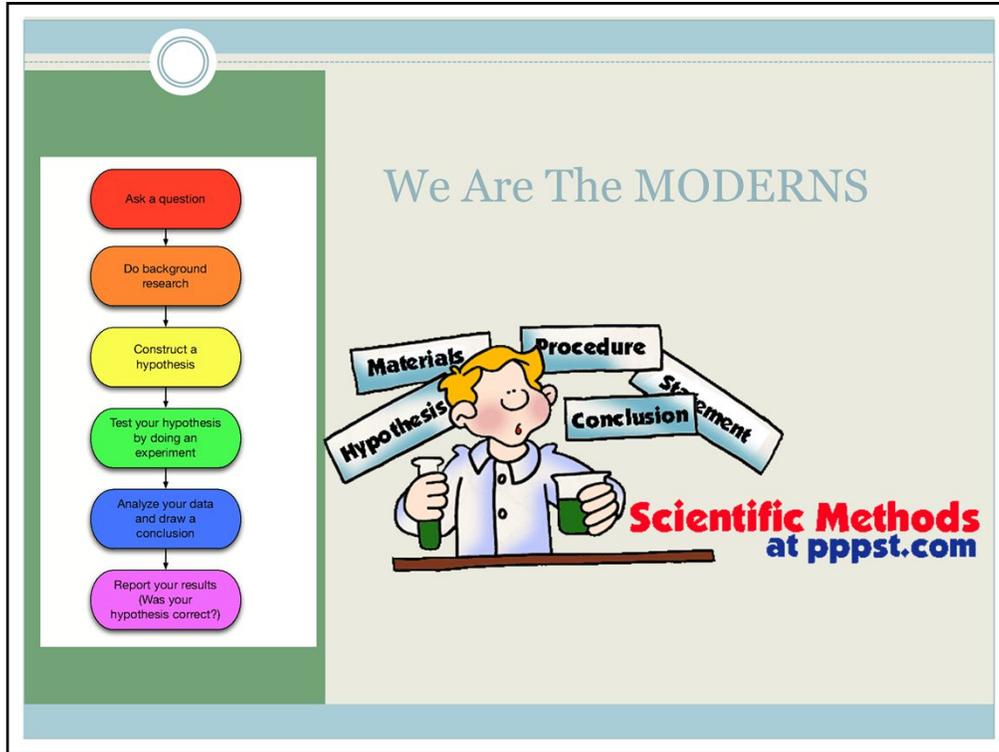
- Facts
- Use tools to measure
- Observed by others
- Repeatable



Modern writers rebelled over this “inclusive” definition of knowledge. Instead, they believed that reliable knowledge must be based on facts, use tools of measurement, be observable by others (unlike the unicorn), and most important, these findings can be repeated by others.

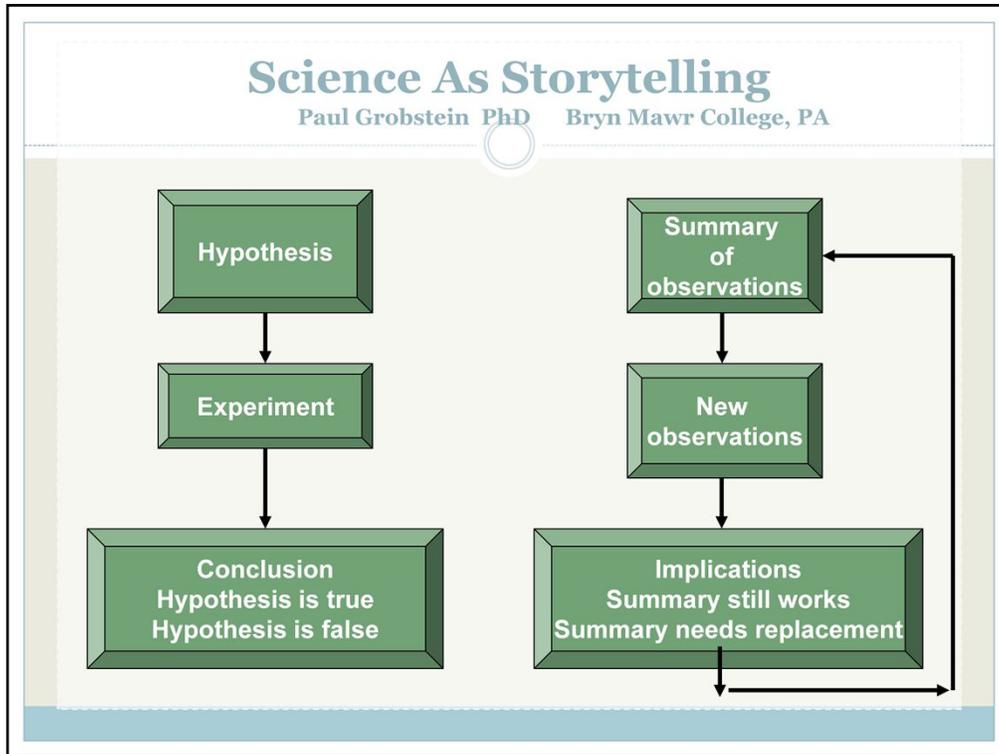


Jonathan Swift wrote a satire on this division, in which books written by the moderns attacked the ancient books, in a library war. Who won the battle?



Unfortunately, we did. WE are the children of the moderns, taught to form a question and test it through rigorous scientific methods.

From hence forth, science equaled facts, while stories equaled fiction. However I argue that findings from scientific research are not always the full, total facts. They are at best an approximation of the truth.



Paul Grobstein, a college professor, teaches a course called “Science as Storytelling”, in which he contrasts the one-way scientific method from hypothesis to conclusion, versus the true state of discovery in which new observations and their implications continuously feedback to story revision, as we gradually “get it less wrong”.

The Stiff Hand – Prevention & Treatment
Grady Hospital, Atlanta, GA, 1975

Hand Rehabilitation Center
 Department of Physical & Occupational Therapy
 Grady Memorial Hospital
 Division of Plastic Surgery, Emory University School of Medicine
 Third Annual Instructional Course on
The Stiff Hand - Prevention & Treatment

Grady Memorial Hospital (Auditorium)
 80 Butler Street, S. E.
 Atlanta, Georgia 30303

Friday, May 9, 1975
 Saturday, May 10, 1975



GUEST FACULTY

Earle E. Peacock, M.D.
 Professor of Surgery
 The University of Arizona
 Tucson, Arizona

Raymond M. Curtis, M.D.
 Associate Clinical Professor
 Orthopedics and Plastic Surgery
 The Johns Hopkins University
 Baltimore, Maryland

Geoffrey H. Bourne, D.Sc., D.Phil.
 Director, Yerkes Regional Primate Research Center

John V. Basmajian, M.D.
 Professor of Physical Medicine
 Professor of Anatomy

William B. Nickell, M.D.
 Attending Plastic Surgeon (Mercy Hospital)
 Birmingham, Alabama

Bonnie Olivett, O.T.R.
 Senior Instructor, Occupational Therapy
 University of Colorado Medical Center

Mr. Sandy Burkhardt, R.P.T., B.S., M.S.
 Associate Professor of Physical Therapy
 University of West Virginia

Carl Hartsampf, Jr., M.D.
 Clinical Assistant Professor of Surgery (Plastic)

Ronald Hovican
 Laboratory Administrator
 Department of Surgery

James Hudson
 Electronic Technologist
 Regional Rehabilitation and Research Training Center

M. J. Jurkiewicz, M.D.
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Richard Mattison, M.D.
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Wyndell Merritt, M.D.
 Instructor in Surgery (Plastic)

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L. O. Vasconez, M.D.
 Assistant Professor of Surgery (Plastic)
 Chief, Hand Section of Plastic Surgery

Ms. Hester Wilke, R.P.T.
 Physical Therapist
 Atlanta Plastic Surgery Clinic

EMORY UNIVERSITY FACULTY

Loai G. Bayne, M.D.
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 Physical Therapy Department
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EXHIBITORS
 Perdue Fredrick Co.

Let me share some personal examples of how stories change and affect our practice. In 1975 I attended my first hand course at Grady Hospital in Atlanta on The Stiff Hand – Prevention and Treatment. Note the diverse faculty of physicians, occupational and physical therapists (there were no hand therapists at this time). The topic was Replantation, a term I did not understand. I studied the hand on the slide for the problem, and finally asked a doctor sitting next to me what was the problem; to which he replied, “the hand is not connected to the body”. I was missing this story completely.

Story 1: Wound Healing Dr. Earle Peacock



Dr. Earle Peacock



The guest speaker at this meeting was Dr. Earle Peacock, who had studied and written on wound healing. Although I did not understand his lecture, he made two statements that burned into my soul:

- All the answers to tissue repair and functional recovery will be found in wound healing research.
- If you don't know wound healing and how to apply this understanding clinically to each tissue, then you have no business treating hands.



I learned that Dr. Peacock and Irene Hollis OT founded the Hand House in Chapel Hill, NC. All of their procedures were based on wound healing principles.

Graduate Program in Hand Therapy Medical College of Virginia



Dr. Wyndell Merritt, Hand Surgeon
training therapists and residents

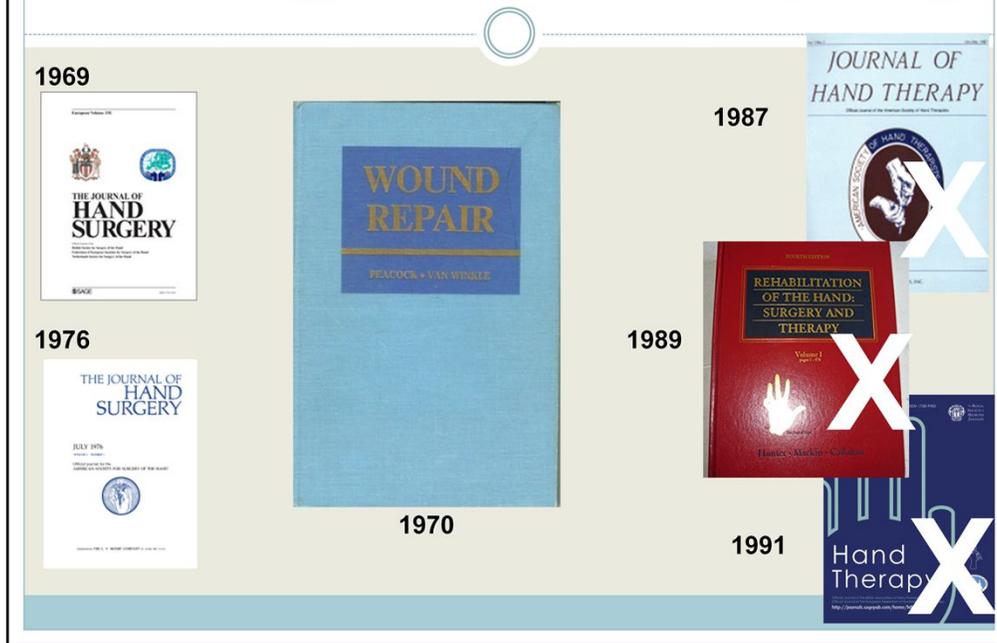
MCV Hand Management Center



MAUREEN HARDY (left), CLINICAL DIRECTOR OF HAND MANAGEMENT CENTER, WORKS WITH LINDA WILSON
Ms. Wilson, Who Has Rheumatoid Arthritis in Her Hands, Had Damaged Knuckles on Her Right Hand Replaced With Plastic Ones
and " she said
he were the joints being considered for sur... measurements of the joints on the doctor

The quest to comprehend the mysteries of wound healing applied to hand injuries led me to graduate school at the Medical College of Virginia. Through unmerited fortune, a hand surgeon Dr. Wyndell Merritt, a former resident of Dr. Peacock at the Chapell Hill Hand House, sought to train residents and therapists on a science based curriculum at MCV.

Hand Therapy Texts & Journals in 1976 = ✖



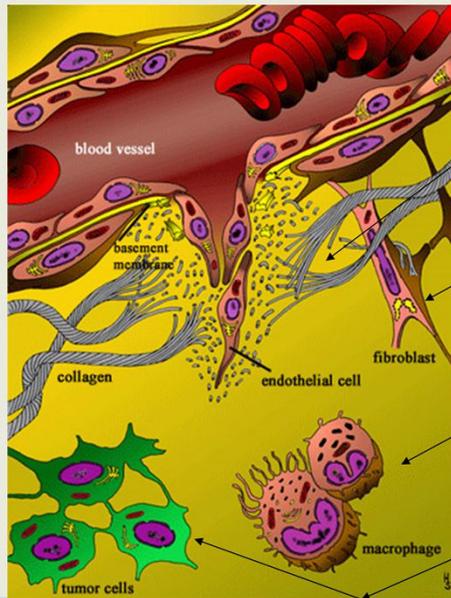
With no hand therapy journals, or texts yet published, my first graduate textbook assigned by Dr. Merritt as mandatory reading was *Wound Repair*, written by (yes) Dr. Earl Peacock!

Angiogenesis: why scar color changes over time



One chapter from the story on wound healing is about blood flow or Angiogenesis, the growth of new blood vessels into a healing wound. Patients often ask how long they must wear a splint, do their exercise, or massage the scar. Part of the answer lies in the color of the scar and how it changes over time. This is the story of blood flow in a wound.

Chemical Signaling to Blood Vessel



Damaged Collagen

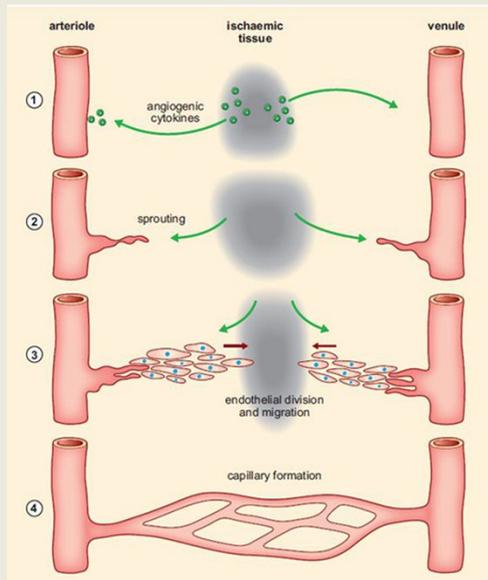
Fibroblasts

Macrophages

Tumor Cells

Chemical signaling from damaged collagen, and growth factors from macrophages, fibroblasts and unfortunately tumor cells, induces uninjured blood vessels to proliferate and migrate out towards the injured tissue.

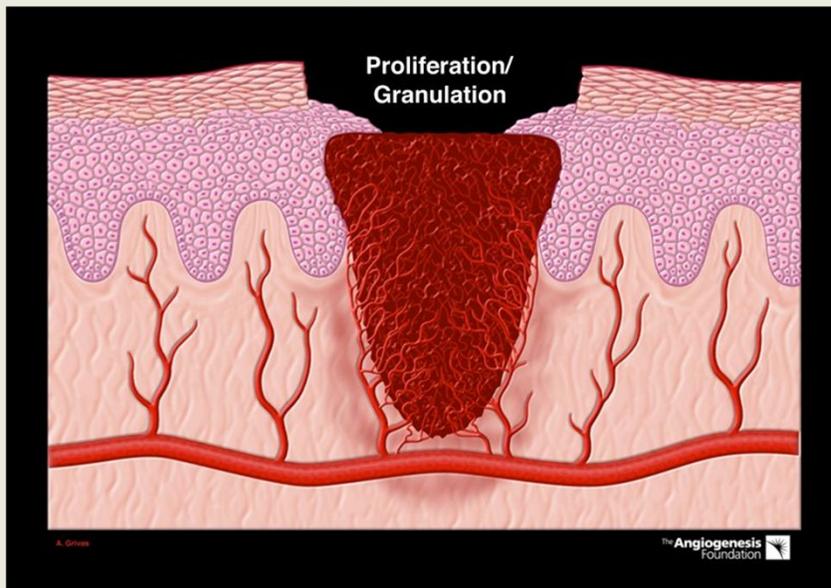
Proliferation of Blood Vessels into Wound



Intro to Histopathology. 1.7 Wound Healing, Angiogenesis

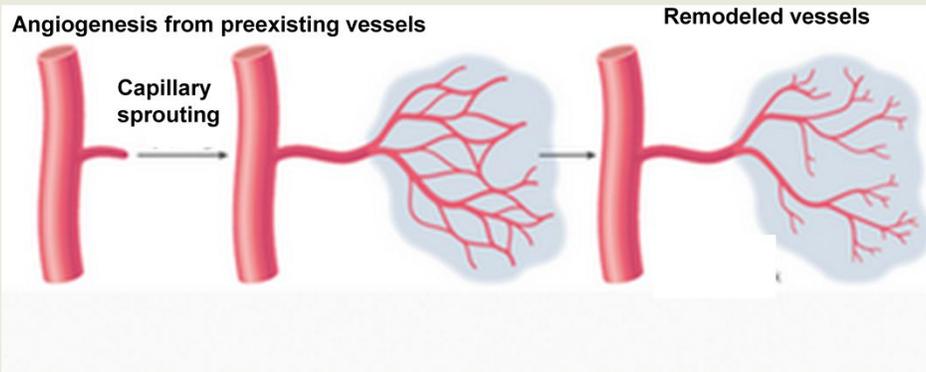
These vascular sprouts join to form a vascular loop and blood flow begins. Supply lines are now in place to give oxygen and nourishment to repair cells.

Wound is “Hyper” Vascularized



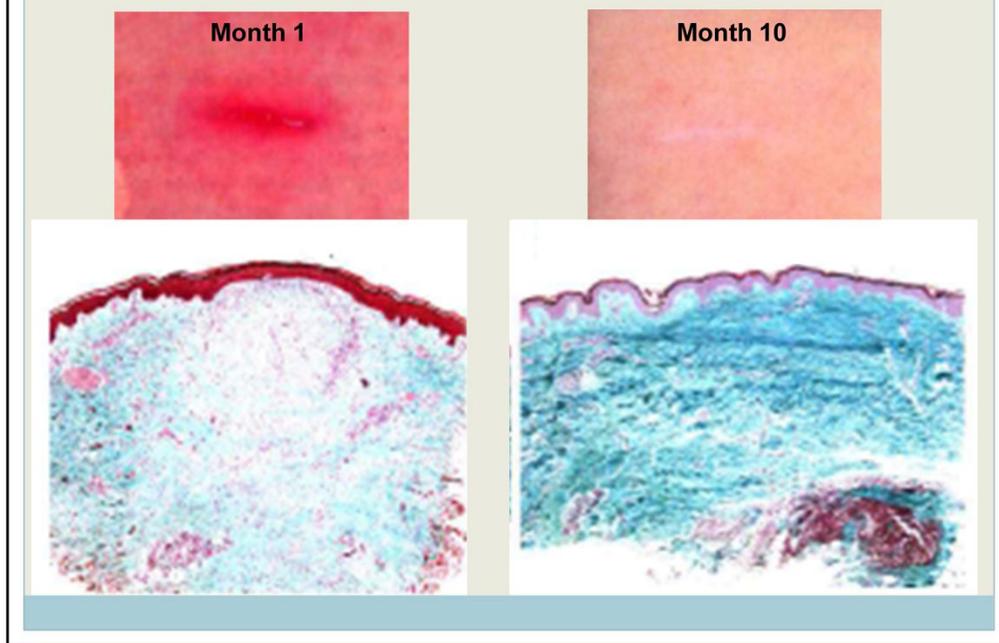
Successful wound healing initially depends on this hyper-vascularity . The wound is emeshed with blood vessels giving it and the surrounding area a red appearance.

Vascular network is remodeled



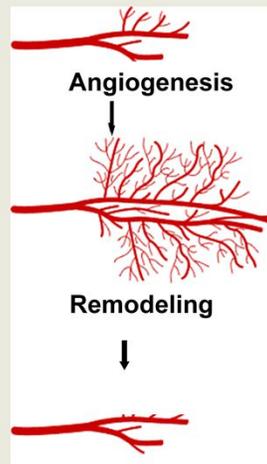
However, this excessive sprouting and redness is not permanent. Like the seasons, capillaries begin to die back during remodeling phase due to angiogenic inhibitors.

Maturation of the Human Scar Bond, Pl & Recon Surg 2008



Histological sections of scars show increased blood vessel density (stained red) in scar at one month; compared to the decrease in scar vascularity at 10 months.

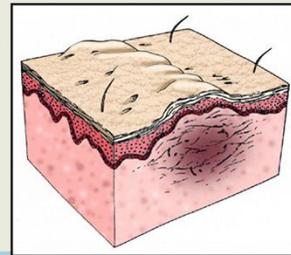
Capillary Sprouting is reversed during Remodeling Phase



The red, highly vascularized scar seen early in healing fades as blood vessels recede, leaving the mature scar paler than surrounding uninjured tissue.

Hypertrophic Scar is not normal Scar

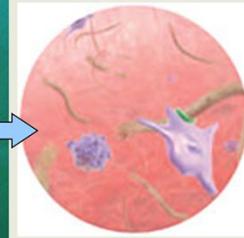
- Higher # blood vessels
- Elevated blood flow
- Prolonged increase in levels of growth factors
- Thickened epidermis
- Higher amounts of myofibroblasts



Amadeu 2003, Pathol Res Pract.

Hypertrophic scars are an abnormal proliferation of dermal tissue, with a higher % of blood vessels.

Silicone on Scar



Branagan 2000
Skin Pharm Appl Skin Physiol
McCarty 2010 J Clin Aest Derm
O'Brien 2013 Cochrane Library

Silicone sheeting is an elastomer used to prevent and improve hypertrophic scar. Silicone is easy to use, has low adverse affects, and effectively reduces scar thickness and color. The proposed action is through enhanced scar hydration, which changes the ratio of collagen to ground substance in the scar. This change makes the scar more pliable (softer), extensible, and less vascularized.

Hypertrophic Scar Treatment

Pressure Rx

- 30 mm Hg/23 hrs day/12 mo



- Depresses blood flow
- Decreases protein deposition
- Increased temperature
- Induces PGE2 (collagenase)

Occlusion Rx

- 12-24 hrs/day for 3 months
- reduces epidermal thickness by 30%



- Increases hydration
- Decreased water vapor loss
- Decreases fibrogenetic cytokines
- Increased temperature
- O₂ permeable
- Reduces tension across the wound

Steinstraesser 2011, PI & Recon Surg

Tsang 2010, J Burn Care Res

Pressure garments have a different mode to affect scar. The physical pressure exerted on the scar depresses blood flow thereby decreasing the aerobic condition necessary for collagen production; protein leakage is also decreased from compressed vessels, note that collagenase action which is an anerobic process, is unaffected by pressure, so scar remodeling continues.

The combined use of silicone and pressure garments is controversial. Tsang reported that the use of both was more effective in treating hypertrophic burn scar; while, Steinstraesser found that pressure garments alone are as effective as the combined use of silicone and garment.

Put Science in the Story of Scar

*"NEVER OVERLOOK THE
POWER OF A GOOD STORY.
THIS IS WHAT PEOPLE
WILL REMEMBER ABOUT
YOUR WORK."*

JANE MAHER, CHIEF MEDICAL
OFFICER, MACMILLAN CANCER
SUPPORT



Why should we use stories with patients? Because weaving together the science with the art of storytelling can be an effective strategy for patient learning and compliance.

Sharing your angiogenesis-scar story while treating the patient may sound like this: "Your scar is pinker than your normal skin color, because it is still baby scar. There are a lot of extra tiny blood vessels in the wound working to provide healing. When healing is over, these vessels will disappear and the mature scar will be paler than its surroundings. Right now we have a chance to change the shape, texture, color, and flexibility of your baby scar before healing is over."

Story 2: Tendon Healing

18th ANNUAL MEETING
1988

THE AMERICAN ASSOCIATION
FOR HAND SURGERY

Canada

Harbour Castle Westin
Toronto, Ontario
Canada*

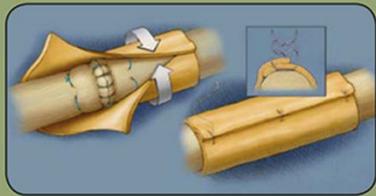
September 29 - October 2, 1988

ASK THE EXPERT COURSES
Friday, September 30, 1988
5:00 PM - 6:30 PM
Metro West

Course Number	Title	Faculty
1	Concepts of Tendon Healing and Repair	Austin D. Potenza, M.D. Charles F. Melone, Jr., M.D. Eric E. Peacock, Jr., M.D. Jimmy A. Chow, M.D. Maureen Hardy, MS PT
2	Surgery of the Peripheral Nerve	A. Lee Dellon, M.D. Susan E. MacKinnon, M.D. Gina Roseman, MS OTR
3	State-of-the-Art of Bone Repair & Reconstruction	Peter C. Amadio, M.D. William F. Blair, M.D. Alan Freeland, M.D. Mary Sorenson, PT
4	Update on Reconstructive Surgery of Hand & Wrist	Robert D. Beckenbaugh, M.D. Leonard S. Bodeli, M.D. Robert H. Bramfield, Jr., M.D. L. Andrew Koman, M.D. Jules S. Shapiro, M.D. Lynne Feehan, BS-PT MSc
5	Soft Tissue	Elof Eriksson, M.D. C. Lin Puckett, M.D.

Thirteen years after attending my first hand course, I was on the faculty of an AAHS Meeting in Canada to speak on tendon rehab. Excited and prepared, I sat on stage waiting for the hand surgeons to finish speaking.

Tendon repair and mobilization?



An extended debate ensued over options for repair and early post-op care that erupted into heated arguments. I sat back in shock watching the conflict until the moderator regained the podium to take control. Dr Chow said he had a personal story to tell. He confessed growing up his favorite dessert was apple pie; however, he also loved ice cream. As an adult he solved this dilemma by enjoying apple pie à la mode. He reasoned that often seemingly divergent options can come together to form a better result. He thanked the panel and we were dismissed. Here is the tendon rehab story I was not able to present then.

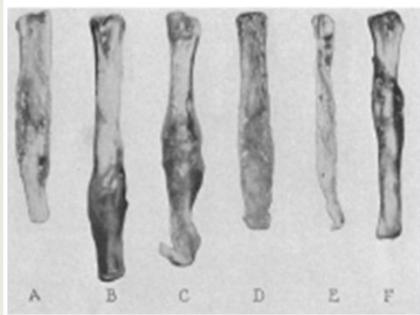
Patient Instruction: Protect Repair



Historically the main message to patients following tendon repair was all about hand positioning to protect the repair. Patients were warned never to extend their wrist, or their tendon repair would pull apart. Therapists spent time teaching patients how to remove their splint, “take the splint off your hand, don’t slide your hand out of the splint”. These warnings were based on tendon suture strength and the fear of tendon gapping or disruption.

In The Beginning, repaired tendons were immobilized

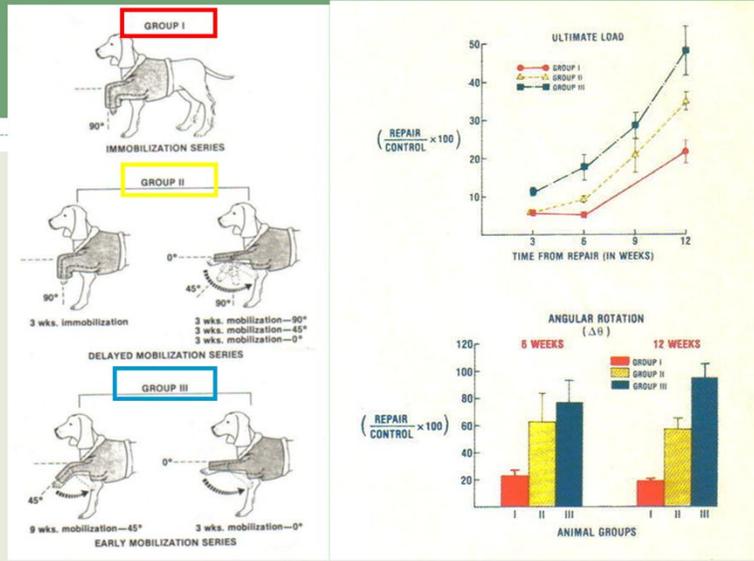
Mason & Allen. The Rate of Healing of Tendons.
Annals of Surgery 1941



2 Strand Repair	↑ Gliding	↑ Tensile Strength	Ø Gap/Rupture
Group A Immobilized	+	Low	High Rupture
Groups B-E Early motion	-	High	High Gap
Group F Limited motion	+	Medium	Intact

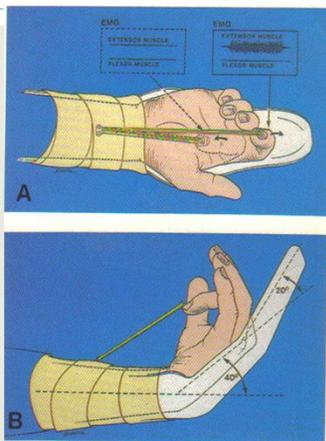
Early studies, like the classic Mason and Allen dog tendon study, showed that the three goals of gliding, tensile strength and an intact repair, could be achieved with protected limited motion.

Gelberman, Effects of early intermittent passive mobilization on healing canine flexor tendons. JHS, 1982

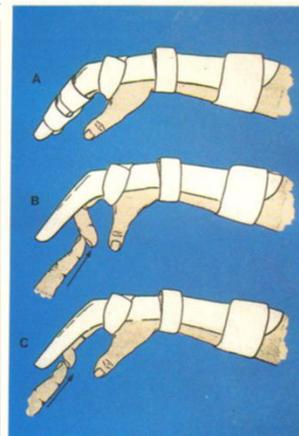


Later work by Gelberman confirmed that tendon gliding and repair strength all benefit greatly by early protected motion. Protected motion was important in both the splint and motion protocol to prevent repair site dehiscence due to low suture strength.

Protected mobilization post tendon repair



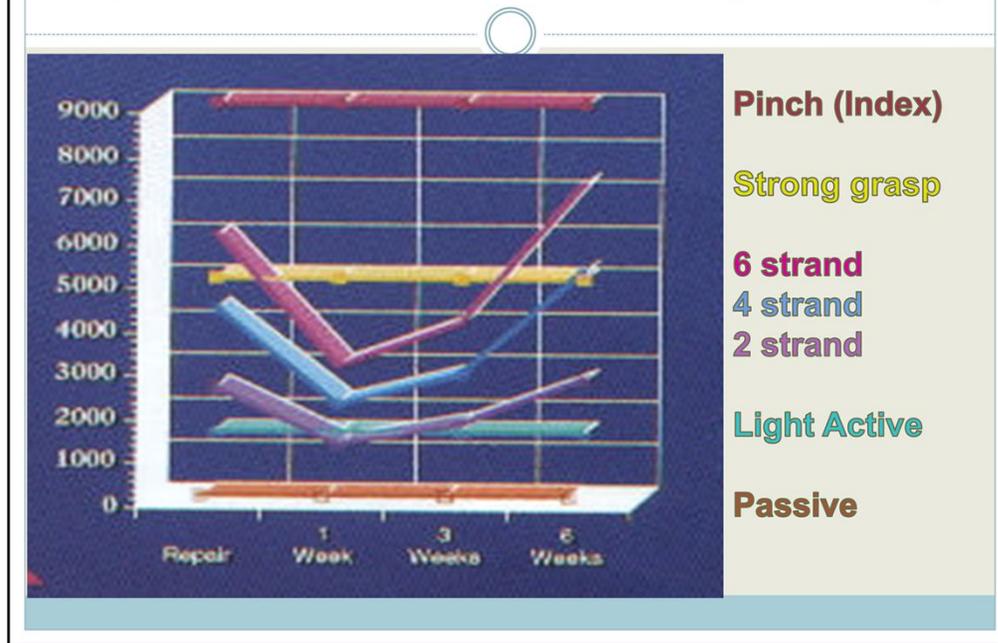
Kleinert 1967



Duran 1974

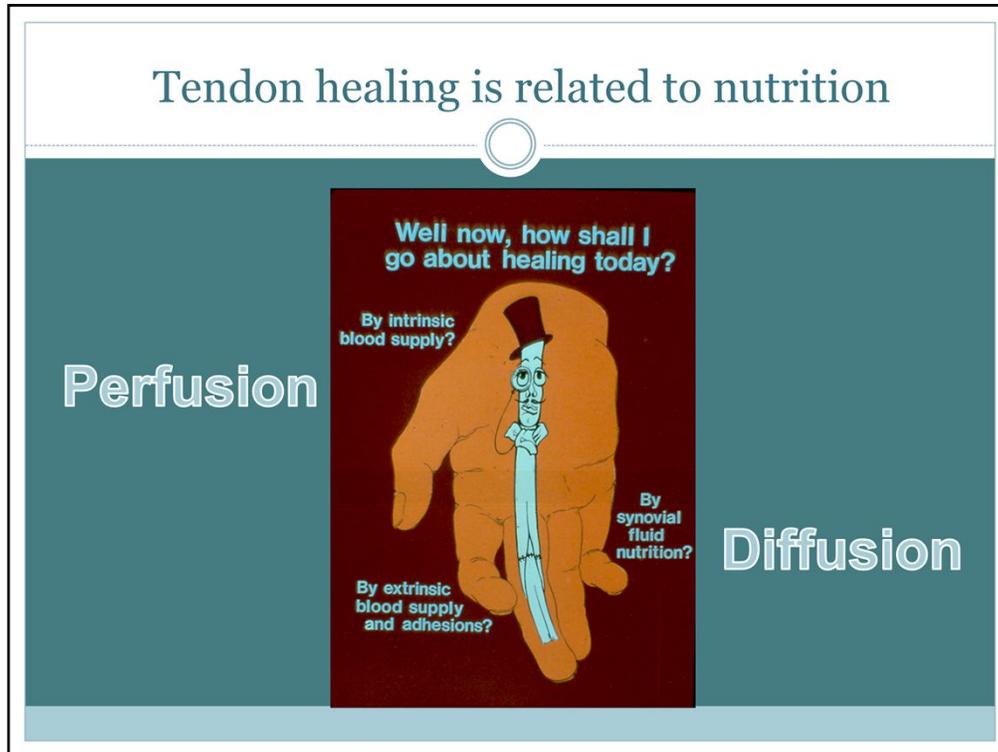
These studies were translated into clinical practice using Kleinert and Duran programs, an apple pie à la mode approach!

2,4,6 Suture Strand and the “Dangerous Dip”



Despite improvement in suturing techniques, our cautionary story continued to warn patients of the “dangerous dip” in repair strength in the early weeks post repair. Tendon sutures loose about 1/3rd of their strength during this time, while the biologic tendon repair is not yet strong. A high rate of tendon ruptures occur during this dangerous dip time period, most caused by patient’s use of grip even while wearing their splint (Harris BJHS, 1999).

Tendon healing is related to nutrition

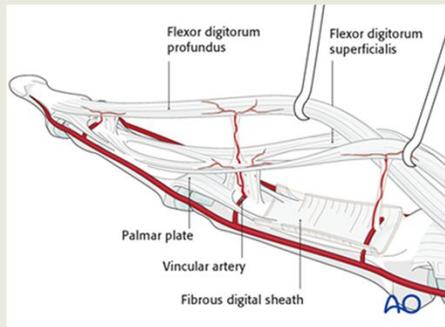


Tendons need nutrition to heal. Dependent on location of injury, this nutrition is provided by blood vessel perfusion, synovial sheath diffusion, or a combination of both.

Blood Perfusion for Tendon Nutrition

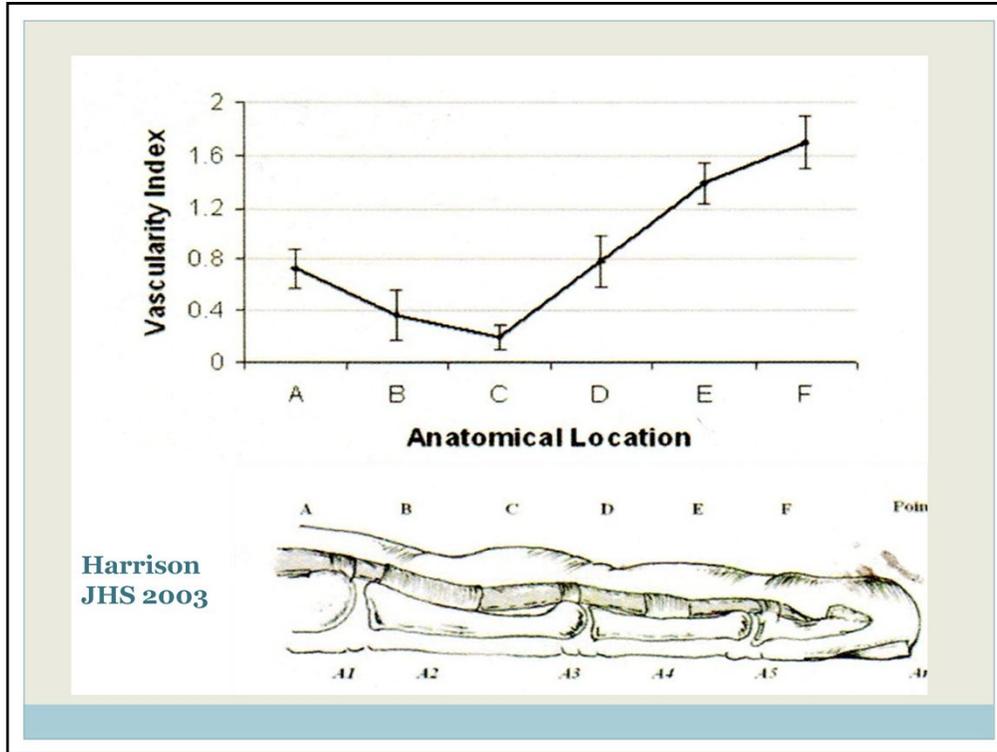
- Muscle & Bone Insertions
- Vincular Vessels

- Dorsal Longitudinal Vessel with vascular loops



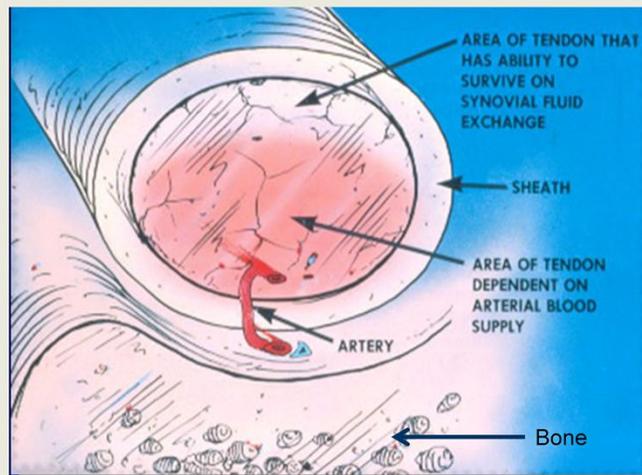
Blood vessels reach the tendon in different ways in different parts of the hand and fingers (Brockis 1953). Outside the synovial sheath, tendons are richly supplied. Proximally at the muscle- tendon junction and distally at the osseous- tendon junction the tendon is imbued with an abundance of blood vessels that, unfortunately, only provide this rich blood supply for a short distance. In non-synovial regions, the mainstay vessels for most of tendon nutrition are vessels from the loose paratenon connective tissue that provide consistent perfusion throughout the core of the tendon.

Within the synovial sheath blood supply is more tenuous. Vinculi from digital arteries penetrate both flexor tendons, interestingly, along the proximal and mid phalanx only. Their role here may be to assure blood flow from their protected dorsal location during the extreme mechanical compression that occurs with PIP and MP joint flexion (Zhang 1990). A weak continuation of the intra-tendinous blood vessels courses downstream from its muscle origin. This lone long vessel runs along the dorsal tendon surface, the tendon surface close to the bone. Many small vascular loops course outward and upward from this main dorsal vessel to nourish the tendon fascicles, but fail to perfuse the volar portion of the tendon. Why would this vascular network fail to reach the volar portion of the tendon leaving it relatively avascular?



Harrison's work confirms that blood flow (vascular index) diminishes between the A1 pulley at the MP joint to beyond the A3 pulley at the PIP joint. As the tendon slides under the pulleys, pressure is localized on the volar side of the congruent tendon, especially as the pulley performs its function of restraining the tendon from bowstringing with flexion. The avascular volar watershed area of the tendon, devoid of any blood vessels, appears to be a high risk area for nonunion following injury.

Diffusion of nutrients from synovial fluid nourishes avascular zone on palmar side of tendon



Nutrition to this avascular palmar area of the tendon needs an answer that blood flow can't provide; and the answer is *diffusion*. Compression begets diffusion. An elegant system evolved where tendons experiencing repetitive compression as they glide under fibrous bands are nourished by nutrient diffusion, similar to joints. Diffusion of nutrients from synovial fluid nourishes this avascular zone on the tendon's palmar side. This intrasynovial tendon nutrition is dependent on the pumping effect of digital motion.

Compression with motion begets diffusion

PROM



AROM



Diffusion is dependent on the pumping effect of digital motion.
Amadio 2012 Tendon Surgery of the Hand; Lundborg 1980 Scand J P&RS

Early motion post flexor tendon repair, results in increased synovial diffusion to the tendon (Lundborg 1980, Amadio 2012). Better nutrition, combined with tendon gliding drives tensile strength gains

Tendon Healing Story

Tendon Nutrition
Tendon Gliding
Tendon Strength



The science of flexor tendon repair is the story of how tendon nutrition is dependent on digital motion; and this motion improves both tendon glide and repair strength. Science alone will not lead to compliance however, unless the patient's experience is part of the story. Kaslutas and Powell (JHT 2013) found that patients struggled to fulfill life roles during the period of restricted hand use following tendon repair. Over 50% of their patients reported removing their splint to perform essential activities. A simple request from the therapist, "tell me what I should know about your situation", begs an invitation into the private concerns facing this individual.

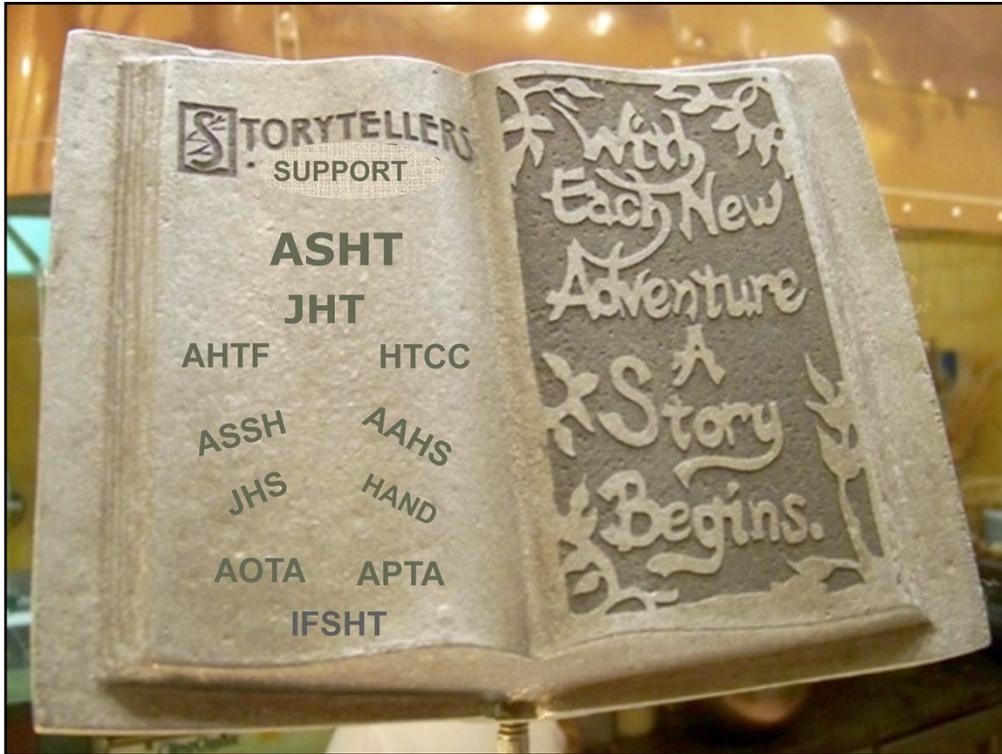


Moderns:
EVIDENCE-
BASED
PRACTICE



Ancients: The Ever Changing Story

The medical record is not where the story lives, as it is merely a record of facts. The story lives between patient and care giver, where each party gains a richer sense of the others' priorities. Stories become more powerful when there is a connection between current scientific facts, professional experience, and the patient's preference. Moderns would title this book, *Evidence Based Practice*; but the Ancients might have a more romantic title like, *The Ever Changing Story*



A shared story creates a community of support. These allied groups support and collect our stories, validating those grounded in science.

Case Reports are really good stories



The screenshot shows the journal's header with the Elsevier logo and the journal title 'Journal of Hand Therapy'. Below the header, a blue arrow points to the article title: 'A client-centered approach for thumb carpometacarpal joint osteoarthritis pain: Two case studies'. The authors listed are Barbara Shankland and Bernadette Nedelec. At the bottom of the article preview, there are two photographs: the left one shows a hand with a white, custom-molded splint on the thumb, and the right one shows a hand with a purple and white wrist brace.

Well written Case Reports are really good stories, ones we all enjoy reading. The narrative takes us on a journey to an in-depth understanding of one problem and the clinical reasoning applied. Successful Case Reports are rich with details and pictures. Remember Alice in Wonderland who said, *“And what is the use of a book, without pictures or conversation?”*

NORTH AMERICAN
INDIAN PROVERB



*“Tell me a fact and I’ll learn.
Tell me a truth and I’ll believe.
But tell me a story and it will
live in my heart forever.”*

Science confirms what we have known for millennia, stories are effective at teaching and changing *behavior*. So return to your clinics, classrooms, or labs and become storytellers, as you have a lot to share.