



Presentation 2006

The origin of the dynamic splint
Dynasplint Principles

THE ORIGIN



History

1 Dr Sterling Bunnell during the Second World War

- * Surgical techniques
- * Describes use of plaster splint / traction
- * Rational use of orthotics for the hand

2 Developments in the use of orthotics and traction
1950-1960-1970

3 1981 Dynasplint was created



COLLAGEN



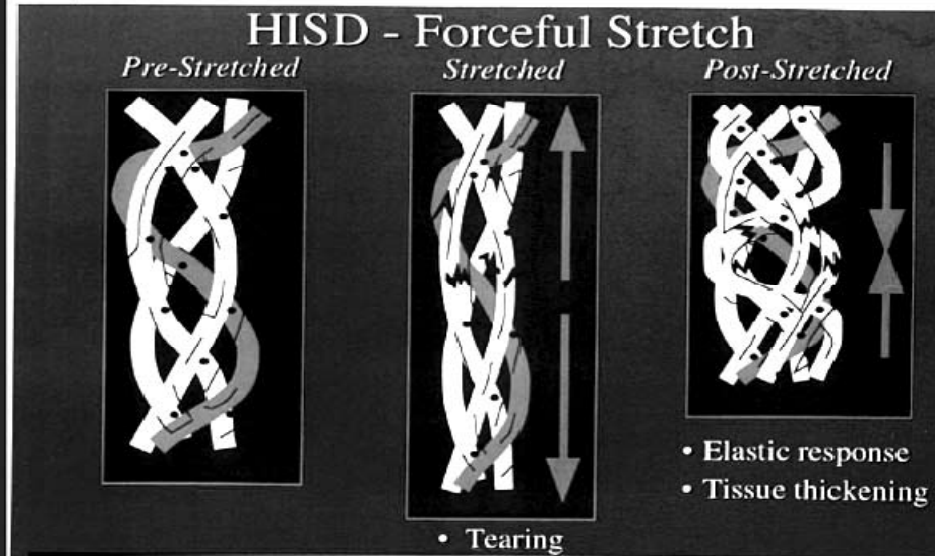
Collagen

Building Blocks to Connective Tissue

- Very crystalline in nature
- Very responsive to force, time and temperature
- Depends on X-link attachments for strength

HISD

High intensity short duration

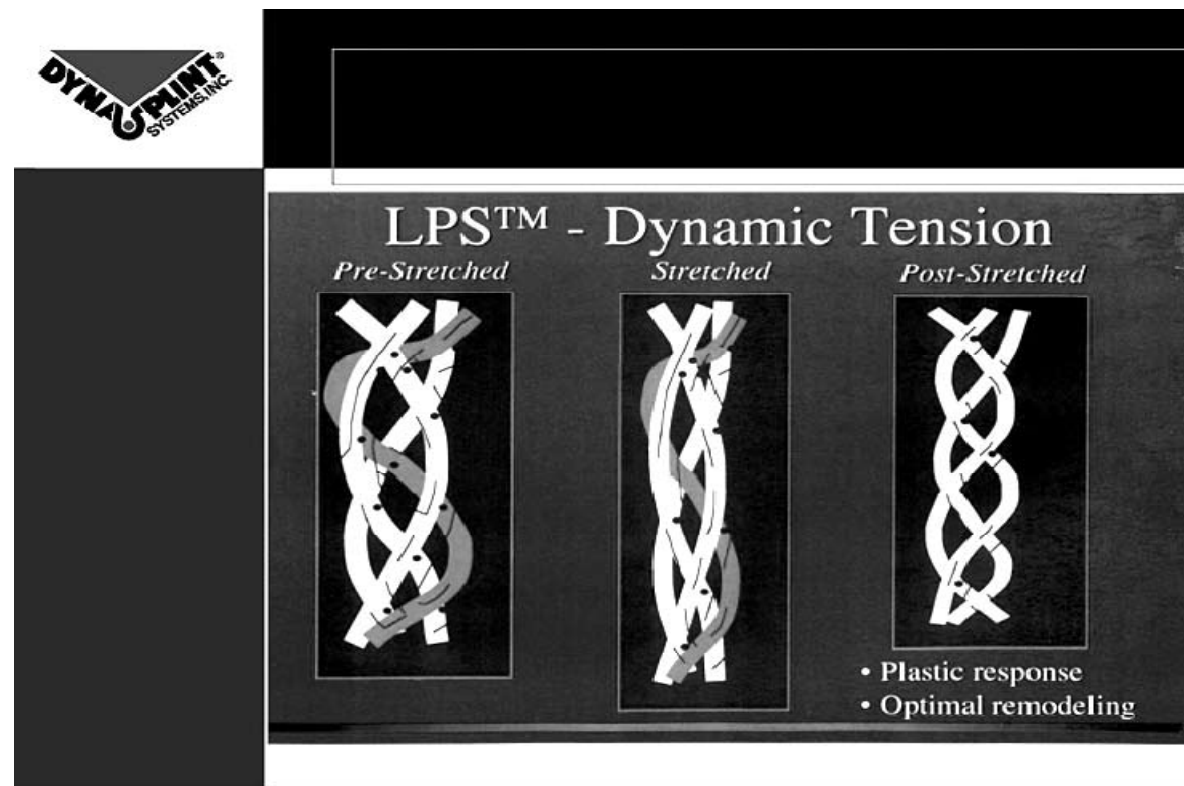


HISD

- HIGH INTENSITY SHORT DURATION
- THE TECHNIQUE USED AT YOUR INTERVENTIONS
- FOR PERIODS OF 15 TO 30 MINUTES

LLPS

Low Load Prolonged Stress



HISTORY

- LOW LOAD PROLONGED STRESS

LLPS

1966

The rational for Prolonged Stretching for Correctional of Shortening of Connective Tissue

“ The attachments between collagen fibbers show resistance to suddenly applied tension but relax or creep when exposed to prolonged tension. Utilizing this plastic characteristic of connective tissue,....within the limits of pain without evidence of tearing of tissues, by prolonged stretching at moderate tension than by intense stretching of short duration.” (Kottke and all.)

LLPS

1981

Biophysical Factors in Range-of-Motion Exercise

“Laboratory studies indicate that **the best way to permanently lengthen connective tissue structure without compromising their structural integrity is prolonged, low-intensity stretching**.....stated that prolonged stretching at moderate tension produced significantly restoration of motionIn – Vitro research has shown that prolonged, low-intensity stretching.....maximizes permanent lengthening of connective tissue and minimizes deterioration.” (The Physician and Sport Medicine December 1981)

LLPS

1984

Low Load Prolonged Stretch VS. High-Load Stretch in Treating Knee Contractures

'This study was designed to compare the results of traditional method of stretching knee flexion contracture by high-load stretch with the results of an experimental method of prolonged knee extension by skin traction, low-load prolonged stretch....., the results demonstrated a preference for LLPS in the treatment knee in the immobile nursing home resident.
" (Physical Therapy March 1984)

LLPS

1988

Assessment and Management of Loss Motion in Orthopaedic Dysfunction

“...However, *we feel the application of LLPS carries lower risk than many forms of HLBS (high load brief stretch).*

When does one initiate LLPS? *Clinically, whether to apply LLPS must be decided as soon as there is evidence of three facts.*

One is that a connective tissue *change has occurred*; two, that any such *changes are greater than can be overcome* by any of the short-lived effects of HLBS or active exercises alone; and, third is the *absence of any contraindication – such as an unhealed structure-that could be subjected to harmful stress through LLPS.....* An example is the Dyna Splint The cuffs are broad enough to meet minimal criteria for safe distribution of surface pressure, the alignment can be fit to deliver the torque at the axis of the rotation of the joint. The internal spring-loaded system can be easily adjusted by physical therapist and the properly instructed patient.” (American Physical Therapy Association; Forum Medicum, Inc., pp 1-11, 1988)

LLPS / THERMAL AGENTS

- 1992 The Use of Thermal Agents to Influence the Effectiveness of a Low-Load Prolonged Stretch

“ This Study documented the effectiveness of applying superficial heat and cold in conjunction with low-load prolonged stretch (LLPS) for increasing shoulder flexibility....Elevation of the tissue temperature prior to and during a low-load stretch has been shown to create less damage compared with a similar stretch at lower temperatures.....statistically significant immediate and residual increase in shoulder ROM were produced with the use of superficial heat in conjunction with LLPS.....” (JOSP November 1992)

T.E.R.T.



T.E.R.T. – Total End Range Time

There is a direct correlation between the amount of time a joint spends at its available end range and the gains in ROM that are made.

DYNASPLINT

- Dynamically keeps the joint at its end range
- Constantly seeks the new end range

T.E.R.T.

- 1994 Effect of Total End Range Time on Improving Passive Range of Motion

“ The objective of this study was to test the validity of the so-called total end range time (TERT) theory. The sum of the gains in Prom for all subjects during their 6 days of casting totalled 106°. The total gain during the 3 days of casting was 60°.....In conclusion, the increase in PROM of a stiff joint is directly proportional to the length of times the joint is held at its end range, or TERT.” (Journal of Hand Therapy July/September 1994)

T.E.R.T.

- 2003 Optimal Daily End Range TIME FOR Contracture: Resolution in Hand Splinting

“ Reduced passive range of motion (PROM) of the joints of the hand is a common sequela of traumatic upper limb injury.....[Sequential analysis showed a statistically significant preference for group B, daily TERT of 6 to 12 hours per day.](#)” (Journal of Hand Therapy July/September 2003)



Creep Phenomenon

- The slow, steady elongation of tissue in response to continuous stress
- Greatest during 1st 6-8 hours
- CREEP NEEDS HOURS!

ORTHOSIS



FIGURE 170.—Remedial exercises at Rehabilitation Center No. 1 (16th Station Hospital), All-Saints Hospital.



FIGURE 173.—Continued. C. Rehabilitation in a station hospital ward.



FIGURE 171.—Dynamic orthosis. (Note—metal plate, spring rubber band and spring mechanism.)





ORTHOSIS

- 1993 Surgical Treatment of Arthrofibrosis of the Knee

"...The authors assert that a logical, stepwise treatment protocol for arthrofibrosis of the knee can be useful to the practicing orthopaedist." (Journal of orthopaedic Techniques September 1993)



ORTHOSIS

- 1994 The use of Splints in the Treatment of Joint Stiffness: Biological Rational and Algorithm for Making Clinical Decisions

"....The proposed algorithm guides the use of splints based on measurement of pain and ROM." (Physical Therapy/Volume 74, Number 12/December 1994)



ORTHOSIS

- 1995 Adjunctive Therapy
Devices: Restoring ROM outside
of the Clinic

"...Overall rehabilitation costs can be kept to a minimum if all healthcare professionals are committed to restoring functional mobility in the most effective and time efficient manner. Utilizing ROM devices or orthoses at home help to meet that goal." (Physical Therapy Products Marsh 1995)



ORTHOSIS

- 1999 Rehabilitation: Focused exercise aids shoulder hypomobility

“ ...Scientific data demonstrate that soft tissue elongation can be effected by heat, force, time, and cooling. ...The patient then need to perform the third TERT in the home....This can also be accomplished by the use of continuous passive movement, splinting, or casting.” (Bio Mechanic November 1999)

DYNAMIC ORTHOSIS

USE

DYNAMIC ORTHESIS

■ 1984

Cases Studies: Contracture and Stiff Joint Management with Dynasplint

“ This Study investigated the efficacy of using Dynasplint LPS devices for restoring range of motions in cases where either immobilization stiffness or an established contracture had developed at the elbow or knee....., resulted in a 61% additional increase in range of motion....Dynasplint knee and elbow devices were found to be highly effective and efficient tools for speeding recovery from immobilization stiffness.....” (The Journal of Orthopaedic and Sports Physical Therapy 1987)

DYNAMIC ORTHESIS

■ 1986

Use of the Dynasplint to Correct Elbow Flexion Burn Contracture: A case Study

“..During the following days of the hospitalization , the splint was continually worn at night,, with full extension shown each morning. A more conscientious effort was then made to apply the splint during periods of inactivity during the day. The considerably lessened the degree of elbow contraction during the day and resulted in a normal range of motion at the time of the patient's discharge.” (The Journal of Burn Care 1986)

DYNAMIC ORTHOSIS

■ 1996

Splinting in the Management of Proximal Interphalangeal Joint Flexion Contracture

- "...A dynamic splint applied with a torque of 0.24 Nm is effective in resolving a flexion contracture from 39 to 21° on average. There is a sound premise for clinical application of dynamic splint for treating flexion contracture, regardless of the severity of the contracture, the time of the contracture, or the stiffness of the joint, provided adequate TERT is maintained." (Journal of Hand Therapy October/December 1996)

DYNAMIC ORTHESIS

■ 1997

The Use of Load-Load Prolonged Stretch Devices in Rehabilitation Programs in the Pacific Northwest

“ The use of LLPS orthoses significantly increase ROM for the whole sample, which in turn significantly improved the subjects' functional outcomes.....Use of LLPS orthoses for contracture management can mediate the losses in ROM and function that occur with joint contractures.” (The American Journal of Occupational Therapy July/August 1997)

DYNAMIC ORTHESIS

■ 2003

Dynamic Splinting of Forearm Rotational Contracture After Distal Radius Fracture

“.....Dynamic forearm rotational splinting effectively restores forearm rotation in a well-aligned distal radius when conventional therapy fails, with excellent results across a spectrum of fracture patterns and treatment groups.”

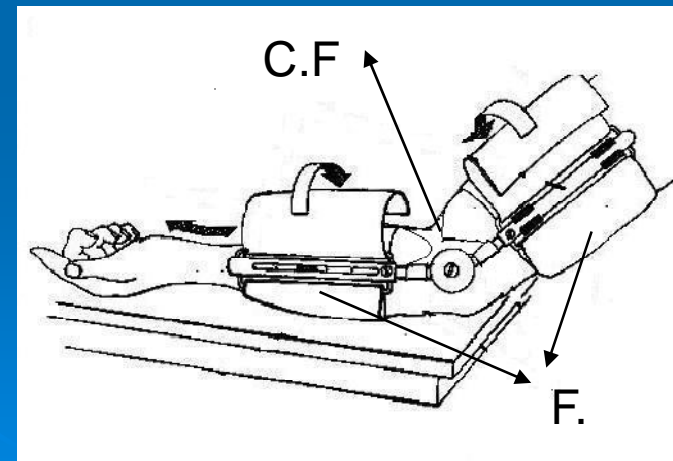
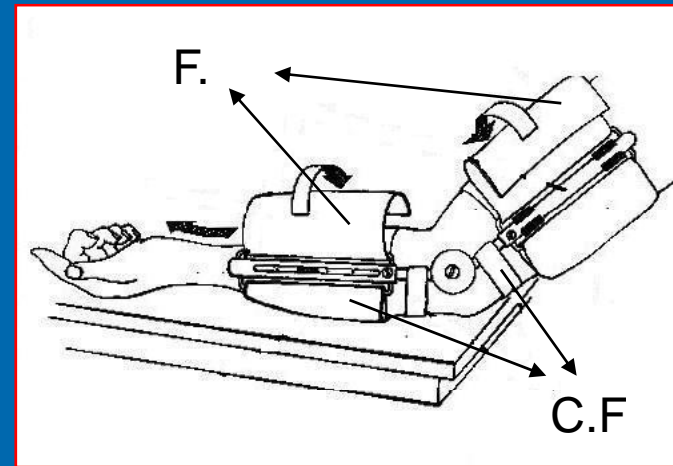
(The Journal of Hand Surgery may 2003)



Dynasplint Principles

Biomechanically Correct:

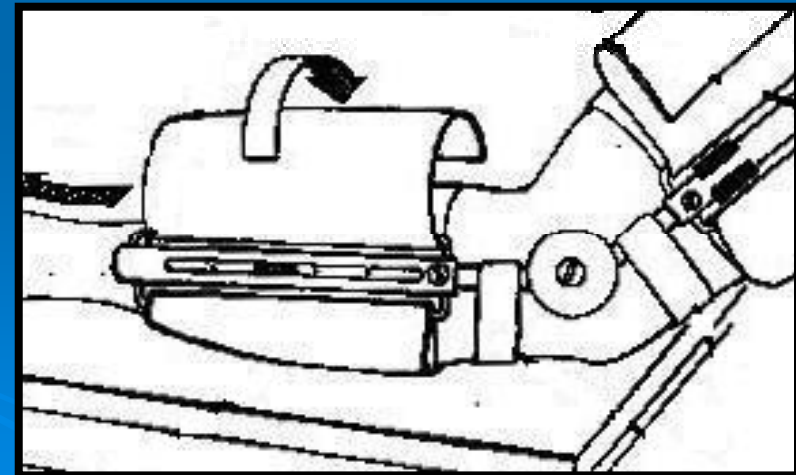
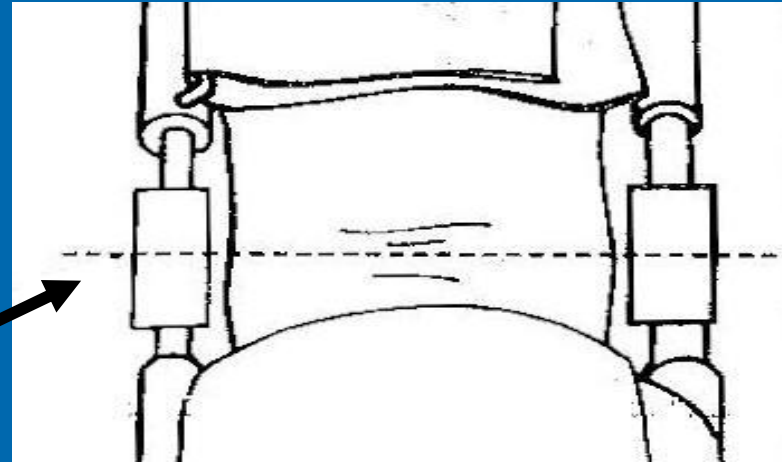
Dynasplint® Systems are biomechanically correct given the 3 or 4 point force/counterforce system. This design allows Dynasplint® Systems to closely mimic the therapist's hands.



Dynasplint Principles

Bilateral Tensioning System:

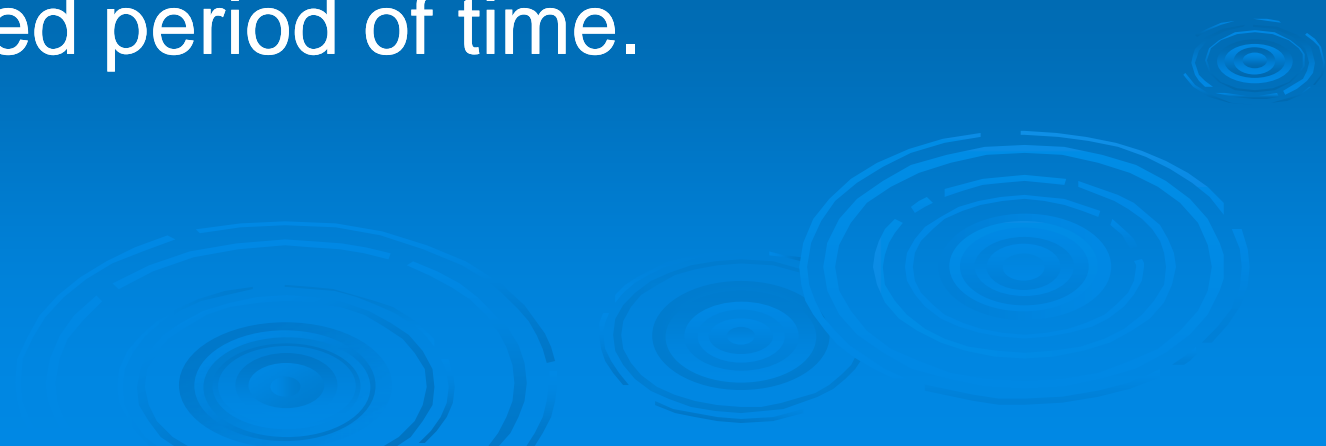
The bilateral tensioning system applies an equal amount of force across the joint line and maintains proper anatomical alignment even as the tension is increased. All of these features add to the comfort and compliance of the patient.



Dynasplint Principles

Physiologically Correct: Dynasplint®

Systems apply a low-load prolonged stretch (LLPS) to the connective tissue by seeking the patient's end ROM. The low intensity stretch is comfortable and safe allowing the patient to wear the splint for an extended period of time.

A decorative graphic consisting of several concentric circles, resembling ripples in water, is located in the bottom right corner of the slide. The circles are light blue and vary in size, with the largest one being the most prominent.

Dynasplint Principles

T.E.R.T. - (Total End Range Time):

There is a direct correlation between the amount of time a joint spends at its available end range and the gains in range of motion.



Dynasplint Principles

Custom Fitting:

All sales consultants receive extensive training in product knowledge as well as diagnoses associated with range of motion limitations. Dynasplint® Systems sales consultants will custom fit the unit and provide support and follow-up care to make sure the unit is used properly.

Dynasplint Principles

- **Patient Friendly:**
- Dynasplint® Systems are very well labeled and easy for the patient
- Changing the tension is as easy as turning a screwdriver!
- **Rental:** All units can be rented or purchased depending on the patient's need.
- Average rental time is 3 months. In most cases, rentals are more cost effective.
- **Wearing Time:** The optimal wear time is 6 - 10 hours based on connective tissue physiology. The patient should wear the unit while at rest, ideally overnight.



Application for patients



PATIENT

- FASTER RECOVERY ROM
- MORE PATIENT COOPERATION
- FOLLOWED BY AN EXTERNAL TECHNICIAN
- TREATMENT FACILITY AT HOME (wear at night)

MULTI-CENTER STUDY

CHART B: COMPARISON OF TOTAL REHABILITATION TIME REQUIRED WITH AND WITHOUT THE USE OF DYNASPLINT ON ELBOWS AND KNEES

Provider Location	Patient's Age	Number of Patients	Movement Restricted	Dynasplint Used	Total Number of Weeks of Dynasplint	Total Number of Weeks of Therapy
Hoffman Estates, IL	29.83	12	Flex & Ext	Yes	7.83	2.92
	34.0	12	Flex & Ext	No	---	14.17
79% Reduction						
Cherry Hill, NJ	44.3	7	Flexion	Yes	5.3	13.5
	30.67	6	Flex & Ext	No	---	22.08
39% Reduction						
Tucson, AZ	41.0	8	Flexion	Yes	10.75	20.90
	31.13	8	Flex & Ext	No	---	33.75
38% Reduction						
Baltimore, MD	41.7	6	Flex & Ext	Yes	12.2	10.7
	44.5	6	Flex & Ext	No	---	29.1
63% Reduction						
Composite Averages (All Centers)	31.4	33	Flex & Ext	Yes	8.8	10.9
	34.6	32	Flex & Ext	No	---	23.4
53% Reduction						

() Increase

Patient Treatment Data Compiled by George R. Hepburn, R.P.T., et al., 1984.