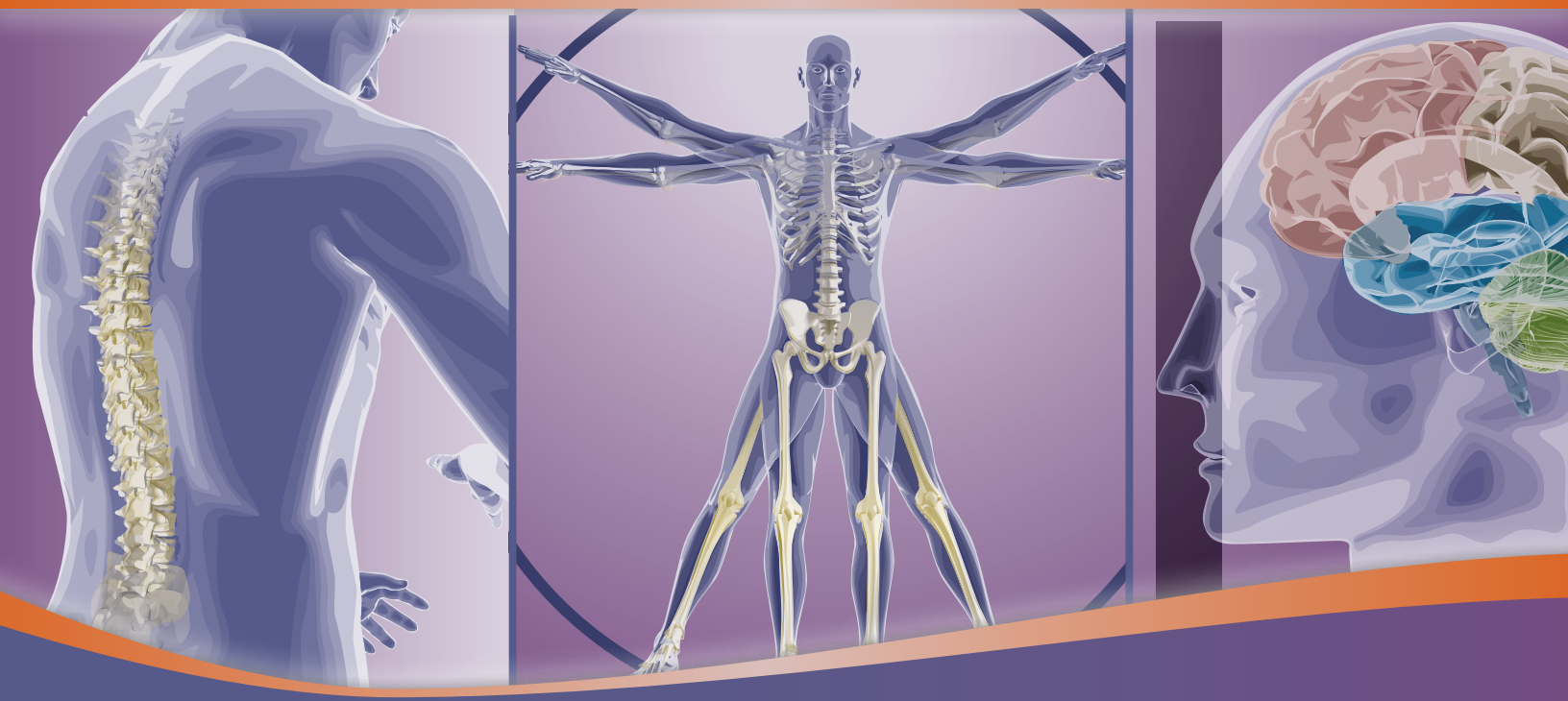
WorkSafeBC

WORKING TO MAKE A DIFFERENCE

8th Annual Health Care Professional Conference



June 8, 2012

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9th Annual
Health Care Professional Conference

Thank you to all conference sponsors, exhibitors and attendees. See you all again in June 2013.

Visit the website for updates:
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WorkSafeBC
WORKING TO MAKE A DIFFERENCE

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CBI HEALTH GROUP

LifeMark HEALTH

8th Annual Health Care Professional Conference

• Attendee List •

First Name	Last Name	Organization	Address	City
Stephen	Allen	Great-West Life	2nd Floor, 8700–200 Street	Langley
Janet	Ames	CBI Health Prince George	NSC–UNBC	Prince George
Yuka	Arai-Chmelik	UBC	2125 Main Mall	Vancouver
Brent	Armstrong	CBI Health — Rehab in Motion	780 Grant Avenue	Courtenay
Craig	Aspinall	WorkSafeBC	6951 Westminster Highway	Richmond
Duncan	Aspinall	CBI Health	5873 York Road	Duncan
Shannon	Atkins	Fraser Health and Provincial Health Services Association	400 13450 102 Avenue	Surrey
Alaa	Badreldin		#2–3039 Kingsway	Vancouver
Cassandra	Basi	Newton Physiotherapy	#230 13711–72 Ave	Surrey
Kevin	Berman	WorkSafeBC	1457 Lansdowne Drive	Coquitlam
Nathan	Berthelot	WorksafeBC	PO Box 4700 Stn Terminal	Vancouver
Michelle	Berube	CBI	940 Goldstream	Victoria
Deepak	Bhasin	Lifemark Health	101, 20230–64 ave	Langley
Janice	Briggs	J.Briggs Counselling	6541 Groveland Drive	Nanaimo
David	Bruce	Vocational Consulting Group	#109–2059 Kaltasin Road	Sooke
Nancy	Buchan	Minoru Sports and Fitness Rehab	7560 Minoru Gate	Richmond
Melanie	Cameron	Workshape	535 Hornby Street	Vancouver
Irene	Chan	CBI Health Centre	217–4800 No. 3 Road	Richmond
Pardeep	Chatha	Asha Counselling Services	#202–15388 24 Avenue	Surrey
Ralph	Cheesman	Back in Motion Functional Assessments Inc	Suite 110– 6651 Elmbridge Way	Richmond
Hazel	Choy	Back in Motion Rehab Inc	#140, 6651 Elmbridge Way	Richmond
Rob	Corcoran	Back in Motion Functional Assessments Inc.	110–6651 Elmbridge Way	Richmond
Adam	Cornett	CBI Health Group	204 – 940 Goldstream Avenue	Victoria

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First Name	Last Name	Organization	Address	City
Maria	Coughlin	Joy Coughlin Physiotherapist Corporation	4515 Daphne Place	Victoria
Lincoln	Cundiff	Evergreen Rehab	3115 Skaha Lake Road	Penticton
Geoff	Dalmer	WorkSafeBC	6951 Westminster Highway	Richmond
Donna	Davidson	CBI Health	15–2665 Cape Horn Avenue	Coquitlam
Carly	Duggleby	Back in Motion Functional Assessments	6651 Elmbridge Way	Richmond
Tricia	Earl	CBI OT Services	101–4300 Wellington Road	Nanaimo
Darren	Earl	CBI Health Group	101–4300 Wellington Road	Nanaimo
Diane	Edwards	Balanced Health Therapeutic Massage	#330 5780 Cambie Street	Vancouver
Deb	Edwards	We Care Health Services	#1108, 7330–137th Street	Surrey
Duane	Endo	WorkSafeBC	6951 Westminster Highway	Richmond
David	Fairweather	Campbell & Fairweather Psychology Group	202–6010 Brickyard Road	Nanaimo
Pauline	Fedder	The Cambie Chiropractic Centre	7293 Cambie Street	Vancouver
Greg	Feehan	Boundary Plaza Psychology	#310, 3665 Kingsway	Vancouver
Jen	Fink	WorkSafeBC	6951 Westminster Highway	Richmond
Kim	Fitton	WorkSafeBC	6951 Westminster Highway	Richmond
Vicky	Forsyth	Back in Motion	#110–6651 Elmbridge Way	Richmond
Finola	Gallagher-Smith	CBI Health Centre	1310–5th Avenue	Prince George
Sheila	Garner	WorkSafeBC	6951 Westminster Highway	Richmond
Stu	Gershman	CBI Health Group	605 Discovery Street	Victoria
Robinder	Gill	North Kamloops Physiotherapy	550 Tranquille Road	Kamloops
Naomi	Goffman	Community Therapists	102–232 E12th Avenue	Vancouver
Anis	Gorginnia	Mountainview Wellness Center	401–426 Columbia Street	New Westminster
Anthony	Gould	IWA-Forest Industry LTD Plan	Suite 150–2955 Virtual Way	Vancouver

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First Name	Last Name	Organization	Address	City
Lee	Grimmer	WorkSafeBC	4980 Wills Road	Nanaimo
Antoinette	Gussenhoven	Banyan Work Health Solutions	1953 Tompkins Crescent	North Vancouver
Mike	Haley	Scott Construction Group	100–1818 Cornwall Avenue	Vancouver
Allyson	Hankins	Bayshore Home Health	#206–2828 152nd Street	Surrey
Ian	Harrison	Scott Construction Group	1818 Cornwall Avenue	Vancouver
Sven	Hartman	VISTA Disability Management	221–119 West Pender Street	Vancouver
Paul	Hatch	Private Practice	15081 86A Avenue	Surrey
Ken	Hemphill	Back in Motion Rehab	#206 –5500 152 Street	Surrey
Robin	Henery	ATF Canada Corp.	150–625 Agnes Street	New Westminster
Susan	Higginbottom	Dr. Susan Higginbottom	300 –1200 Lonsdale Avenue	North Vancouver
Naomi	Hill	Raincoast Community Rehabilitation Services Inc.	2392 Kingsway	Vancouver
Abeed	Hirji	LifeMark Health	#230–181 Keefer Place	Vancouver
Kamla	Hoekstra	Back in Motion Rehab	206–5500 152nd Street	Surrey
Tracie	Holland	Back In Motion Rehab	5500 152nd Street	Surrey
Grace	Hopp	KeyWest Psychology Services	2300–2850 Shaughnessy Street	Port Coquitlam
Nastaran	Hosseini	Mountainview Wellness Centre	401–426 Columbia Street	New Westminster
Zenona	Hrabar	OrionHealth	120, 16555 Fraser Highway	Surrey
Alice	Hsing	RCMP	657 West 37th Avenue	Vancouver
Iveta	Janickova	Treloar Physiotherapy Clinic	505–686 West Broadway	Vancouver
Steven	Jones	CBI Health Centre	2nd Floor	Victoria
Jeannette	Jorgenson	LifeMark Health	101 20230 64th Ave	Langley
Barry	Judge	Drake Medox Surrey	13817–103 Ave	Surrey
Shannon	Kane	CBI Health Centre	605 Discovery Street	Victoria
Michelle	Kegaly	New West Wellness Centre Inc.	140–815 1st Street	New Westminster
John	Kim	Rehabworks Disability Management	PO Box 45017	Langley
Heather	King	Active Life Physiotherapy	145 West 1st Street	North Vancouver
Anthony	Koelink	LifeMark Vancouver	181 Keefer Place	Vancouver

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First Name	Last Name	Organization	Address	City
Sarina	Kot	Private Practice	262–2025 West 42nd Avenue	Vancouver
Cary	Kruger	Kruger Neuro-Rehabilitation Inc.	112–1890 Cooper Road	Kelowna
Bobbi	Laird	Sealyte Counselling Services	25009–140 East Island Highway	Parksville
William	Lakey	BC Public Service	707–808 Nelson Street	Vancouver
Anna	Lam	WorkSafeBC	6951 Westminster Highway	Richmond
Rick	Lau	pt Health	7315 Edmonds Street, Suite 20	Burnaby
Ronald	Laye	Dr. Ronald Laye	2550 Stephens Street	Vancouver
Amy	Lefrancois	Great-West Life	900–1075 West Georgia Street	Vancouver
Mega	Leung	Mega Leung Counselling Services	150–10451 Shellbridge Way	Richmond
Dennis	Leung	Simon Fraser University	8888 University Drive	Burnaby
Sandy	Liles	BC Centre for Ability	Opportunities Fund	Vancouver
Danuta	Lipien	Drake Medox Surrey	13817–103 Avenue	Surrey
John	Loh	Dr. John Loh Chiropractic Corp.	201–3377 Coast Meridian Road	Port Coquitlam
Riley	Louie	CBI Health Centre	217–4800 No. 3 Road	Richmond
Cody	Low	Manulife	Suite 600–1095 West Pender Street	Vancouver
Jennifer	Lyle	Total Therapy	4162 Dawson Street	Burnaby
BILL	LYONS	LIFEMARK	209–12080 Nordel Way	SURREY
John	MacDonald	Private practice	187 West 13th Avenue	Vancouver
Sarah	Macey	South Delta Physiotherapy Clinic	107–1077 56th Street	Delta
Margaret	Mallam	RCMP	657 West 37th Avenue	Vancouver
Yenna	Mansfield	Community Therapists	207–5740 Cambie Street	Vancouver
Brad	Marshell	Drake Medox Surrey	13817–103 Avenue	Surrey
Dave	Maxwell	CBI Health Group	#110–46167 Yale Road	Chilliwack
Lawrence	Miller	Dr. Lawrence Miller, Professional Psychology Corporation	405–3551 Foster Avenue	Vancouver
Dev	Mitra	Drake Medox Kamloops	164 Oriole Road	Kamloops
Barbara	Mott	Great-West Life	900–1075 West Georgia Street	Vancouver

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First Name	Last Name	Organization	Address	City
Mary Jo	Mulgrew	Focus Rehabilitation and Consulting Inc.	#112–1890 Cooper Road	Kelowna
Lesley	Norris	Back in Motion Rehab	210–7525 King George Boulevard	Surrey
Timothy	Ong	Chronic Back Pain Clinic	16490 28th Avenue	Surrey
Lephuong	Ong	OrionHealth	201–3150 East 54th Avenue	Vancouver
Tania	Percy	Progressive Rehab, OrionHealth	#401–3999 Henning Drive	Burnaby
Kathleen	Phillips	We Care Home Health Services	2291 West Railway Street	Abbotsford
Avis	Picton	OrionHealth	5641 Sherwood Boulevard	Delta
Julie	Plummer	Pacific Risk Management	135–10451 Shellbridge Way	Richmond
Audrey	Pons	WorkSafeBC	PO Box 4700 Stn. Terminal	Vancouver
Colleen	Quee-Newell	Dr. Colleen Quee-Newell Inc.	309–2902 West Broadway	Vancouver
Tamara	Rae	OrionHealth – Progressive Rehab	2737 Wyat Place	North Vancouver
Trevor	Randall	CBI Health Centre	2755 Lougheed Highway	Port Coquitlam
Jennifer	Read	OT Works!	1517 London Street	New Westminster
Debra	Richards	Richards and Company	151 Skinner Street	Nanaimo
Chris	Rowe	OrionHealth	120–16555 Fraser Highway	Surrey
Debbie	Ruggiero	ADL Occupational Therapy Inc.	#112–1890 Cooper Road	Kelowna
Joan	Russell	Lifemark Health	104, 1634 Harvey Avenue	Kelowna
Nirmal	Sahota	Orion Health	120–16555 Fraser Hwy	Surrey
Lucy	Samuel	WorkSafeBC	#400–224 West Esplanade	North Vancouver
Patricia	Samuhel	Treloar Physiotherapy Clinic	505–686 West Broadway	Vancouver
Adrienne	Sankey	Minoru Sports & Fitness Rehabilitation	7560 Minoru Gate	Richmond
Susan	Schincariol	UBC	3463 West 28th Avenue	Vancouver
Kelley	Scott	CBI Health Centre	2755 Lougheed Highway	Port Coquitlam

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First Name	Last Name	Organization	Address	City
Peter	Sharpe	Hand Therapy Centers	910 Baycrest Drive	North Vancouver
Nicole	Sloboda	Fraser Health Authority	10765 Beecham Place	Maple Ridge
Brad	Smiley	LifeMark Health	230, 181 Keefer Place	Vancouver
Lindsay	Smith	LifeMark	#104, 1634 Harvey Avenue	Kelowna
Bali	Sohi	Private practice	#319B 2099 Lougheed Highway	Port Coquitlam
Jacqueline	Sordi	Bayshore Home Health	1512 Fort Street	Victoria
Carol	Talley	CBI	2518 Monte Vista Place	Victoria
Roxana	Tatomir	BC Centre for Ability	# 404–3547 Euclid Avenue	Vancouver
Michele	Tedford	WorkSafeBC	6951 Westminster Highway	Richmond
Aurora	To	RCMP	657 West 37th Avenue	Vancouver
Tien Hong	Tsai	Apex Fitness and Rehabilitation	#318 2990 Princess Crescent	Coquitlam
Sabrina	Vaghela	OT Works!	1517 London Street	New Westminster
Gregory	van Popering	KinActive	203–777 West Broadway	Vancouver
Julie	Veilleux	Work In Progress Rehab Specialists	2109–11871 Horseshoe Way	Richmond
Linda	Waithman	Progressive Rehab – OrionHealth	#9–12333 English Avenue	Richmond
Muriel	Wells	South Delta Physiotherapy	107–1077 56th Street	Delta
Yuk Shuen Sandra	Wong	Dr. Wong & Associates Professional Psychology Corporation	337–2184 West Broadway	Vancouver
Matthew	Wright-Smith	Healthx Physical Therapy	20501 Logan Avenue	Langley
Alice	Yu	OrionHealth	201–3150 East 54th Avenue	Vancouver

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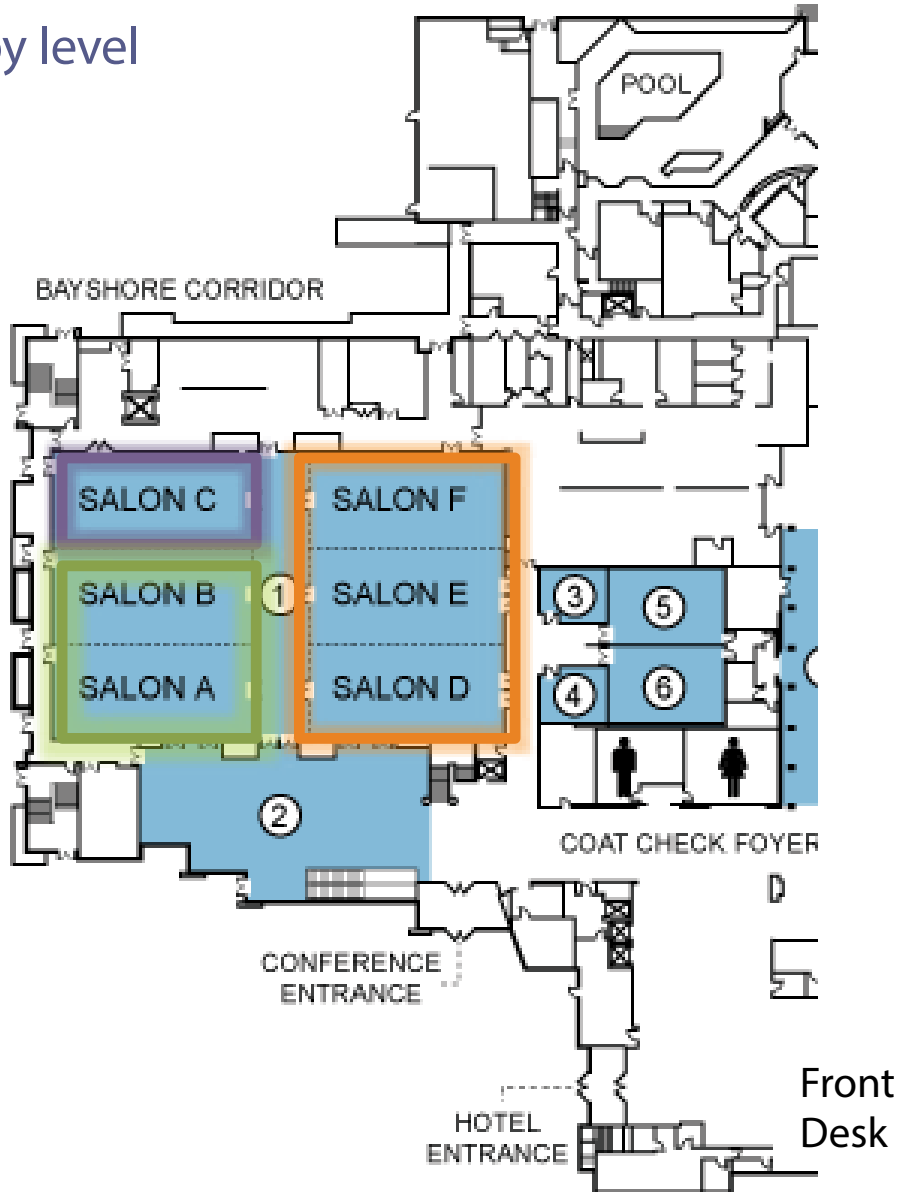
June 8, 2012
8th Annual Health Care Professional Conference
Agenda

Start	End	Topic/Activity	Presenter	Location
7:45	8:20	Registration/Breakfast/Visit booths		
8:20	8:30	Introduction	Scott McCloy Director, Community Relations, WorkSafeBC	Ballroom
8:30	8:45	WorkSafeBC Update	Steve Barnett Chief Financial Officer, WorkSafeBC	Ballroom
8:45	9:25	Cognitive Behavioral Therapy, Motivational Interviewing, and Acceptance and Commitment Therapy as Approaches to Managing Chronic Pain	Dr. Dan O'Connell Institute for Health Care Communication, and University of Washington School of Medicine, Seattle, Washington	Ballroom
9:25	10:05	**Concurrent Workshops:**		
		Management of the Chronic Non-Cancer Pain Patient - the Physiotherapist/ Occupational Therapist Approach	Cara Rodrigues, BSc, BSc (OT) Occupational Therapist, OrionHealth Vancouver Pain Clinic Heather Watson, BEd, BSc, MPT Physiotherapist, LifeMark Health Pain Management Team	Salon C
		Active Rehabilitation for Slow to Recover Concussion	Grant L. Iverson, Ph.D. Director, Neuropsychology Outcome Assessment Laboratory, Professor, Department of Psychiatry, UBC	Ballroom
10:05	10:35	Refreshment break/Visit booths		
10:35	11:50	Panel discussion with all morning guest speakers		Ballroom
11:50	1:00	Lunch/Visit booths		
1:00	1:40	Management of the Shoulder from a Surgeon's Perspective: Diagnosis, Treatment including Postoperative, and Anticipated Recovery	Dr. Robert Hawkins, MD Orthopaedic Surgeon, Clinical Professor of Orthopaedic Surgery at UBC	Ballroom

Start	End	Topic/Activity	Presenter	
1:40	2:20	**Concurrent Workshops:**		
		Musculoskeletal imaging on: back, shoulder and knee	Dr. Hugue Ouellette, MD, FRCP Musculoskeletal Radiologist at both Vancouver General and UBC Hospitals, Assistant Professor at the UBC Department of Radiology	Salon C
		A New Approach to Managing Workplace Shoulder Injuries: concepts, construct and early findings from the WorkSafeBC-Fraser Health Authority-PABC Shoulder Pilot Project	Jamie MacGregor, BSc (PT), BSc (Kin), CHT Physiotherapist and Certified Hand Therapist, and the Physiotherapy Association of British Columbia's WorkSafeBC Liaison	Ballroom
2:20	2:40	Refreshment break/Visit booths		
2:40	3:55	Panel discussion with all afternoon guest speakers		Ballroom
3:55	4:15	Closing remarks	Scott McCloy Director, Community Relations, WorkSafeBC	Ballroom

Room Location Map

Lobby level

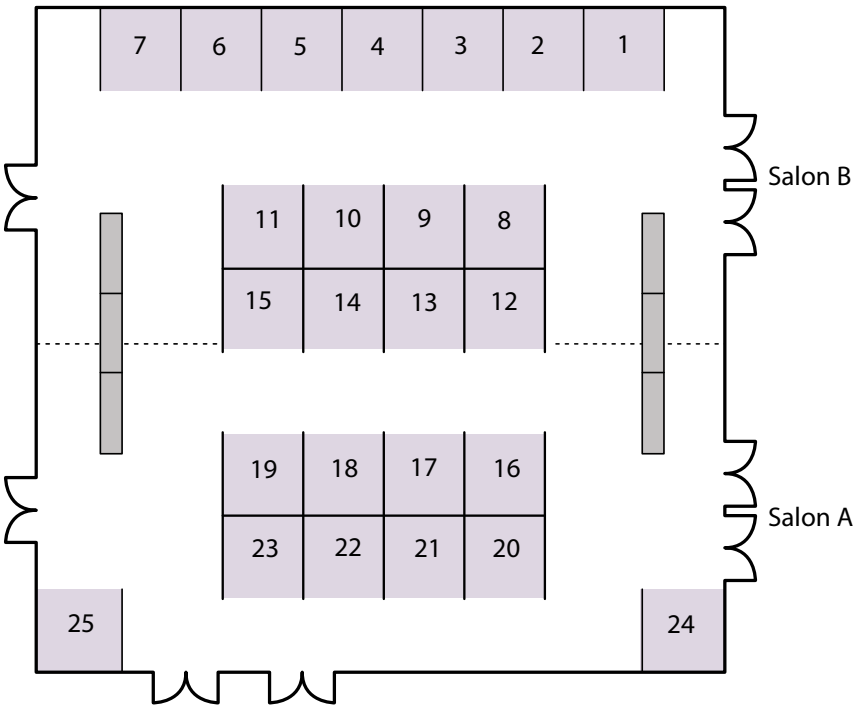


Plenary room

Breakout room

Exhibitor room

Exhibitor Floor Plan



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5.	LifeMark Health	LifeMark HEALTH
6.	CBI Health Group	CBI HEALTH GROUP
7.	Valco	VALCO
8.	BC MedEquip	BC MEDEQUIP
9.	Orion Health	OrionHealth REHABILITATION & ASSESSMENT CENTRES
10.	Classic LifeCare	Classic LifeCare
11.	Connect Communities	connect connectcommunities.ca
12.	We Care Home Care	we care HOME HEALTH SERVICES
13.	Macdonald's	Macdonald's
14.	Community Therapists	community therapists
15.	ChairLines	CHAIRLINES TOTAL OFFICE SOLUTIONS
16.	Edgewood	EDGEWOOD
17.	PT Health	pt Health SOLUTIONS TO GET WELL & STAY WELL
18.	Bayshore Home Health	Bayshore Home Health
19.	Canadian Magnetic Imaging	cmi
20.	OT Works	OT Works!
21.	WorkSafeBC, Industry and Labour Services (Health Care)	WORK SAFE BC WORKING TO MAKE A DIFFERENCE
22.	Massage Therapists' Association of British Columbia	REGISTERED MASSAGE THERAPIST RMT
23.	Paris Orthotics/ SportMed	orthotics SPORTMED
24.	WorkSafeBC, Health Care Services	WORK SAFE BC WORKING TO MAKE A DIFFERENCE
25.	WorkSafeBC, Evidence Based Practice Group	WORK SAFE BC WORKING TO MAKE A DIFFERENCE

Up to date as of June 1, 2012

Speaker Disclosure Statements

All presenters participating in these programs are expected to disclose to the program audiences any real or apparent conflict of interest related to the content of their presentation.

Guest Speaker	The following information discloses my relationship with WorkSafeBC (Workers' Compensation Board), and/or other corporate sponsors that might relate in some way to the presentation of my subject at this conference
Steve Barnett	Nothing additional to biography
Dr. Robert H. Hawkins	Nothing additional to biography
Dr. Grant Iverson	Nothing additional to biography
Jamie MacGregor	Nothing additional to biography
Scott McCloy	Nothing additional to biography
Dr. Daniel O'Connell	Nothing additional to biography
Dr. Hugue Ouellette	Nothing additional to biography
Cara Rodrigues	Nothing additional to biography
Heather Watson	Nothing additional to biography

• Steve Barnett •

Steve completed his undergraduate degree at Washington State University, articled as a chartered accountant, and upon completing his CA, began a career in the financial side of school district administration. It culminated in 1994 when he was appointed assistant deputy minister of finance and administration in the B.C. Ministry of Education.

In 1996, Steve joined the Workers' Compensation Board, serving as front-line manager of a claims office. Over the next few years, he moved into senior management and director roles. In 1999, he was appointed executive director of Compensation Services, taking on responsibility for claims operations province-wide. In 2002, Steve became executive director of rehabilitation and administration in the Compensation Services division, focusing on the external rehabilitation network and how it interacted with adjudication. In early 2004, he was appointed vice-president. One year later, Steve also became the assistant CFO of the newly renamed WorkSafeBC. In January 2008, he was named CFO, and was also responsible for overseeing the Claims Management Solutions project, implemented in 2009.

Steve is married with three step-daughters and five grandchildren, all of whom he enjoys spending time with. The odd game of golf is nice, too.

Notes

Notes

• Dr. Robert H. Hawkins •

Dr. Robert H. Hawkins is a Clinical Professor of Orthopaedic Surgery at the University of British Columbia. He currently practices orthopaedic surgery in Vancouver with privileges at Vancouver General Hospital, and he is actively involved in undergraduate and postgraduate orthopaedic education.

In 1983, Dr. Hawkins did a Clinical Scholarship in Shoulder with Dr. R.J. Hawkins in London, Ontario, and thereafter developed a special interest in shoulder and upper extremity disorders. In 1995, he was elected associate membership in the American Shoulder and Elbow Surgeons, and in 2004 he was elected to active membership.

Topic: Management of Shoulder Injuries: A Surgeon's Perspective

The learning objectives are:

- Become familiar with the most common causes of shoulder pain in Injured Workers
- Identify shoulder injuries which require immediate surgical attention
- Describe when shoulder injuries should and should not be referred for surgery
- Learn why reconstructive surgery is usually postponed in patients diagnosed with frozen shoulder
- Understand the dilemma of elective shoulder surgery in the setting of excessive chronic pain
- Describe the four most common shoulder injuries and their post-operative rehabilitation

Management of Shoulder Injuries
A Surgeon's Perspective

Robert H Hawkins MD FRCS(C)
Clinical Professor
Department of Orthopaedics
University of British Columbia

Course Objectives:

At the conclusion of this course participants will be able to:

1. List common shoulder injuries seen in the worker
2. Describe the treatment, recovery and prognosis of these injuries
3. Recognize the features that suggest early referral
4. Recognize features that represent complicating co-morbidities which will not be helped by early surgical intervention

Common shoulder injuries:

Proximal humeral fracture
AC separation
Glenohumeral dislocation
Acute cuff tear
Long head of biceps tear
Pectoralis major tendon tear

General concepts for treatment and recovery

Pre-emptive analgesia

- Interscalene block
- Bipuvicaine wound infiltration
- Cold compression device
- Multi-modal analgesic medication
- Anti-inflammatories
- Plain acetomenophen
- Acetomenophen with codeine
- Oral narcotic

Three Phase Rehabilitation Program

Acute phase→Recovery Phase→Functional Phase

1. Acute Phase or Phase I

Onset at injury/ surgery

Tissues are unstable/ require protection
Objective: create a stable environment
Example: fracture→cast

2. Recovery Phase or Phase II
Healing tissues now stable
Objective: restore function in motion, force couple balance scapular stability and kinematic chain
active and early resistive exercises
Example: treat stiffness and weakness

3. Functional Phase or Phase III
Motion and strength are now largely restored
Objective: address remaining deficits eg co-ordination endurance etc
May start modified athletic activity or RTW at modified duty
Example: functional progressions to allow return to work/ play

Determining stage of recovery:

- Fracture not healed? → still in acute phase
- Fracture healed, limb weak and joint stiff?→ ready for recovery phase
- Fracture healed, joint mobile and limb strong, lacks co-ordination and endurance?→ advance to functional phase

Recognizing abnormally prolonged pain

Types of pain:
1. Nociceptive pain
– tissue damage
2. Neuropathic pain
-damage to neural tissue, allodynia, hyperpathia, dysesthesias

How the surgeon should approach prolonged pain:

- After physical recovery RTW often delayed by prolonged pain
- Prolonged pain may indicate unrecognized pathology
- Re-examine
- Re-image
- Re-consider psycho-social factors
- Pain signal can outlast peripheral tissue injury because of central sensitization

The Injured Worker with prolonged pain:

- injured worker suffers the same physical injuries that everyone else does – in the acute setting: dislocations, fractures, AC separations, cuff contusions ; in the chronic repetitive setting: bursitis/ tendonitis
- injured worker may have additional challenges

1. <u>anxiety</u> - anxiety of a frightening workplace injury; fear of having to return to a hostile work environment; worry about not being able to return to a job that is physically difficult but pays well. This is the element of "psycho-social issues"

which are well known to influence pain processing (both longevity and intensity).

2. Pre-injury co-morbidities some people already accept as their own responsibility: alcohol and other substance abuse; tobacco dependency; obesity; anger issues; limited education or limited educational potential; poor coping ability; family stresses
3. Entitlement: "they told me this job came with benefits if I got injured and my union steward is supposed to help me deal with all of this shit"

Shoulder Injuries and Surgeries

Proximal humeral fractures

Four potential "parts": articular segment; shaft segment; greater tuberosity; lesser tuberosity

Determine: is fracture displaced? Is fracture stable?

Considered displaced if any segment shifted >1 cm or angulated >45°

- Stable and undisplaced: start early ROM
- Unstable and undisplaced: sling for 3 weeks until "knitting" ie stable then start ROM
- Displaced: closed or open reduction and internal fixation; thus stabilized so start early ROM
- Phase III is usually delayed until 3 months

AC Separations

- First degree:
    - AC ligaments strained; CC ligaments intact
    - AC tender but no "bump" or step
    - Joint is stable so commence early ROM according to symptoms
- Second degree:
    - AC ligaments torn; CC ligaments strained
    - AC "bump" or step is small
    - Accept minor deformity; ice and rest for 10 days then ROM
- Third degree:
    - AC and CC ligaments torn
    - Large "bump"
    - For most workers/ athletes accept deformity; sling or Kenny-Howard brace 4-6 weeks; then ROM
    - Surgery if severe "ear-tickler" deformity and in selected athletes

  When to refer: severe deformity

Rotator cuff injuries

1. External impingement (tendinosis) –cuff is intact
2. Partial thickness tears
3. Full thickness tears:

i. <1 cm = small
ii. 1-3 cm = medium
iii. 3-5 cm = large
iv. >5 cm =massive

Principles:

- Younger cuff is strong thus large forces required to cause rupture; fracture more likely
- Old cuff is weak and may rupture with little or no warning
- Silent cuff tears are common: in a person with widespread soft tissue pain an MRI will often show one and surgery may not help
- After acute injury eg shoulder strain or dislocation suspect cuff tear if significant weakness persists > 3 weeks
- Xray will only rule out a fracture; get ultrasound or MRI
- When to refer: persistent weakness after subsidence of acute pain especially drop-arm sign ER weakness
- A partial thickness or small full thickness tear does not alter shoulder biomechanics very much so may recover well and if not is easy to repair
- A large or massive tear alters biomechanics significantly; can be very hard to repair if neglected
- Not all tears need surgery but natural history is for PT tear→FT tear; and small FT tear→big FT tear

- If non-surgical approach is adopted then put patient on a "watch list": re-assess/ re-image periodically

When to refer:

- Any tear medium or large tear
- Prolonged significant weakness
- Prolonged significant pain

When not to refer:

- Resolution of pain and weakness ("watch list")

Post-operative care of rotator cuff repair

- Repairs of even small tears can be fragile [12]
- Massive
    - Phase I: 0-6 weeks passive elevation (no reciprocal pulley[13])
        - 6-12 weeks assistive exercises
    - Phase II: no active/resistive exercises until >3 mos
- Small-Large:
    - Phase I: 0-6 weeks assistive only
    - Phase II: begin active/ resistive at 6-10 weeks depending on size
    - Phase III: after 3 mos depending on size

Cuff tear arthropathy

- A unique form of glenohumeral arthritis caused by prolonged mechanical/ vertical instability associated with a long-standing large or massive cuff tear
- Only 5% of cuff tears will progress to CTA
- Shoulder is painfully weak often recurrently swollen: marked lag signs (drop arm, hornblower's signs)
- Recurrent painful bleeds if on anti-coagulants
- Conventional total shoulder prosthesis will loosen and fail in absence of functioning rotator cuff
- Surgical treatment: hemi-arthroplasty with lat transfer; reverse shoulder prothesis

Bankart and Inferior Capsular Shift

Surgical procedure: arthroscopic repair of the Bankart lesion (detachment of antero-inferior labrum) and capsulorrhaphy

- Phase I:
    - 3 weeks in sling (<20 yrs of age – 3-4 weeks; 20-30 yrs – 3 weeks; 30-50 yrs - 2 weeks; >50 yrs 1-2 weeks)
    - Codman exercises
- Phase II: sling off; gentle stretching for elevation and ER
- Phase II: after 4 months; proprioceptive drills
- No return to collision sports until >6 mos

Long head of biceps rupture

Commonly spontaneous or with minimal trauma (lawn mower starter cord)
Upper arm bruising and "popeye" muscle
Short head remains intact so function preserved
Consequences of non-operative care or neglect:

- Cosmetic deformity
- Elbow flexion weakness recovers
- Forearm supination weakness recovers to 80-90% of full
- Uncommon biceps cramping

Consequences of surgical treatment:

- Cannot "repair" only tenodesis (ie does not restore any of LHB function in GH joint)
- Cosmetic deformity improved or removed
- Elbow flexion weakness recovers
- Forearm supination weakness recovers to 90-95% of full
- Biceps cramping less likely

Conclusion:

- tenodesis only in <50 year olds
- when you see an acute "popeye" deformity, worry about the rotator cuff not the LHB

Notes

• Dr. Grant Iverson, Ph.D. •

Dr. Grant Iverson is a Professor in the Department of Psychiatry at the University of British Columbia, and he is a clinician scientist, with over 230 published articles and book chapters. Dr. Iverson has a longstanding research interest in outcome from sport-related concussion and mild traumatic brain injury, and he's involved in ongoing clinical research with injured athletes, civilians, active duty military personnel, and veterans. His work is internationally recognized in this area.

Dr. Iverson was a consensus panel member for the 3rd International Conference on Concussion in Sport in Zurich, Switzerland, in 2008, and was a founding member of the Traumatic Brain Injury Subcommittee of the Defense Health Board, a civilian advisory board to the United States Secretary of Defense. He currently serves on the Steering Committee to develop a Brain Injury Research Strategy for Canada.

Professor Iverson is currently collaborating on several studies relating to outcome from mild traumatic brain injury with researchers from the U.S. Army, Defense and Veterans Brain Injury Center, and the U.S. Department of Veterans Affairs.

Workshop session: Active Rehabilitation for Slow to Recover Concussion

The learning objectives are:

- To appreciate the limitations of "watchful waiting" in patients with mild Traumatic Brain Injury (TBIs).
- To encourage active rehabilitation for athletes, workers, and military service members who are slow to recover following head trauma.
- To recognize the special treatment and rehabilitation needs of workers who sustain mild TBIs and multiple bodily injuries

Active Rehabilitation for Slow to Recover Concussion

Grant L. Iverson, Ph.D., Professor

Faculty of Medicine
Department of Psychiatry
University of British Columbia

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- Alcohol Beverage Medical Research Council
- Rehabilitation Research and Development (RR&D) Service of the US Department of Veterans Affairs
- Defense and Veterans Brain Injury Center

It is essential to appreciate that…

Mild Traumatic Brain Injuries are Not Created Equally

Spectrum of MTBI

Extremely Mild (Transient)

Structural Damage (Permanent)

Continuum of Pathophysiology

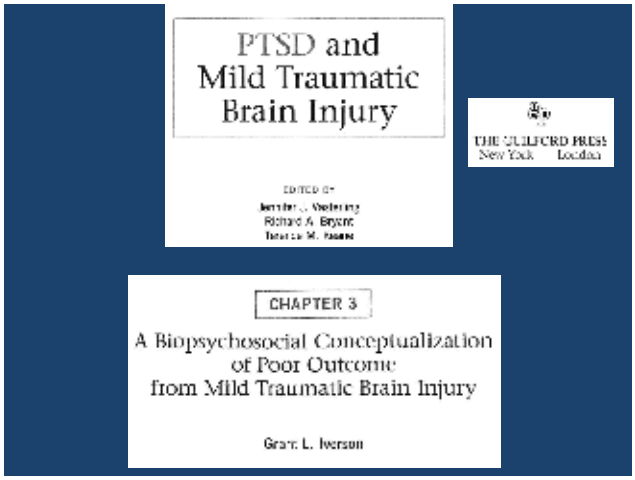
Minor Neurometabolic

Major Neurometabolic & Pathoanatomical (e.g., Contusion)

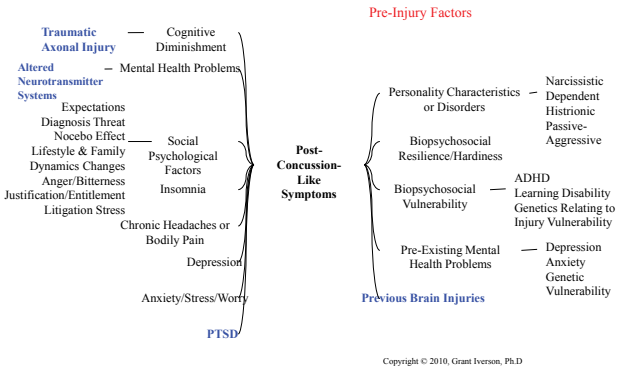
Continuum of Biological & Psychological Vulnerability

Extremely Hardy — Extremely Vulnerable

There is no *simple*, reasonably explanatory model for good or poor outcome



Biopsychosocial Model for Poor Outcome



Content of this Presentation

- Rationale for Active Rehabilitation
- Exercise as a Component of Treatment
- Treatment & Rehabilitation Strategies

Consensus-based guidelines exist for managing typical sport-related concussions in adolescents and adults

(Zurich)

No evidence-based guidelines exist for treatment and rehabilitation services for children, adolescents, adults, or older adults who are slow to recover following concussion

Typical vs. Atypical Recovery

- Clinicians, athletic trainers, and coaches know that some athletes have atypical recoveries
- What we don't understand well:
  - Characteristics?
  - Risk factors?
  - Recommendations for management?

Management Protocol: Stepwise

- No activity / Rest
- Light aerobic exercise
- Sport-specific exercise
- Non-contact training drills
- Full contact practice
- Return to play

Rationale for Rest

- Neurobiology of acute concussion (e.g., ionic fluxes, hypermetabolism, neurotransmitter systems)
- Avoid overlapping injuries (and possible overlapping or magnified pathophysiology)
- "Temporal Window" for neuroplasticity (animal studies)

Possible Risk Factors for Persistent Symptoms

- Multiple previous injuries
- Overlapping injuries
- Vestibular injury
- Trauma-triggered migraine; migraine exacerbation
- Adverse psychological reaction to injury

Additional Possible Risk Factors

- Pre-existing vulnerabilities
  - Destabilized following injury
  - Mechanisms of destabilization: biopsychosocial
- Ongoing cellular dysfunction due to injury

Athletes with Pre-Existing Problems or Vulnerabilities

Poorly Understood

- Pre-existing mental health problems
  - Depression
  - Anxiety
- Genetic loading and pre-existing mental health problems
- Risk for prolonged mental health problems following injury

Athletes with a Pronounced Adverse Psychological Reaction to Injury

Reactions to Injury

- Anxiety, stress, worry, fear
- Anger
- Discouragement
- Sleep disturbance
- Mild depression
- Altered sense of self

Reactions to Injury

- Prospective study of amateur athletes
- Physical injury was associated with:
  - Increased symptoms of depression
  - Increased anger
  - Decreased vigor

Smith et al. (1993)

Injured Male Collegiate Athletes

- 343 young men
- 10 sports
- Injured athletes exhibited greater depression and anxiety and lower self-esteem than controls immediately following physical injury and at follow-up 2 months later.

Leddy et al. (1994)

High athletic identity is associated with greater experience of depressive symptoms in injured adolescent athletes (Manuel et al., 2002)

Researchers have reported that mood state is related to perceived PROGRESS in rehabilitation

Active Rehabilitation for Slow to Recover

Why?

When?

How?

Treatment & Rehabilitation Strategies

- Provide education & reassurance
- Address the athlete's personal, family, team, and school stressors
- Collaborate with the school
- Collaborate with the parents, trainer, coach, family doctor
- Anxiety and stress management
- Use exercise as treatment (and increase school, social, and recreational activity participation)

Converging lines of diverse medical and scientific evidence support the use of exercise as a core component of treatment for adults (and children ??) who have poor outcome from mild TBI.

Exercise as Treatment

- Exercise facilitates molecular markers of neuroplasticity and promotes neurogenesis in the healthy rodent brain and the injured brain.
- Associated with changes in neurotransmitter systems (Chaouloff, 1989; Molteni, Ying, & Gomez-Pinilla, 2002).

Exercise

- Improved mood and lower stress (Callaghan, 2004; Conn, 2010)
- Improved sleep quality (Youngstedt, 2005)
- Positive effects on self-esteem (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004)

Exercise

- Effective treatment, or adjunctive treatment, for mild forms of anxiety and depression (Daley, 2008; Mead et al., 2009; Rethorst, Wipfli, & Landers, 2009)
- Associated with reduced pain and disability in patients with chronic low back pain (Bell & Burnett, 2009; Henchoz & Kai-Lik So, 2008)
- Regular long-term aerobic exercise reduces migraine frequency, severity, and duration (Koseoglu, Akboyraz, Soyuer, & Ersoy, 2003; Lockett & Campbell, 1992)

Exercise

- Most research relating to exercise and cognitive functioning has been conducted with adults and older adults.
- In a meta-analysis of 29 studies, people who were randomly assigned to receive aerobic exercise training had small improvements in attention, processing speed, memory, and executive functioning (Smith et al., 2010).
- Mechanisms not well understood.

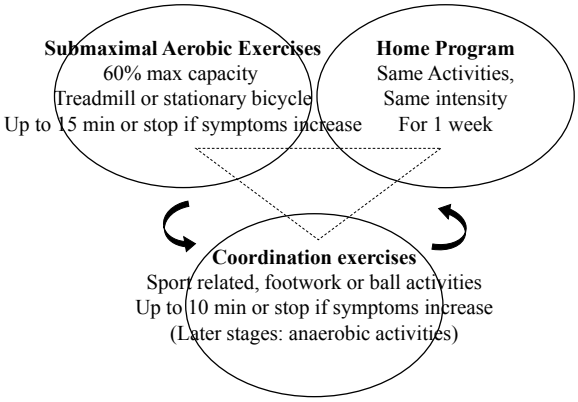
British Columbia Concussion Rehabilitation Program (BC-CRP)

- Supervised protocol for exertional testing as part of the stepwise return to play program
- Circuit training for slow to recover adults
- Has not been used with children
- Has been adapted for Injured Workers

Active Rehab for Slow-to-Recover Children

- Montreal Children's Hospital
- Implemented after one month post injury
- For this group, significant lifestyle restrictions, including avoiding physical activity, can actually contribute to symptom maintenance over time.
- The longer a child (or adult) has symptoms, the more likely it is that other factors that are separate from or only partially related to the neurobiology of the original injury are causing or maintaining the symptoms.

Gagnon, Galli, Friedman, and Iverson (2009)



First Study

- All 16 of the children and adolescents who participated in the program experienced a relatively rapid recovery and returned to their normal lifestyles and sport participation.

Gagnon et al. 2009

Treatment & Rehabilitation for Injured Workers

The Management of Concussion/mTBI Working Group. (2009). *VA/DoD clinical practice guideline for management of concussion/mild traumatic brain injury (mTBI)*

General Principles

- Treatment of somatic complaints (e.g., sleep, dizziness/coordination problems, vision, fatigue) should be based upon individual factors and symptom presentation.
- Headache is the single most common symptom and assessment and management of headaches in individuals should parallel those for other causes of headache.
- Medication for ameliorating the neurocognitive effects attributed to mild TBI is not recommended.

- Treatment of psychiatric symptoms and problems may include both psychotherapeutic and pharmacological treatment modalities.
- In patients with persistent post-concussive symptoms, that have been refractory to treatment, consideration should be given to other factors including psychiatric, psychosocial support, and compensatory/litigation issues.

Common Symptoms Following Concussion/MTBI	Pharmacological Treatment	Non-Pharmacologic Treatment	Referral After Failed Response to Initial Treatment
Headaches	Non narcotic pain meds NSAIDs Triptans (migraine type)	Sleep education Physical therapy Relaxation	Neurology Pain clinic
Feeling dizzy	Antibiotics, decongestants for infections, and fluid		Dizzy: ENT/Neurology after ENT interventions
Loss of balance Poor coordination		Physical therapy	Neurology
Nausea	Antiemetics	Sleep education	GI
Change in appetite			Consider Mental Health
Sleep disturbances -Difficulty falling or staying a sleep (insomnia)	Sleep Medications	Sleep education	Mental Health PM&R Neurology
Vision problems -Blurring -Trouble seeing -Sensitivity to light		Sleep education Light desensitization Sunglasses	Optometry Ophthalmology**
Hearing difficulty -Sensitivity to noise		Environmental modifications	Audiology ENT Sensitivity to Noise: Speech and Language Pathology

Psychological Treatment

- Cognitive Behavior Therapy
- Self-Management
- Behavioral Activation
- Stress Management
- Acceptance & Commitment Therapy

Conclusions

Some people have atypical, protracted recoveries following concussion

No evidence-based guidelines exist for treatment and rehabilitation services for children, adolescents, adults, or older adults who are slow to recover following concussion

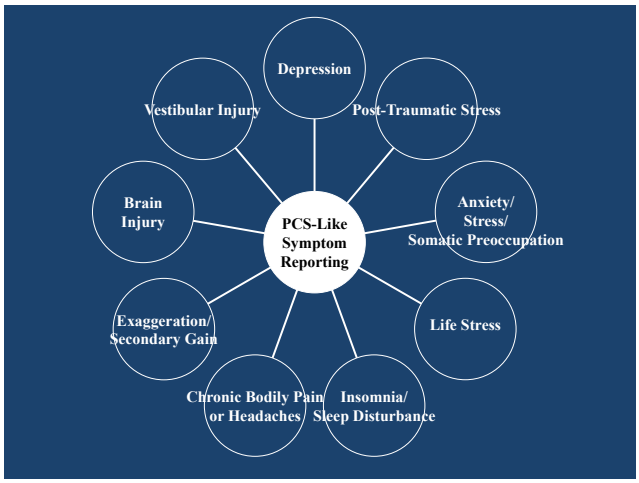
Converging lines of diverse medical and scientific evidence support the use of active rehabilitation

Careful and Comprehensive Assessment = Targets for Treatment and Rehabilitation

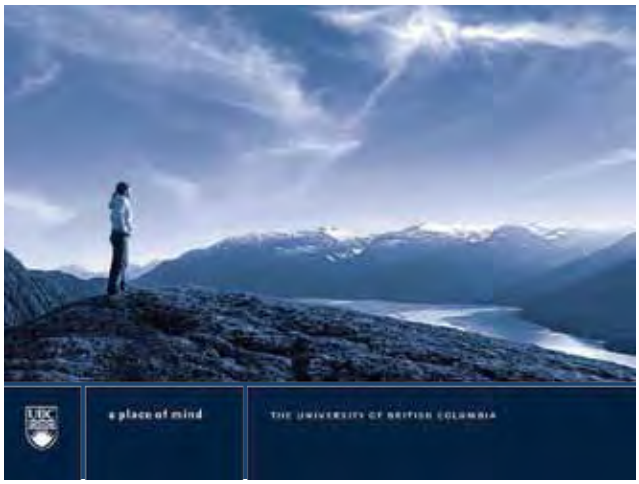
Reduce Symptoms; Improve Function

- Sleep Disturbance
- Stress & Anxiety
- Depression
- Deconditioning
- Headaches
- Bodily Pain

Treat What You Can Treat


Depression
Vestibular Injury
Post-Traumatic Stress
Brain Injury
PCS-Like Symptom Reporting
Anxiety/ Stress/ Somatic Preoccupation
Exaggeration/ Secondary Gain
Life Stress
Chronic Bodily Pain or Headaches
Insomnia/ Sleep Disturbance


Thank You


a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Active Rehabilitation for Slow-to-Recover Children

Grant L. Iverson, Isabelle Gagnon, and Grace S. Griesbach

No evidence-based guidelines exist for treatment and rehabilitation services for children and adolescents who are slow to recover following a mild traumatic brain injury (mTBI). While children are acutely injured, we believe that it is prudent to provide them and their families with early education and reassurance as well as to strongly encourage (1) rest, (2) taking time off from sports (including noncontact activities such as physical education classes in school and extracurricular dance), and (3) avoiding vigorous play. During this time period children might also benefit from substantial reductions in mental activity and stimulation, such as attending school, writing exams, or playing video games. Mental and physical rest following injury has been strongly encouraged for sport-related concussion in agreement and consensus statements (McCrory et al., 2005, 2009).

From a practical perspective, enforcement of complete rest, especially for active children and adolescents involved in many sports, is very difficult, and determinations of how much school is reasonable to miss are not easy to make. Basically, parents are expected to monitor injured children's symptoms and to work with a physician and other health care professionals who have expertise in concussion management (if available) on a plan for returning to school, extracurricular activities, and sports. As we wait for scientific evidence to accumulate regarding the best strategies for managing the acute recovery period and for returning to activities, common sense and clinical judgment prevail.

Fortunately, most children who sustain mTBIs appear to recover, functionally, within the first few weeks postinjury. Some children, however, report persisting symptoms. For children with persisting symptoms, four options are available for ongoing management: (1) encourage continued rest and avoid vigorous activity; (2) allow the child to engage in limited activities under parental supervision; (3) provide

symptomatic treatment (e.g., analgesics and antimigraine medications for headaches, or psychological treatment for behavioral issues); or (4) implement active rehabilitation. The first two options rely on "watchful waiting."

The purpose of this chapter is to encourage an active approach to treatment and rehabilitation for children who are slow to recover after an mTBI, in order to reduce symptoms and improve functioning in a more timely manner. Children who are slow to recover are at risk for secondary problems and consequences if their normal activities are curtailed for extended periods of time—while they wait for complete resolution of symptoms. These problems include, but are not limited to, physical deconditioning, anxiety and stress, mild depression, irritability, and acting-out behavior at home and at school. Moreover, as time passes, the strength of the association between the neurobiology of the original injury and the ongoing symptoms likely diminishes, whereas the importance of preexisting factors (e.g., mental health problems, attention-deficit/hyperactivity disorder [ADHD], social–emotional adjustment issues) and current noninjury factors (e.g., dispositional, mental health, situational, and environmental issues) increases. Eventually, for most cases, determining what is causing, maintaining, or exacerbating symptoms becomes nearly impossible. Thus, prolonged activity restrictions might actually be iatrogenic in some cases.

There is a dearth of direct scientific evidence that active rehabilitation with children who are slow to recover after mTBI is time-effective, cost-effective, or clinically efficacious. There simply has been very little clinical research in this area. However, considerable indirect evidence, in multiple areas, supports an active rehabilitation approach. In the first section of this chapter, we provide the rationale for encouraging rest and providing education and reassurance while acutely injured—prior to initiating active rehabilitation. In the second section, we review diverse lines of indirect evidence that support an active rehabilitation approach. In the third section, we discuss education and reassurance as an early intervention strategy. In the fourth section, we describe an active rehabilitation program based at Montreal Children's Hospital. The chapter concludes with a summary and directions for future research.

RATIONALE FOR REST DURING THE "TEMPORAL WINDOW"

The rationale for rest following concussion comes from four lines of evidence. First, based on neuroscience literature, concussions are assumed to cause complex, interwoven cellular and vascular changes characterized by ionic shifts, abnormal energy metabolism, diminished cerebral blood flow, and impaired neurotransmission (Giza & Hovda, 2001, 2004). The stretching of axons results in an indiscriminate release of neurotransmitters and uncontrolled ionic fluxes. Mechanoporation, the development of transient membrane pores due to mechanical force, allows calcium (Ca^{2+}) influx and potassium (K^{+}) efflux, contributing to rapid and widespread depolarization. Cells respond by activating ion pumps in an attempt to restore the normal membrane potential, increasing glucose utilization (i.e., accelerated glycolysis). There also appears to be impaired oxidative metabolism. These factors contribute to a state of hypermetabolism, which occurs in tandem with decreased cerebral blood flow. During the early postinjury period, cerebral metabolism is likely dedicated to restoring

cerebral function. Thus, placing an energy demand on the system, through exercise, could compromise restorative events.

Second, concussions can have an enormously adverse effect on physical and cognitive functioning in the first few days postinjury. In a meta-analysis of 39 studies, the acute adverse effect of sport-related concussion on objectively measured cognition was shown to be large (Hedge's $g = -.81$), and the adverse effect on balance ($g = -2.56$) and subjective symptoms ($g = -3.31$) was very large (Broglio & Puetz, 2008). As seen in Figure 14.1, the "average" acute effect of concussion on cognition is comparable to the effect of early dementia. Notably, if the "average" deviation from normal is approximately one standard deviation, then some people will have no appreciable cognitive deficits, and some will have extremely low cognitive test scores (e.g., > 2 *SD*s from the mean). As seen in Figure 14.2, the acute effect of concussion on balance and subjectively experienced symptoms is enormous. In addition to

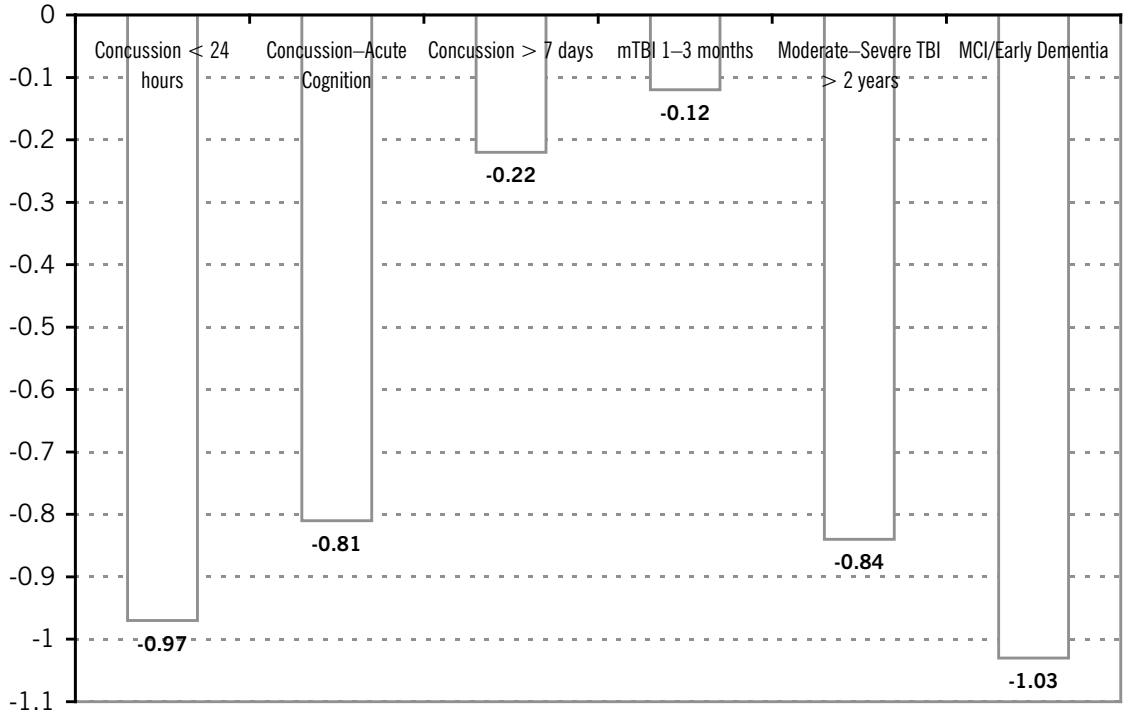


FIGURE 14.1. Meta-analytic effect sizes: Adverse effects on neuropsychological functioning. As a rule, the studies in the meta-analyses do not involve children, but some involve high school athletes. Effect sizes typically are expressed in pooled, weighted standard deviation units. However, across studies, there are some minor variations in the methods of calculation. By convention, effect sizes of 0.2 are considered small, 0.5 medium, and 0.8 large. This is from a statistical, not necessarily clinical, perspective. For this figure, the overall effect on cognitive or neuropsychological functioning is reported. Effect sizes less than 0.3 should be considered very small and difficult to detect in individual patients because the patients and control groups largely overlap. Sport-related concussion < 24 hours and > 7 days from Belanger and Vanderploeg (2005); concussion–acute from Broglio and Puetz (2008); mTBI 1–3 months and moderate-severe > 24 months in Schretlen and Shapiro (2003); and mild cognitive impairment (MCI) or early dementia based on memory testing (Bäckman, Jones, Berger, Laukka, & Small, 2005).

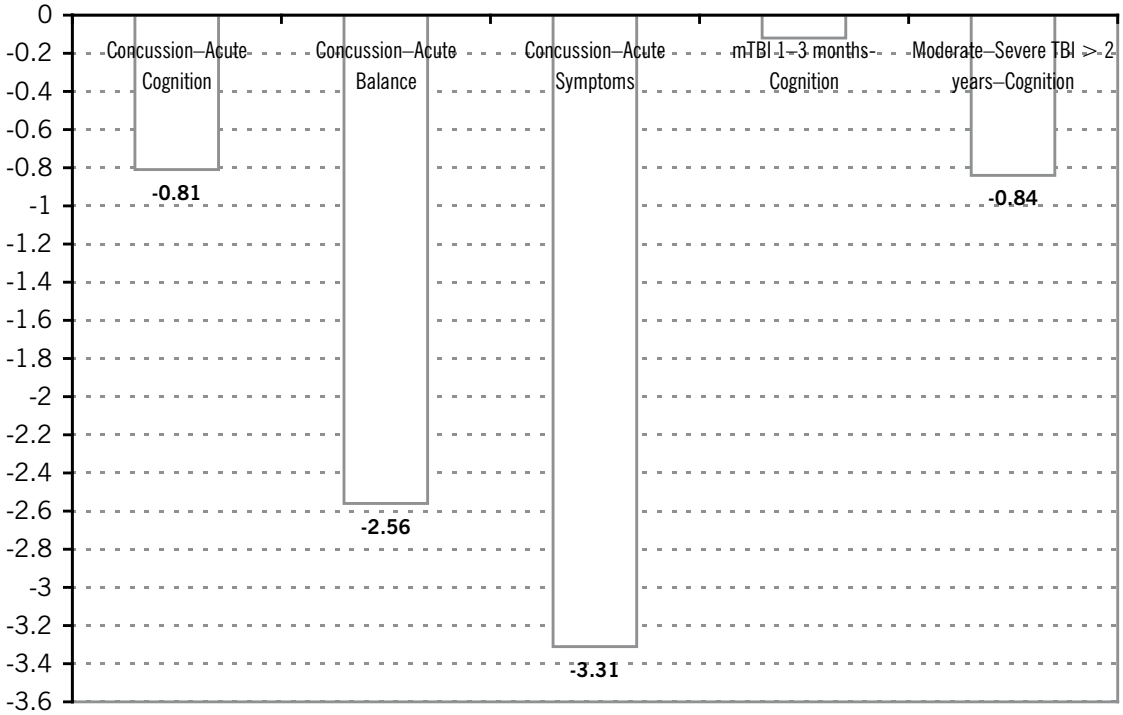


FIGURE 14.2. Meta-analytic effect sizes: Adverse effects of mTBI on functioning. As a rule, the studies in the meta-analyses do not involve children, but some involve high school athletes. Effect sizes typically are expressed in pooled, weighted standard deviation units. However, across studies, there are some minor variations in the methods of calculation. Sport-related concussion–acute from Broglio and Puetz (2008); mTBI 1–3 months and moderate–severe > 24 months in Schretlen and Shapiro (2003).

objective evidence of cognitive and balance impairments, concussions are associated with widespread physical (e.g., headaches, dizziness, nausea, light and noise sensitivity, fatigue, hypersomnia/insomnia) and neurobehavioral (e.g., irritability, emotional dysregulation) symptoms in the acute postinjury period.

Third, evidence is emerging in the animal literature that there is a "temporal window" of vulnerability during which a second injury results in magnified cognitive and behavioral deficits and greater levels of traumatic axonal injury (Laurer et al., 2001; Longhi et al., 2005; Vagnozzi et al., 2007). That is, mice that are reinjured during this temporal window have worse behavioral and neurobiological outcomes than mice who are reinjured after the temporal window. Taken together, human studies illustrate that concussions can have an enormously adverse effect on subjective symptoms, balance, and cognition in the first 48 hours postinjury—and animal studies show that reinjury during the temporal window can lead to worse outcome. Thus, from a clinical management perspective, promoting rest during the acute recovery period prevents possible magnified pathophysiology attributable to overlapping injuries.

Finally, as described later in this chapter, when animals are allowed to exercise too soon after an injury, they do not show exercise-induced increases in molecular

markers of neuroplasticity. Disruptions in cellular function due to metabolic alterations might interfere with the positive effects of exercise on neurobiology. Brain injuries result in alterations such as mitochondrial dysfunction, decreases in blood flow, and changes in glucose metabolism that compromise neuronal functioning and signaling. Theoretically, increasing energy demand during the period of restoration and recovery could compound the hypermetabolism and slow the recovery process. These lines of evidence support the recommendation for rest during the acute recovery period. However, the optimal duration of this rest period following very mild injuries is unknown, but is likely to be days (rather than weeks to months).

EDUCATION AND REASSURANCE AS AN EARLY INTERVENTION STRATEGY

Most research relating to education and reassurance as a treatment intervention following mTBI has been done with adults. In general, adults who participate in these early intervention programs, consisting of educational materials plus various additional treatments and/or assessments (e.g., neuropsychological testing, meeting with a therapist, reassurance, access to a multidisciplinary team), report fewer postconcussion symptoms at 3 months postinjury (Ponsford et al., 2001, 2002) and at 6 months postinjury (Minderhoud, Boelens, Huizenga, & Saan, 1980; Mittenberg, Tremont, Zielinski, Fichera, & Rayls, 1996; Wade, King, Wenden, Crawford, & Caldwell, 1998) compared to adults who receive standard hospital treatment. The educational brochures or sessions typically provide information regarding common symptoms, likely time course of recovery, reassurance of recovery, and suggested coping strategies following mTBI (e.g., Mittenberg et al., 1996; Paniak, Toller-Lobe, Reynolds, Melnyk, & Nagy, 2000; Ponsford et al., 2002; Wade et al., 1998).

Ponsford and colleagues (2001) conducted the only study involving early education and reassurance intervention for children who have sustained mTBIs. One group of children with mTBIs was assessed at 1 week and 3 months postinjury, and a second group was assessed at 3 months only. The first group received an information brochure describing symptoms and coping strategies, and those seen only at 3 months did not receive this booklet. The symptoms resolved for most children by 3 months postinjury. Children with a previous brain injury or a history of learning or behavior problems were more likely to report ongoing symptoms. The group that received the information booklet reported fewer symptoms at 3 months postinjury than the group that did not receive this booklet.

There are a number of recommendations for managing mTBI in children. First, children should rest during the acute stage of recovery; they should reduce physical and cognitive activities. Second, in collaboration with their parents, children should monitor their symptoms and discuss them with their doctor. Third, some students, after returning to school, might benefit from (a) taking rest breaks as needed, (b) spending fewer hours at school, (c) being given more time to take tests or complete assignments, (d) receiving help with schoolwork, and/or (e) reducing time spent on the computer, reading, or writing (*www.cdc.gov/concussion/pdf/TBI_factsheet_TEACHERS-508-a.pdf*). Finally, returning to sports or vigorous physical activity

should be a gradual and stepwise process. These strategies are effective for most children, most of the time. For those who have poor outcome after following these recommendations, however, alternative and innovative management strategies are needed.

RATIONALE FOR EXERCISE AS TREATMENT

Converging lines of evidence suggest that exercise should be included as a core component of treatment for children and adults who have poor long-term outcome following mTBI. The evidence presented in this section converges to illustrate some of the benefits of exercise, and particularly of aerobic endurance exercise, on brain health and functioning. This evidence comes from both animal and human studies—the human studies are mostly with adults and older adults.

Neuroplasticity

Exercise facilitates molecular markers of neuroplasticity and promotes neurogenesis (Michelini & Stern, 2009; Neeper, Gomez-Pinilla, Choi, & Cotman, 1995; van Praag, 2008). One of the key molecules that exercise increases is brain-derived neurotrophic factor (BDNF; see glossary of neuroscience terms in Table 14.1). BDNF is well known for increasing neuronal survival and facilitating long-term potentiation (LTP; Kang, Welcher, Shelton, & Schuman, 1997; Suen et al., 1997). LTP is one of the key mechanisms underlying synaptic plasticity and is thought to have a vital role in the formation of memories. BDNF expression is, in large part, activity dependent (Thoenen, 1995). Exercise-induced BDNF increases are prevalent in the hippocampus, a region of the brain that is involved with long-term memory (Neeper et al., 1995). Because of its beneficial effects, delivery of BDNF to the traumatically injured brain has been pursued. However, because BDNF does not freely cross the blood–brain barrier, exogenous delivery of BDNF to the brain has been challenging. The fact that exercise increases BDNF in an endogenous manner makes it particularly relevant for TBI treatment and rehabilitation. Other growth factors that are increased with exercise are vascular endothelial growth factor (VEGF; Fabel et al., 2003) and insulin-like growth factor 1 (IGF 1; Carro, Trejo, Busiguina, & Torres-Aleman, 2001). Both VEGF and IGF are known to increase vascularization and neuronal proliferation.

In addition to growth factors, exercise increases other proteins that enhance neural function and cognitive performance. Proteins such as synapsin I, calcium/calmodulin-dependent protein kinase II (CaMKII), and cyclic-AMP response-element-binding protein (CREB) have been found to increase with exercise. These exercise-induced increases in synapsin I, CaMKII and CREB are also observed after experimental brain injury, as they are typically seen in the uninjured brain (see Table 14.1; Griesbach, Hovda, Molteni, Wu, & Gomez-Pinilla, 2004b). Multiple other effects of exercise have an influence on synaptic plasticity and neural protection. For example, exercise has been shown to increase angiogenic factors (Ding et al., 2004), reduce oxidative stress (Navarro, Gomez, Lopez-Cepero, & Boveris, 2004; Pan et

TABLE 14.1. Glossary of Neuroscience Terms

Term	Function	Effects of exercise
Angiogenesis	It is the growth of new blood vessels, also known as *vascularization*.	It is found to occur with exercise.
Brain-derived neurotrophic factor (BDNF)	It is a protein in the neurotrophin family of growth factors. This protein can facilitate the growth and differentiation of new neurons and synapses. BDNF helps with neuronal survival after injury and facilitates synaptic function.	It increases with exercise (Cotman & Berchtold, 2002; Neeper et al., 1995).
Calcium/calmodulin-dependent protein kinase II (CaMKII)	It facilitates synaptic plasticity through the regulation of glutamate receptors.	It increases with exercise (Vaynman, Ying, & Gomez-Pinilla, 2003).
Cytokines	These are intercellular messengers with pro- or anti-inflammatory properties.	Some cytokines that are involved in neurodegenerative diseases decrease with exercise (Ang, Wong, Moochhala, & Ng, 2004; Ding, Vaynman, Souda, Whitelegge, & Gomez-Pinilla, 2006).
Growth factors	Proteins (and other substances) that can stimulate cell growth, differentiation, and proliferation.	These are increased with exercise (Neeper, Gomez-Pinilla, Choi, & Cotman, 1996).
Insulin-like growth factor 1 (IGF1)	Hormone involved in growth and tissue remodeling that has been found to be involved in neurogenesis and neuroprotection.	It increases with exercise (Carro et al., 2001).
Long-term potentiation (LTP)	Increase in neuronal signal transmission that is believed to underlie learning and memory.	It is facilitated with exercise (Farmer et al., 2004).
Neurotrophins	A family of proteins that facilitates the development, growth, function, and survival of neurons.	Some neurotrophins, such as BDNF, are increased with exercise.
Neuronal proliferation	Also known as neurogenesis or the formation of new neuronal cells.	It is facilitated with exercise (van Praag et al., 1999).
Oxidative stress	Results in the production of free radicals that can compromise cell function and lead to cell death.	Exercise decreases oxidized proteins (Griesbach et al., 2008; Navarro et al., 2004).
Synaptogenesis	It is the formation of synapses and results in the increase of intracellular signaling.	It is increased with exercise.
Vascular endothelial growth factor (VEGF)	Family of cytokines that stimulate blood vessel growth.	It is increased with exercise (Fabel et al., 2003).

al., 2007; Wu, Ying, & Gomez-Pinilla, 2004), and increase hippocampal cerebral blood flow. It has also been shown to increase hippocampal neurogenesis (van Praag, Christie, Sejnowski, & Gage, 1999; van Praag, Shubert, Zhao, & Gage, 2005) and increase an array of genes involved in synaptic plasticity (Tong, Shen, Perreau, Balazs, & Cotman, 2001).

Neurotransmitter Systems and Mental Health

Exercise is associated with changes in the neurotransmitter systems of the brain. The glutamatergic, dopaminergic, noradrenergic, and serotonergic systems demonstrate particular benefits (Chaouloff, 1989; Molteni, Ying, & Gomez-Pinilla, 2002), which in turn contribute to improved mood and to a general sense of well-being (Callaghan, 2004; Conn, 2010; Duman, 2005). In adults, exercise can be an effective treatment for mild and even more severe depression (Babyak et al., 2000; Daley, 2008; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005; Lawlor & Hopker, 2001; Mead et al., 2008, 2009; Penninx et al., 2002; Rethorst, Wipfli, & Landers, 2009), but its use in clinical practice remains limited, especially as an adjunct to established treatment approaches such as psychotherapy or pharmacotherapy (Strohle, 2009).

The effect of exercise on anxiety has been examined in many studies with adults (Barbour, Edenfield, & Blumenthal, 2007; Greenwood & Fleshner, 2008; Herring, O'Connor, & Dishman, 2010; Wang et al., 2010). Broman-Fulks and Storey (2008) reported that brief aerobic exercise is associated with reduction in anxiety sensitivity (i.e., the tendency to fear and dwell upon anxiety-related symptoms). Smits and colleagues (2008) randomly assigned participants with elevated anxiety sensitivity to a 2-week exercise intervention, exercise plus cognitive therapy, and wait-list control. Both exercise conditions resulted in a large beneficial change in anxiety sensitivity. Merom and colleagues randomized clinical patients with anxiety disorders to group cognitive behavior therapy with either exercise or educational information as an adjunct. Patients in the exercise groups reported greater improvement in anxiety and stress (Merom et al., 2008). In a meta-analysis of the effects of exercise on anxiety, Wipfli, Rethorst, and Landers (2008) reported an overall effect size of –0.48. This medium effect size represents a substantial reduction in anxiety among exercise groups compared to no-treatment control groups.

Cognitive Functioning

Most research relating to exercise and cognitive functioning has been conducted with adults and older adults. In a meta-analysis of 29 studies, people who were randomly assigned to receive aerobic exercise training had small improvements in attention, processing speed, memory, and executive functioning (Smith et al., 2010). The mechanisms by which exercise and level of fitness are associated with improved cognition are not well understood. In fact, another meta-analysis of the literature concluded that the cardiovascular–aerobic fitness hypothesis, as the primary mechanism or mediator for the relation between exercise and improved cognition, is not supported. These authors encouraged additional research on other physiological and psychological variables that might influence the relation between exercise and cognition (Etnier, Nowell, Landers, & Sibley, 2006).

The direct and indirect effects of exercise, and overall fitness, on brain functioning, cognition, and academic performance in children have been a topic of considerable interest. In a study of 259 public school children, aerobic capacity was positively associated, and body mass was negatively associated, with academic achievement. Greater aerobic fitness was associated with better performance in reading and mathematics (Castelli, Hillman, Buck, & Erwin, 2007). Davis and colleagues randomized sedentary overweight children to low-dose exercise, high-dose exercise, or a control condition. The exercise sessions were 5 days per week for 15 weeks. Those in the high-dose exercise group performed better on a test of executive functioning than children in the control group (Davis et al., 2007). Groups of children with varying levels of fitness have also been studied on specific cognitive tasks. For example, children have been classified as having higher fitness levels versus lower fitness levels and then compared on cognitive testing, such as memory and executive functioning. In some studies, children with high fitness levels perform better on cognitive testing (Buck, Hillman, & Castelli, 2008; Chaddock, Hillman, Buck, & Cohen, 2011). Researchers have designed experiments in which children complete cognitive tasks before and after an aerobic exercise session, in comparison to before and after rest or sedentary activities. Children tend to perform better on tests of attention and executive functioning after the exercise session (Hillman et al., 2009). In a study of adolescents, an exercise session was not associated with improved electrophysiological indices of cognitive control—but level of fitness was (Stroth et al., 2009).

Fitness and Brain Morphology

Recently, researchers have investigated the association between fitness and brain morphology in children. Chaddock and colleagues (2010a) reported that children with greater fitness levels showed greater bilateral hippocampal volumes and better performance on a memory test than children with lower fitness levels. This research team also examined the relation between level of fitness and basal ganglia morphology in children. Children with greater fitness levels showed greater volumes of the dorsal (but not ventral) striatum relative to children with lesser fitness levels. The children with greater fitness also performed better on a test of attentional control (Chaddock et al., 2010b).

Self-Esteem

Exercise is associated with higher ratings of self-esteem (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004). When examining if exercise alone or exercise as part of a comprehensive intervention could improve self-esteem among children and young adolescents, Ekeland et al. (2004) reported that exercise has positive short-term effects on self-esteem in children and young people while having positive effects on general physical health.

Sleep, Pain, and Headaches

Exercise is associated with improved sleep quality (Youngstedt, 2005). Furthermore, evidence indicates that exercise is associated with reduced pain and disability in

patients with chronic low back pain (Bell & Burnett, 2009; Henchoz & Kai-Lik So, 2008), and it has been studied for its beneficial effects on the treatment of migraines and other types of headaches. Headaches are one of the hallmark symptoms of mTBI in children, and it is a symptom that they complain about when they fail to recover swiftly after their injury. Researchers have reported that regular long-term aerobic exercise reduces migraine frequency, severity, and duration (Koseoglu, Akboyraz, Soyuer, & Ersoy, 2003; Lockett & Campbell, 1992), possibly due to increased nitric oxide production (Narin, Pinar, Erbas, Ozturk, & Idiman, 2003); however, methodological limitations with research in this area may limit confidence in these findings (Busch & Gaul, 2008). In many studies, investigators use submaximal aerobic exercise, with intensities varying between 50 and 85% of maximal heart rate, to explore the impact of exercises on migraines.

Exercise as Treatment for Brain Injury in Animals

Both clinical and animal studies have indicated that exercise has neuroprotective qualities and is beneficial for physical and mental health. What remains uncertain is if and when it should be implemented after brain injury, and more specifically after an mTBI. In other words, it is not clear whether the beneficial effects of exercise are dependent on a specific time window, and we do not know if recovery can be hampered if exercise is implemented too early. Several studies relating to exercise following brain injuries in animals have been conducted by Griesbach and colleagues. These rodent exercise studies indicate that a therapeutic window should be taken into consideration when utilizing voluntary exercise to enhance neural function following the concussive injury model of fluid percussion brain injury (FPI; an experimental method for inducing mild–moderate brain injuries; Griesbach et al., 2004b). Rats underwent an FPI and were housed with or without access to a voluntary running wheel. Exercise began either the day of the injury or 2 weeks afterward. The beneficial effects of exercise were found only if exercise was delayed. The animals that were given access to a running wheel from 14 to 21 days postinjury did show an increase in BDNF and other molecular markers of plasticity. Injured rats with the delayed exercise also performed better on a hippocampal-dependent learning and memory task when compared to sedentary FPI rats with the same postinjury delay. A later study showed that the exercise-induced increase in BDNF was associated with better performance on a learning and memory task, in that BDNF blockade reversed the cognitive effects of exercise (Griesbach, Sutton, Hovda, Ying, & Gomez-Pinilla, 2009). However, rats that were allowed to exercise during the first week postinjury failed to show an increase in BDNF and other target proteins, such as synapsin I and CREB. In addition, the acutely exercised FPI rats also performed worse in the behavioral task when compared to injured rats that were not exercised and were tested at the same postinjury time (Griesbach et al., 2004b). Moreover, molecular markers of plasticity that increased in sedentary counterparts were reduced when rats were acutely exercised (in the first week postinjury; Griesbach, Gomez-Pinilla, & Hovda, 2004a). These findings suggest that premature exercise compromises compensatory responses to the injury. In these studies, early physiological stimulation through voluntary exercise reduced the capacity for neuroplasticity.

Animal studies also suggest that the time window is dependent on the particular characteristics or severity of the injury, such that the necessary delay for exercise to be effective after an FPI is severity dependent (Griesbach, Gomez-Pinilla, & Hovda, 2007). Along these lines, variations in the biomechanical forces and region of damage might influence the outcome of exercise. When rats were allowed to exercise acutely following a controlled cortical impact injury, an increase in BDNF was observed (Griesbach, Hovda, Gomez-Pinilla, & Sutton, 2008). In contrast to the FPI model that was used in the previously mentioned studies, the controlled cortical impact injury results in an area of pronounced focal cell death with less diffusivity. In the cortical impact study, notably, the injured rats chose not to exercise as much in the first 3 days after the injury compared to rats that underwent an FPI.

The reasons for the lack of exercise-induced increases in BDNF during a "temporal window" are unknown. Disruptions in cellular function due to postinjury metabolic alterations might interfere with the effects of exercise. TBI results in alterations such as mitochondrial dysfunction, decreases in blood flow, and changes in glucose metabolism that compromise neuronal functioning and signaling. During the early postinjury period, cerebral metabolism is likely to be dedicated to restoring cerebral function. Thus, placing an energy demand on the system, through exercise, can compromise restorative events. In addition TBI disrupts the regulation of stress hormones, such as corticosteroids, which are known to influence BDNF expression. A recent study in rats indicated that the stress response is heightened for the first week postinjury after a mild FPI (Griesbach, Hovda, Tio, & Taylor, 2011). This finding raises the possibility that elevations in glucocorticoids, which are known to suppress levels of BDNF and CREB, contribute to the undesired effects (i.e., poor performance in the water maze and suppression of molecular markers of plasticity) of early exercise that have been observed after FPI.

The translation of findings in animal studies to humans is not straightforward. As indicated above, the response to exercise appears to be dependent on the injury characteristics (e.g., more severe injuries require longer rest periods prior to exercise). In contrast to animal studies that control for subject and injury homogeneity, studying the effects of exercise in injured human subjects is challenging due to the diversity of the subjects and injury characteristics, as well as lack of consistency within and between studies in regard to postinjury assessment intervals.

HUMAN STUDIES INVOLVING EXERCISE AND ACTIVITY LEVEL FOLLOWING mTBI

Guidelines for returning children to physical activity following injury are typically derived from adult recommendations, which in turn are usually based on expert consensus rather than empirical data. Generally, the consensus-based standard of care requires that symptomatic children be restricted from participating in physical activity (McCrory et al., 2009; Purcell, 2009). While symptoms are present, both cognitive and physical rest are advocated to allow the restoration of normal brain metabolism and resolution of disrupted physiological activity (Giza & Hovda, 2001). Due to obvious methodological and ethical issues, very little human research is available on

the relationship between activity levels in the acute postinjury period, or on the duration of a rest period in relation to the resolution or persistence of symptoms.

Majerske and colleagues (2008) studied 86 high school student athletes who were retrospectively assigned to one of the following five groups, based on their self-reported postconcussion activity level at the time of their follow-up visits to a concussion clinic: (1) no school or exercise activity (n = 35); (2) school activity only (n = 77); (3) school activity and light activity at home (e.g., slow jogging, mowing the lawn; n = 57); (4) school activity and sports practice (n = 26); (5) school activity and participation in a sports game (n = 9) (Majerske et al., 2008). The group that seemed to function the best cognitively was #3 (school and light activity at home), and the group that functioned the worst cognitively was #5 (school and return to competition). This quasi-experimental retrospective cohort study is interesting and provocative, but does not allow causal inferences. It suggests a relationship, however, between activity level and cognitive functioning acutely and postacutely following injury. The lack of clear information about the time lapse between injury and complete symptom recovery, as well as activity level in relation to the acuteness of the injury, makes it difficult to interpret the results when trying to determine the optimal duration of a recommended rest period following injury.

Using a different approach, McCrea et al. (2009) explored the impact of a symptom-free waiting period on clinical outcome and risk of reinjury after sport-related concussions in high school and college athletes. In their prospective, nonrandomized study, 635 athletes with concussion were grouped based on the presence and duration of a symptom-free waiting period before they returned to sports participation after their injury. The majority of athletes (60.3%) observed a symptom-free waiting period that lasted from 1 day to 7 days or more. The other athletes returned to play immediately after symptom resolution or, for some, prior to complete recovery from the concussion. No differences in outcome 45 or 90 days postinjury could be found between the two groups. With regard to risks of sustaining a second concussion during the same playing season, the researchers reported that although the overall incidence of repeat concussions was low (3.78%), the overwhelming majority of them occurred within 10 days of the initial injury, whether the athlete had observed a symptom-free waiting period or not. This finding was presented as supporting the hypothesis of a time-sensitive window of cerebral vulnerability postconcussion.

Both of these studies are worthy of note in that they are among the first to challenge a common consensus-based guideline recommendation (McCrory et al., 2009) supporting the application of a symptom-free waiting period with all concussed athletes, and an even longer one in younger children. The nonrandomized nature of the designs precludes definitive conclusions, but they are a first step in trying to determine the optimal duration of a symptom-free waiting period or even if the need for this waiting period is supported by empirical evidence. The methodology used in these studies relies on retrospective or secondary analyses of data collected clinically as part of routine care, or from other ongoing studies, illustrating the inherent ethical difficulties in manipulating level of activity participation following concussion in human subjects. Although most experts agree that initial rest is beneficial, at least until symptom resolution, when children are slow to recover following an mTBI, the literature does not provide specific recommendations regarding rehabilitation

strategies. Rather, in sports at least, the recommendation is simply to rest and limit activities. With no mention of a time limit, clinicians are left with little information regarding treatment strategies to promote recovery in more complex cases.

Exercise as Treatment for mTBI in Humans

In a retrospective survey study of adults who had sustained TBIs of all severities, Gordon and colleagues (1998) reported that those individuals who engaged in exercise reported fewer symptoms of depression and better general health status than those who did not exercise. In a series of experimental treatment studies with adults who had sustained moderate–severe TBIs, Driver and colleagues showed that aquatic exercise is associated with improved self-esteem, health-promoting behaviors, and improved psychological functioning (Driver & Ede, 2009; Driver, O'Connor, Lox, & Rees, 2004; Driver, Rees, O'Connor, & Lox, 2006). Gemmell and Leathem (2006) provided a 6-week course of tai chi to a small sample of individuals with TBIs. Compared to a wait-list control group, they reported significant improvements in psychological functioning and mental health. Blake and Batson (2009) also reported that participation in tai chi was associated with improvements in self-esteem and psychological functioning in adults with TBIs.

In terms of mTBI, Iverson and colleagues developed the British Columbia Concussion Rehabilitation Program (BC-CRP), based on mental and physical circuit training, for injured adults with workers' compensation claims who were slow to recover (Iverson, Brooks, Azevedo, & Gaetz, 2006). A "circuit" consists of 14 minutes of sustained mental activity (i.e., Connors Continuous Performance Test—Second Edition), followed by sustained physical activity (i.e., exercise bike for 15 minutes), then a 15-minute rest period. A "session" consists of three circuits, lasting 2.5 hours. Sessions are done daily, 3–5 days per week. Pre- and postsession concussion symptom ratings are obtained for each session, using an abbreviated version of the Post-Concussion Scale. A person progresses, in stages, after completing *three consecutive sessions without significant symptom elevation*. Each stage has an increasingly intense physical component (increasing bike tension and increasing revolutions per minute—tailored to the individual needs and physical conditioning of the injured worker), but maintains the same cognitive and rest components. Outside the circuit training, we reinforce the importance of maintaining daily activity, such as 15- to 30-minute walks with family or friends and cognitive activities such as reading, sudoko, and crosswords. Counseling regarding good sleep hygiene is provided. The BC-CRP is well suited for injured workers with protracted recovery from an mTBI. It provides active rehabilitation, physical and mental conditioning, and is easily provided in conjunction with education, psychotherapy, counseling, and/or work-specific rehabilitation. This program, however, has not been studied in clinical research or clinical trials to evaluate its efficacy.

Similarly, Leddy et al. (2010) set out to test the safety and effectiveness of subsymptom threshold exercise training for the treatment of postconcussion syndrome in adults. In their study, individuals who had been experiencing postconcussion symptoms at rest for more than 6 weeks (mean duration of 19 weeks) were enrolled in an intervention consisting of aerobic exercises of a duration and intensity determined

with the administration of a graded treadmill test. Individuals reported no adverse events during the intervention, experienced resolution of their postconcussion symptoms, and had a successful return to activities (sports or work).

THE MONTREAL CHILDREN'S HOSPITAL ACTIVE REHABILITATION PROGRAM FOR SLOW-TO-RECOVER CHILDREN AND ADOLESCENTS

Children who fail to recover in the expected time from an mTBI pose a challenge to practitioners involved in their care, whether in the context of sports teams, school involvement, or within the health care system. For these slow-to-recover children who fail to return to preinjury status after the expected initial recovery period, guidelines are broad, unclear with regard to interventions, and unhelpful to the professionals who are faced with determining the best approach to management. The Montreal Children's Hospital (MCH) is a tertiary care pediatric university teaching hospital, and as part of the trauma programs within the institution, an mTBI (or concussion) clinic serves two specific groups of children. First, children who have been asymptomatic at rest for 5–7 days undergo a physical and cognitive exertion test as part of their gradual return-to-activities protocol. Children in this group thus benefit from an opportunity to become increasingly active in a supervised environment, to ensure that they remain asymptomatic under cognitive and cardiovascular stress. The second group of children is composed of those who remain symptomatic at rest 4 weeks after their mTBI, for whom the term *slow to recover* has been used. As stated previously, current consensus-based recommendations focus on a period of physical and cognitive rest until symptom resolution, with a gradual return to activity once symptoms subside. If those symptoms persist, children and teens are faced with a prolonged period of inactivity and a "wait-and-see" approach that may itself contribute to the persistence of symptoms, as it can with any athletic injury. A rehabilitation intervention that aims at facilitating recovery, therefore, appeared as an appropriate step. Faced with the mission of returning children who were slow to recover to activities (academic and physical) after their mTBI, clinicians in the MCH trauma programs designed an innovative active rehabilitation program that is described in Gagnon, Galli, Friedman, Grilli, and Iverson (2009).

The approach used at the MCH is based on a theoretical model anchored in current neuroscience evidence, as well as on the clinical expertise of professionals involved in the care of children with mTBI. Before children enter the intervention, a screening of general neurological status, balance, coordination, cognitive functioning, and postconcussion symptoms is performed to document preintervention status as well as to determine if there are any contraindications to exercise. Before beginning the active rehabilitation protocol, children are also assessed by a neuropsychologist who conducts a clinical interview aimed at establishing preinjury cognitive, psychosocial, and emotional functioning—and exploring possible personal factors contributing to the persistence of symptoms.

The graded rehabilitation is comprised of four components. First, submaximal (60% maximal capacity) aerobic training is provided for up to 15 minutes. Second, light coordination exercises, up to 10 minutes, are tailored to the child's favorite

activity or main sport. Third, visualization and imagery techniques are introduced. Finally, a home program allows continued training outside the clinic, thus facilitating school attendance and minimizing disruptions to the child's daily life. The program is summarized in Figure 14.3.

All program activities are based on principles derived from a variety of the studies discussed in this chapter and also summarized in Gagnon et al. (2009). For the *aerobic* component, children are asked to choose between fast-paced walking/light jogging on a treadmill or peddling a stationary bicycle, both of which can be used in conjunction with an interactive gaming system (e.g., Nintendo Wii) to provide distraction and further enjoyment of the activity. Using a portable heart rate monitor (e.g., Polar monitor and chest strap), children are instructed to exercise at a maximal heart rate corresponding to 60% of their maximal capacity for no more than 15 minutes. *Coordination* exercises are tailored to the child's favorite sport or physical activity and last a maximum of 10 minutes. Heart rate continues to be monitored throughout this phase of the program. If at any point during the physical exertion (aerobic activities and coordination exercises), any of the symptoms found on the Post-Concussion Scale—Revised appear or increase, the activity is terminated and the duration recorded. *Visualization* and imagery techniques are introduced as a third component to reinitiate positive experiences in relation to participation in physical activity. The child is asked to choose a motor component of his or her sport or favorite activity at which he or she is usually successful and that is finite in duration (e.g., a particular football drill). The physical therapist discusses the technique of positive visualization and proceeds to practice with the child in the clinic to achieve realistic timing and motor imagery of the chosen activity. Throughout the components of the intervention, children and their families are provided reassurance and engaged in a

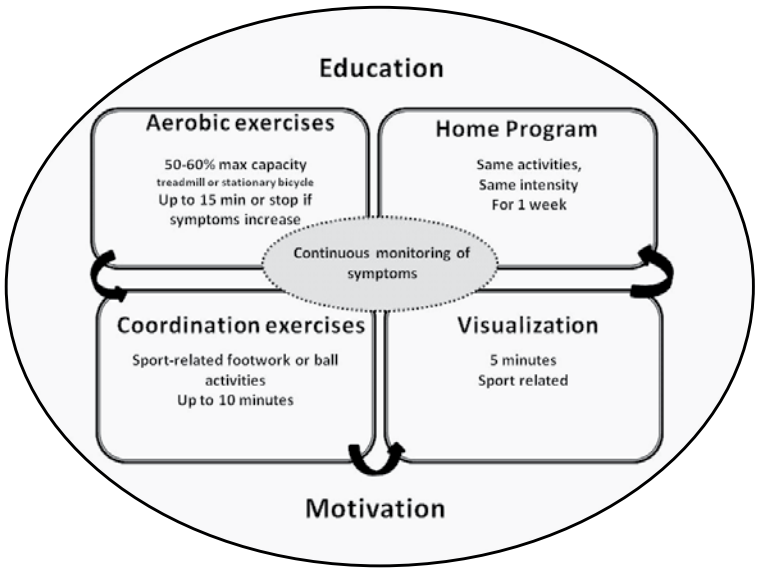


FIGURE 14.3. Montreal Children's Hospital rehabilitation after concussion program. From Gagnon, Galli, Friedman, Grilli, and Iverson (2009). Copyright 2009 by. Reprinted by permission.

discussion that reviews information regarding the likely time course of recovery and general coping strategies that they were given during the acute period postinjury. This component helps to determine the personal meaning and impact of the mTBI on the child and parents, and its consequences on their daily lives. Clinicians also watch for, and address, the impact of other life stressors on children's symptoms. Strong emotional reactions to having symptoms or overpathologizing the symptoms can also be addressed. These discussions are a segue for teaching coping skills to the child and parent to reduce their stress and anxiety.

The final component is a home program that includes all parts of the intervention. The home program lasts approximately 20 minutes daily (monitored with the use of a log) and is continued until the next planned weekly visit to the clinic for reassessment. The child and parents are also instructed to interrupt the home session and contact the Neurotrauma Program if any worsening of symptoms occurs. Finally, the child is followed weekly until symptom-free at rest for 1 week. At that time, the standard return-to-activity protocol, including exertion testing and graded return to activities, is initiated.

Outcome from participation in this intervention has been positive, although results remain anecdotal without the inclusion of a proper control group to gather empirical data. In Gagnon et al. (2009), a case series of 16 individuals who successfully returned to their activities following the active rehabilitation protocol is presented. Satisfaction with the intervention was reported as high and qualitative comments suggested greater empowerment for both children and parents when compared to their state prior to entering the program. Further testing of the intervention is underway to identify a subgroup of individuals who may benefit the most from such an approach.

Both this pediatric rehabilitation approach and the adult examples presented previously have advanced the concept that supervised and controlled aerobic exercise may be beneficial for individuals who fail to recover readily after an mTBI. Although these strategies appear promising, they remain in exploratory stages. To date, little emphasis has been placed on trying to determine the optimal "dosage" or protocol to use with clinical patients. Moreover, none of the reported studies used a control group of equivalent slow-to-recover individuals randomized to different intervention strategies, thus making it difficult to attribute recovery solely to the proposed rehabilitation programs.

CONCLUSIONS AND FUTURE DIRECTIONS

Fortunately, most children who experience mild brain injuries in sports or daily life recover swiftly. A minority, however, do not. Children who are slow to recover present a challenge to the health care system. At present, no evidence-based guidelines exist for how to manage children who experience atypical recovery. In the initial days following injury, both mental and physical rest have been strongly encouraged (McCrory et al., 2005, 2009). The optimal time period for rest, however, is unknown. From a practical perspective, children need to, and naturally will, transition back into an active lifestyle. Clinicians must decide when to transition from activity restrictions and watchful waiting to more active treatment and rehabilitation.

There is evolving interest in using exercise as an adjunctive treatment for people who have sustained TBIs (Devine & Zafonte, 2009; Lojovich, 2010; Mossberg, Amonette, & Masel, 2010). Converging lines of diverse medical and scientific evidence support the use of exercise as a core component of treatment for children and adults who have poor outcome from mTBI. However, some important questions remain unanswered. The optimal period of rest following injury is unknown, and it might differ across the lifespan. Similarly, we do not know when it is most clinically efficacious to begin increasing a child's activity levels. We do not know the most beneficial types of exercise, or the best frequency, intensity, and duration of training sessions. We do not know the dispositional and/or clinical characteristics of injured children that might facilitate or hinder the beneficial treatment effects of exercise. A tremendous amount of research will be necessary to answer these questions. With time, we are confident that clinical researchers will make important advances that will facilitate evidence-based recommendations for treatment and rehabilitation of children who are slow to recover after mTBI.

REFERENCES

Ang, E. T., Wong, P. T., Moochhala, S., & Ng, Y. K. (2004). Cytokine changes in the horizontal diagonal band of Broca in the septum after running and stroke: A correlation to glial activation. *Neuroscience*, *129*(2), 337–347.

Babyak, M., Blumenthal, J. A., Herman, S., Khatri, P., Doraiswamy, M., Moore, K., et al. (2000). Exercise treatment for major depression: Maintenance of therapeutic benefit at 10 months. *Psychosomatic Medicine*, *62*, 633–638.

Bäckman, L., Jones, S., Berger, A. K., Laukka, E. J., & Small, B. J. (2005). Cognitive impairment in preclinical Alzheimer's disease: A meta-analysis. *Neuropsychology*, *19*(4), 520–531.

Barbour, K. A., Edenfield, T. M., & Blumenthal, J. A. (2007). Exercise as a treatment for depression and other psychiatric disorders: A review. *Journal of Cardiopulmonary Rehabilitation and Prevention*, *27*(6), 359–367.

Belanger, H. G., & Vanderploeg, R. D. (2005). The neuropsychological impact of sports-related concussion: A meta-analysis. *Journal of the International Neuropsychological Society*, *11*(4), 345–357.

Bell, J. A., & Burnett, A. (2009). Exercise for the primary, secondary and tertiary prevention of low back pain in the workplace: A systematic review. *Journal of Occupational Rehabilitation*, *19*(1), 8–24.

Blake, H., & Batson, M. (2009). Exercise intervention in brain injury: A pilot randomized study of tai chi qigong. *Clinical Rehabilitation*, *23*(7), 589–598.

Broglio, S. P., & Puetz, T. W. (2008). The effect of sport concussion on neurocognitive function, self-report symptoms, and postural control: A meta-analysis. *Sports Medicine*, *38*(1), 53–67.

Broman-Fulks, J. J., & Storey, K. M. (2008). Evaluation of a brief aerobic exercise intervention for high anxiety sensitivity. *Anxiety, Stress, and Coping*, *21*(2), 117–128.

Buck, S. M., Hillman, C. H., & Castelli, D. M. (2008). The relation of aerobic fitness to Stroop task performance in preadolescent children. *Medicine and Science in Sports and Exercise*, *40*(1), 166–172.

Busch, V., & Gaul, C. (2008). Exercise in migraine therapy: Is there any evidence for efficacy? A critical review. *Headache*, *48*(6), 890–899.

Callaghan, P. (2004). Exercise: A neglected intervention in mental health care? *Journal of Psychiatry and Mental Health Nursing*, *11*(4), 476–483.

Carro, E., Trejo, J. L., Busiguina, S., & Torres-Aleman, I. (2001). Circulating insulin-like growth factor I mediates the protective effects of physical exercise against brain insults of different etiology and anatomy. *Journal of Neuroscience*, *21*(15), 5678–5684.

Castelli, D. M., Hillman, C. H., Buck, S. M., & Erwin, H. E. (2007). Physical fitness and academic achievement in third- and fifth-grade students. *Journal of Sport and Exercise Psychology*, *29*(2), 239–252.

Chaddock, L., Erickson, K. I., Prakash, R. S., Kim, J. S., Voss, M. W., Vanpatter, M., et al. (2010a). A neuroimaging investigation of the association between aerobic fitness, hippocampal volume, and memory performance in preadolescent children. *Brain Research*, *1358*, 172–183.

Chaddock, L., Erickson, K. I., Prakash, R. S., VanPatter, M., Voss, M. W., Pontifex, M. B., et al. (2010b). Basal ganglia volume is associated with aerobic fitness in preadolescent children. *Developmental Neuroscience*, *32*(3), 249–256.

Chaddock, L., Hillman, C. H., Buck, S. M., & Cohen, N. J. (2011). Aerobic fitness and executive control of relational memory in preadolescent children. *Medicine and Science in Sports and Exercise*, *43*(2), 344–349.

Chaouloff, F. (1989). Physical exercise and brain monoamines: A review. *Acta Physiologica Scandinavia*, *137*, 1–13.

Conn, V. S. (2010). Depressive symptom outcomes of physical activity interventions: Meta-analysis findings. *Annals of Behavioral Medicine*, *39*(2), 128–138.

Cotman, C. W., & Berchtold, N. C. (2002). Exercise: A behavioral intervention to enhance brain health and plasticity. *Trends in Neurosciences*, *25*(6), 295–301.

Daley, A. (2008). Exercise and depression: A review of reviews. *Journal of Clinical Psychology in Medical Settings*, *15*(2), 140–147.

Davis, C. L., Tomporowski, P. D., Boyle, C. A., Waller, J. L., Miller, P. H., Naglieri, J. A., et al. (2007). Effects of aerobic exercise on overweight children's cognitive functioning: A randomized controlled trial. *Research Quarterly for Exercise and Sport*, *78*(5), 510–519.

Devine, J. M., & Zafonte, R. D. (2009). Physical exercise and cognitive recovery in acquired brain injury: A review of the literature. *PM & R: The Journal of Injury, Function, and Rehabilitation*, *1*(6), 560–575.

Ding, Q., Vaynman, S., Souda, P., Whitelegge, J. P., & Gomez-Pinilla, F. (2006). Exercise affects energy metabolism and neural plasticity-related proteins in the hippocampus as revealed by proteomic analysis. *European Journal of Neuroscience*, *24*(5), 1265–1276.

Ding, Y. H., Luan, X. D., Li, J., Rafols, J. A., Guthinkonda, M., Diaz, F. G., et al. (2004). Exercise-induced overexpression of angiogenic factors and reduction of ischemia/reperfusion injury in stroke. *Current Neurovascular Research*, *1*(5), 411–420.

Driver, S., & Ede, A. (2009). Impact of physical activity on mood after TBI. *Brain Injury*, *23*(3), 203–212.

Driver, S., O'Connor, J., Lox, C., & Rees, K. (2004). Evaluation of an aquatics programme on fitness parameters of individuals with a brain injury. *Brain Injury*, *18*(9), 847–859.

Driver, S., Rees, K., O'Connor, J., & Lox, C. (2006). Aquatics, health-promoting self-care behaviours and adults with brain injuries. *Brain Injury*, *20*(2), 133–141.

Duman, R. S. (2005). Neurotrophic factors and regulation of mood: Role of exercise, diet and metabolism. *Neurobiology of Aging*, *26*(Suppl. 1), 88–93.

Dunn, A. L., Trivedi, M. H., Kampert, J. B., Clark, C. G., & Chambliss, H. O. (2005). Exercise treatment for depression: Efficacy and dose response. *American Journal of Preventative Medicine*, *28*(1), 1–8.

Ekeland, E., Heian, F., Hagen, K. B., Abbott, J., & Nordheim, L. (2004). Exercise to improve

self-esteem in children and young people. *Cochrane Database of Systematic Reviews* (1), CD003683.

Etnier, J. L., Nowell, P. M., Landers, D. M., & Sibley, B. A. (2006). A meta-regression to examine the relationship between aerobic fitness and cognitive performance. *Brain Research Reviews*, *52*(1), 119–130.

Fabel, K., Tam, B., Kaufer, D., Baiker, A., Simmons, N., Kuo, C. J., et al. (2003). VEGF is necessary for exercise-induced adult hippocampal neurogenesis. *European Journal of Neuroscience*, *18*(10), 2803–2812.

Farmer, J., Zhao, X., van Praag, H., Wodtke, K., Gage, F. H., & Christie, B. R. (2004). Effects of voluntary exercise on synaptic plasticity and gene expression in the dentate gyrus of adult male Sprague–Dawley rats *in vivo*. *Neuroscience*, *124*(1), 71–79.

Gagnon, I., Galli, C., Friedman, D., Grilli, L., & Iverson, G. L. (2009). Active rehabilitation for children who are slow to recover following sport-related concussion. *Brain Injury*, *23*(12), 956–964.

Gemmell, C., & Leathem, J. M. (2006). A study investigating the effects of tai chi chuan: Individuals with traumatic brain injury compared to controls. *Brain Injury*, *20*(2), 151–156.

Giza, C. C., & Hovda, D. A. (2001). The neurometabolic cascade of concussion. *Journal of Athletic Training*, *36*(3), 228–235.

Giza, C. C., & Hovda, D. A. (2004). The pathophysiology of traumatic brain injury. In M. R. Lovell, R. J. Echemendia, J. T. Barth, & M. W. Collins (Eds.), *Traumatic brain injury in sports* (pp. 45–70). Lisse, Switzerland: Swets & Zeitlinger.

Gordon, W. A., Sliwinski, M., Echo, J., McLoughlin, M., Sheerer, M. S., & Meili, T. E. (1998). The benefits of exercise in individuals with traumatic brain injury: A retrospective study. *Journal of Head Trauma Rehabilitation*, *13*(4), 58–67.

Greenwood, B. N., & Fleshner, M. (2008). Exercise, learned helplessness, and the stress-resistant brain. *Neuromolecular Medicine*, *10*(2), 81–98.

Griesbach, G. S., Gomez-Pinilla, F., & Hovda, D. A. (2004a). The upregulation of plasticity-related proteins following TBI is disrupted with acute voluntary exercise. *Brain Research*, *1016*(2), 154–162.

Griesbach, G. S., Gomez-Pinilla, F., & Hovda, D. A. (2007). Time window for voluntary exercise-induced increases in hippocampal neuroplasticity molecules after traumatic brain injury is severity dependent. *Journal of Neurotrauma*, *24*(7), 1161–1171.

Griesbach, G. S., Hovda, D. A., Gomez-Pinilla, F., & Sutton, R. L. (2008). Voluntary exercise or amphetamine treatment, but not the combination, increases hippocampal brain-derived neurotrophic factor and synapsin I following cortical contusion injury in rats. *Neuroscience*, *154*(2), 530–540.

Griesbach, G. S., Hovda, D. A., Molteni, R., Wu, A., & Gomez-Pinilla, F. (2004b). Voluntary exercise following traumatic brain injury: Brain-derived neurotrophic factor upregulation and recovery of function. *Neuroscience*, *125*(1), 129–139.

Griesbach, G. S., Hovda, D. A., Tio, D., & Taylor, A. N. (2011). Heightening of the stress response during the first weeks after a mild traumatic brain injury. *Neuroscience*, *178*, 147–158.

Griesbach, G. S., Sutton, R. L., Hovda, D. A., Ying, Z., & Gomez-Pinilla, F. (2009). Controlled contusion injury alters molecular systems associated with cognitive performance. *Journal of Neuroscience Research*, *87*(3), 795–805.

Henchoz, Y., & Kai-Lik So, A. (2008). Exercise and nonspecific low back pain: A literature review. *Joint Bone Spine*, *75*(5), 533–539.

Herring, M. P., O'Connor, P. J., & Dishman, R. K. (2010). The effect of exercise training on anxiety symptoms among patients: A systematic review. *Archives of Internal Medicine*, *170*(4), 321–331.

Hillman, C. H., Pontifex, M. B., Raine, L. B., Castelli, D. M., Hall, E. E., & Kramer, A. F. (2009). The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children. *Neuroscience*, *159*(3), 1044–1054.

Iverson, G. L., Brooks, B. L., Azevedo, A., & Gaetz, M. (2006, September). *Modifying the British Columbia Concussion Recovery Program for use with injured adults with post-concussion syndrome*. Poster presented at the Brain Injury of the Americas Conference (North American Brain Injury Society—NABIS), Maimi, FL.

Kang, H., Welcher, A. A., Shelton, D., & Schuman, E. M. (1997). Neurotrophins and time: Different roles for TrkB signaling in hippocampal long-term potentiation. *Neuron*, *19*(3), 653–664.

Koseoglu, E., Akboyraz, A., Soyuer, A., & Ersoy, A. O. (2003). Aerobic exercise and plasma beta endorphin levels in patients with migrainous headache without aura. *Cephalalgia*, *23*, 972–976.

Laurer, H. L., Bareyre, F. M., Lee, V. M., Trojanowski, J. Q., Longhi, L., Hoover, R., et al. (2001). Mild head injury increasing the brain's vulnerability to a second concussive impact. *Journal of Neurosurgery*, *95*(5), 859–870.

Lawlor, D. A., & Hopker, S. W. (2001). The effectiveness of exercise as an intervention in the management of depression: Systematic review and meta-regression analysis of randomised controlled trials. *British Medical Journal*, *322*(7289), 763–767.

Leddy, J. J., Kozlowski, K., Donnelly, J. P., Pendergast, D. R., Epstein, L. H., & Willer, B. (2010). A preliminary study of subsymptom threshold exercise training for refractory post-concussion syndrome. *Clinical Journal of Sport Medicine*, *20*(1), 21–27.

Lockett, D. M., & Campbell, J. F. (1992). The effects of aerobic exercise on migraine. *Headache*, *32*, 50–54.

Lojovich, J. M. (2010). The relationship between aerobic exercise and cognition: Is movement medicinal? *Journal of Head Trauma Rehabilitation*, *25*(3), 184–192.

Longhi, L., Saatman, K. E., Fujimoto, S., Raghupathi, R., Meaney, D. F., Davis, J., et al. (2005). Temporal window of vulnerability to repetitive experimental concussive brain injury. *Neurosurgery*, *56*(2), 364–374.

Majerske, C. W., Mihalik, J. P., Ren, D., Collins, M. W., Reddy, C. C., Lovell, M. R., et al. (2008). Concussion in sports: Postconcussive activity levels, symptoms, and neurocognitive performance. *Journal of Athletic Training*, *43*(3), 265–274.

McCrea, M., Guskiewicz, K., Randolph, C., Barr, W. B., Hammeke, T. A., Marshall, S. W., et al. (2009). Effects of a symptom-free waiting period on clinical outcome and risk of reinjury after sport-related concussion. *Neurosurgery*, *65*(5), 876–882; discussion, 882–883.

McCrory, P., Johnston, K., Aubry, M., Cantu, R., Dvorak, J., Graf-Baumann, T., et al. (2005). Summary of the Second International Conference on Concussion in Sport, Prague, Czech Republic. *Clinical Journal of Sport Medicine*, *15*(2), 48–55.

McCrory, P., Meeuwisse, W., Johnston, K., Dvorak, J., Aubry, M., Molloy, M., et al. (2009). Consensus statement on concussion in sport: The 3rd International Conference on Concussion in Sport held in Zurich, November 2008. *British Journal of Sports Medicine*, *43*(Suppl. 1), i76–i90.

Mead, G. E., Morley, W., Campbell, P., Greig, C. A., McMurdo, M., & Lawlor, D. A. (2008). Exercise for depression. *Cochrane Database of Systematic Reviews* (4), CD004366.

Mead, G. E., Morley, W., Campbell, P., Greig, C. A., McMurdo, M., & Lawlor, D. A. (2009). Exercise for depression. *Cochrane Database of Systematic Reviews* (3), CD004366.

Merom, D., Phongsavan, P., Wagner, R., Chey, T., Marnane, C., Steel, Z., et al. (2008). Promoting walking as an adjunct intervention to group cognitive behavioral therapy for anxiety disorders: A pilot group randomized trial. *Journal of Anxiety Disorders*, *22*(6), 959–968.

Michelini, L. C., & Stern, J. E. (2009). Exercise-induced neuronal plasticity in central autonomic networks: Role in cardiovascular control. *Experimental Physiology*, *94*(9), 947–960.

Minderhoud, J. M., Boelens, M. E., Huizenga, J., & Saan, R. J. (1980). Treatment of minor head injuries. *Clinical Neurology and Neurosurgery*, *82*(2), 127–140.

Mittenberg, W., Tremont, G., Zielinski, R. E., Fichera, S., & Rayls, K. R. (1996). Cognitive-behavioral prevention of postconcussion syndrome. *Archives of Clinical Neuropsychology*, *11*(2), 139–145.

Molteni, R., Ying, Z., & Gomez-Pinilla, F. (2002). Differential effects of acute and chronic exercise on plasticity-related genes in the rat hippocampus revealed by microarray. *European Journal of Neuroscience*, *16*(6), 1107–1116.

Mossberg, K. A., Amonette, W. E., & Masel, B. E. (2010). Endurance training and cardiorespiratory conditioning after traumatic brain injury. *Journal of Head Trauma Rehabilitation*, *25*(3), 173–183.

Narin, S. O., Pinar, L., Erbas, D., Ozturk, V., & Idiman, F. (2003). The effects of exercise and exercise-related changes in blood nitric oxide level on migraine headache. *Clinical Rehabilitation*, *17*(6), 624–630.

Navarro, A., Gomez, C., Lopez-Cepero, J. M., & Boveris, A. (2004). Beneficial effects of moderate exercise on mice aging: Survival, behavior, oxidative stress, and mitochondrial electron transfer. *American Journal of Physiology: Regulatory, Integrative and Comparative Physiology*, *286*(3), R505–R511.

Neeper, S. A., Gomez-Pinilla, F., Choi, J., & Cotman, C. (1995). Exercise and brain neurotrophins. *Nature*, *373*(6510), 109.

Neeper, S. A., Gomez-Pinilla, F., Choi, J., & Cotman, C. W. (1996). Physical activity increases mRNA for brain-derived neurotrophic factor and nerve growth factor in rat brain. *Brain Research*, *726*(1–2), 49–56.

Pan, Y. X., Gao, L., Wang, W. Z., Zheng, H., Liu, D., Patel, K. P., et al. (2007). Exercise training prevents arterial baroreflex dysfunction in rats treated with central angiotensin II. *Hypertension*, *49*(3), 519–527.

Paniak, C., Toller-Lobe, G., Reynolds, S., Melnyk, A., & Nagy, J. (2000). A randomized trial of two treatments for mild traumatic brain injury: 1 year follow-up. *Brain Injury*, *14*(3), 219–226.

Penninx, B. W., Rejeski, W. J., Pandya, J., Miller, M. E., Di Bari, M., Applegate, W. B., et al. (2002). Exercise and depressive symptoms: A comparison of aerobic and resistance exercise effects on emotional and physical function in older persons with high and low depressive symptomatology. *Journals of Gerontology: Series B, Psychological Sciences and Social Sciences*, *57*(2), P124–P132.

Ponsford, J., Willmott, C., Rothwell, A., Cameron, P., Ayton, G., Nelms, R., et al. (2001). Impact of early intervention on outcome after mild traumatic brain injury in children. *Pediatrics*, *108*(6), 1297–1303.

Ponsford, J., Willmott, C., Rothwell, A., Cameron, P., Kelly, A. M., Nelms, R., et al. (2002). Impact of early intervention on outcome following mild head injury in adults. *Journal of Neurology, Neurosurgery, and Psychiatry*, *73*(3), 330–332.

Purcell, L. (2009). What are the most appropriate return-to-play guidelines for concussed child athletes? *British Journal of Sports Medicine*, *43*(Suppl. 1), i51–i55.

Rethorst, C. D., Wipfli, B. M., & Landers, D. M. (2009). The antidepressive effects of exercise: A meta-analysis of randomized trials. *Sports Medicine*, *39*(6), 491–511.

Schretlen, D. J., & Shapiro, A. M. (2003). A quantitative review of the effects of traumatic brain injury on cognitive functioning. *International Review of Psychiatry*, *15*(4), 341–349.

Smith, P. J., Blumenthal, J. A., Hoffman, B. M., Cooper, H., Strauman, T. A., Welsh-Bohmer,

K., et al. (2010). Aerobic exercise and neurocognitive performance: A meta-analytic review of randomized controlled trials. *Psychosomatic Medicine*, *72*(3), 239–252.

Smits, J. A., Berry, A. C., Rosenfield, D., Powers, M. B., Behar, E., & Otto, M. W. (2008). Reducing anxiety sensitivity with exercise. *Depression and Anxiety*, *25*(8), 689–699.

Strohle, A. (2009). Physical activity, exercise, depression, and anxiety disorders. *Journal of Neural Transmission*, *116*(6), 777–784.

Stroth, S., Kubesch, S., Dieterle, K., Ruchsow, M., Heim, R., & Kiefer, M. (2009). Physical fitness, but not acute exercise modulates event-related potential indices for executive control in healthy adolescents. *Brain Research*, *1269*, 114–124.

Suen, P. C., Wu, K., Levine, E. S., Mount, H. T., Xu, J. L., Lin, S. Y., et al. (1997). Brain-derived neurotrophic factor rapidly enhances phosphorylation of the postsynaptic *N*-methyl-D-aspartate receptor subunit 1. *Proceedings of the National Academy of Sciences of the United States of America*, *94*(15), 8191–8195.

Thoenen, H. (1995). Neurotrophins and neuronal plasticity. *Science*, *270*(5236), 593–598.

Tong, L., Shen, H., Perreau, V. M., Balazs, R., & Cotman, C. W. (2001). Effects of exercise on gene-expression profile in the rat hippocampus. *Neurobiology of Disease*, *8*(6), 1046–1056.

Vagnozzi, R., Tavazzi, B., Signoretti, S., Amorini, A. M., Belli, A., Cimatti, M., et al. (2007). Temporal window of metabolic brain vulnerability to concussions: Mitochondrial-related impairment—Part I. *Neurosurgery*, *61*(2), 379–388; discussion, 388–389.

van Praag, H. (2008). Neurogenesis and exercise: Past and future directions. *Neuromolecular Medicine*, *10*(2), 128–140.

van Praag, H., Christie, B. R., Sejnowski, T. J., & Gage, F. H. (1999). Running enhances neurogenesis, learning, and long-term potentiation in mice. *Proceedings of the National Academy of Sciences of the United States of America*, *96*(23), 13427–13431.

van Praag, H., Shubert, T., Zhao, C., & Gage, F. H. (2005). Exercise enhances learning and hippocampal neurogenesis in aged mice. *Journal of Neuroscience*, *25*(38), 8680–8685.

Vaynman, S., Ying, Z., & Gomez-Pinilla, F. (2003). Interplay between brain-derived neurotrophic factor and signal transduction modulators in the regulation of the effects of exercise on synaptic-plasticity. *Neuroscience*, *122*(3), 647–657.

Wade, D. T., King, N. S., Wenden, F. J., Crawford, S., & Caldwell, F. E. (1998). Routine follow up after head injury: A second randomised controlled trial. *Journal of Neurology, Neurosurgery, and Psychiatry*, *65*(2), 177–183.

Wang, C., Bannuru, R., Ramel, J., Kupelnick, B., Scott, T., & Schmid, C. H. (2010). Tai chi on psychological well-being: Systematic review and meta-analysis. *BMC Complementary and Alternative Medicine*, *10*, 23.

Wipfli, B. M., Rethorst, C. D., & Landers, D. M. (2008). The anxiolytic effects of exercise: A meta-analysis of randomized trials and dose–response analysis. *Journal of Sport and Exercise Psychology*, *30*(4), 392–410.

Wu, A., Ying, Z., & Gomez-Pinilla, F. (2004). The interplay between oxidative stress and brain-derived neurotrophic factor modulates the outcome of a saturated fat diet on synaptic plasticity and cognition. *European Journal of Neuroscience*, *19*(7), 1699–1707.

Youngstedt, S. D. (2005). Effects of exercise on sleep. *Clinical Sports Medicine*, *24*(2), 355–365, xi.

• Jamie MacGregor, BSc (PT), BSc (Kin), CHT •

Jamie MacGregor is a Physiotherapist and Certified Hand Therapist. A partner in Priest Valley Manual Therapy Centre and owner of Okanagan Hand Therapy in Vernon, B.C., Jamie has been working in private practice orthopaedics for the past 14 years, with an emphasis on hand and upper extremity rehabilitation over the past 8 years.

Jamie has been a member of the PABC Business Affairs Committee and WorkSafeBC liaison for the past four years. As a PABC-WorkSafeBC liaison, Jamie works with physiotherapists and WorkSafeBC officers in addressing treatment model concerns, developing stronger relationships between physiotherapists and WorkSafeBC, and developing new treatment models for Injured Workers. Jamie is currently involved in the WorkSafeBC-Fraser Health Authority-PABC combined pilot study on shoulder injuries.

Workshop session: A New Approach to Managing Workplace Shoulder Injuries: concepts, construct and early findings from the WorkSafeBC-Fraser Health Authority-PABC Shoulder Pilot Project

The learning objectives are:

- To identify the driving factors for establishing a new treatment and management model for shoulder injuries
- To understand the key concepts incorporated in the new approach to treatment and management of these injuries
- To outline the clinical care map and treatment team members of the model
- To review early findings/outcomes from the pilot study
- To discuss the future potential/utilization of this treatment mode

A New Approach to Managing Workplace Shoulder Injuries:

Concepts, Construct and Early Findings from the WorkSafeBC-Fraser Health Authority-PABC Shoulder Pilot Project

Jamie MacGregor
BSc (PT), BSc (Kin), CHT

Jamie MacGregor
BSc (PT), BSc (Kin), CHT

- Owner/partner in Priest Valley Manual Therapy Centre, Vernon, BC; sole proprietor, Okanagan Hand Therapy, Vernon, BC
- Physiotherapy Association of British Columbia (PABC) PABC-WSBC liaison
- PABC representative involved in the Fraser Health Authority-WSBC-PABC Pilot Project
  - RECOVERY AT WORK (RAW)
  - SUB-PILOT: SHOULDER INJURIES

OBJECTIVES

- To identify the driving factors for establishing a new treatment and management model for shoulder injuries.
- To understand the key concepts incorporated in the new approach to treatment and management of these injuries.
- To outline the clinical care map and treatment team members of the model.
- To review early findings/outcomes from the pilot study.
- To discuss the future potential/utilization of this treatment model.

WHY SHOULDERS?

WSBC:

- Shoulder claims trending upwards in terms of claims duration
  - currently longest body part duration for WSBC
- Consistent with statistics from all WCB jurisdictions across Canada
- In 2009- New Brunswick and Alberta piloted new models
- By 2010 WSBC Health Care Services are investigating these models and outcomes
- 2011 WSBC Health Care Services began formulating a similar pilot
- Access to motivated and engaged employer, motivated and engaged provider group

WHY SHOULDERS?

PABC

- Engaged with WSBC in process of changing the model and paradigm for acute care physiotherapy.
- In 2010: initiated discussion of changing current service delivery model for Injured Workers in B C
- Early 2011: PABC proposes new service delivery model (early/immediate access to care, early RTW focus and planning by PT, functional and psychosocial evaluations, team based approach)
- Pilot: planning in mid-2011 for Fall start, halted due to regional resource limitations
- Decision to blend PABC-WSBC-FHA pilots due to similar model structure, motivation, and goals.

WHY SHOULDERS?

FHA:

- Experience with previous Recovery At Work pilot: all 'stream 1' soft tissue injuries (non-exceptional, first time injuries)
- Participation in current RAW Pilot Project confirmed
- Committed to early access to care with early RTW focus and support
- Recognize need for treatment, RTW support, and team approach regardless of claim status early on.
- Experienced team of disability managers/return to work facilitators empowered to work outside the box with new RTW and access to treatment concepts

ESSENTIAL COMPONENTS FOR RAW PILOT

- Driving force for WSBC, FHA, PABC
- Engaged employer with buy-in and personnel to execute pilot requirements
- WSBC Health Care Services and Worker and Employer Services (WES) agreement on pilot need, goal and model of care.
- Provider group of Physiotherapists with expertise in treatment in shoulder injuries, functional assessment, and return to work support.

IN OTHER WORDS…

- COMPLETE BUY-IN
  - FRASER HEALTH AUTHORITY
  - WORKSAFEBC
  - PHYSIOTHERAPY ASSOCIATION OF BC

PILOT KEY CONCEPTS

- CARE TEAM CONCEPT

  New model in RAW pilot

  was the first WSBC acute care Physiotherapy pilot to incorporate a care team concept.

  i.e. The 'Multi-disciplinary team based approach
- Early/Immediate access to care
- WSBC developed processes to expedite access to care and specialized services
- Employer funded and referred access to treatment team while claim still pending (immediate access)

KEY CONCEPTS (cont'd)

- Physiotherapy focus on functional evaluation and early return to work support.
- Psychosocial evaluation and support for worker from Day 1.
- Agreed upon best practice physiotherapy management with pre- and post-surgical treatment protocols.
- Expedited referral by physiotherapist to Orthopaedic surgeons (WSBC Visiting Specialists Clinic).

THE TEAM

- WSBC
- FHA
- PABC

WSBC

WSBC – Health Care Services

- David Florkowski, PhD(c), M.Ed., ATC, CSCS, CEAS, CFCE
  - **Program Manager,** Health Care Services, Visiting Specialists Clinic
- Sharon Cameron, PT
  - **Quality Assurance Supervisor**, Health Care Services
- Michelle Tan, MD, CCFP, MBA
  - **Manager, Health Care Development and Quality Initiatives**

WSBC – Worker and Employer Services

- Lionel Earle
  - **Client Services Manager**, Abbotsford SDL
- Paulette Baker, RN
  - **Return to Work Specialist – Nurse**, Abbotsford SDL
- George Nangle, Paul Rempel, Anna Strangway
  - **Case Managers**, Abbotsford SDL
- Bim Meetarbhan, MD
  - **Medical Advisor**

FHA

- Angela Andrews, BHK, RK, CDMP
  - **Managing Consultant** – Disability Programs, Workplace Health
- Kim Singbeil, BPE (Kin), CDMP
  - **Program Leader**, Workplace Health – Disability Management

PABC

Physiotherapy Clinics

- Burnaby Square Orthopaedic & Sports
- Coquitlam Physiotherapy & Hand Therapy
- Drake Medox – Surrey
- Fraser Valley Physiotherapy and Rehabilitation
- Golden Ears Orthopaedic & Sports
- Health X Langley
- Keary Physiotherapy Clinic
- LifeMark Surrey
- Sport and Spine Rehabilitation

PT Lead: Jamie MacGregor, BSc (PT), BSc (Kin), CHT

PHYSICIANS

- Robert Hawkins, MD
- William Regan, MD
- Mike Gilbart, MD
- Mike Wilkinson, MD

Psychologist

Grant Grobman, MA, R. Psych

CLINICAL CARE MAP

- Work in progress at present
- Progress flows in three primary directions:
  - The Happy Path (assess, +/- treat, RTW)
  - The Less Happy Path (surgical consult, no surgery, PT, RTW)
  - The Unhappy Path (surgical candidate, pre- and post-operative therapy, +/- referral to BSRS, +/- Rehab Physician assessment.... RTW planning and implementation.

CLINICAL CARE MAP

EARLY FINDINGS

- WHAT WE KNOW

- WHAT WE DON'T KNOW

WHAT THE FUTURE HOLDS?

ASSUMPTION: favourable results...

Expand to :

Same model, same body part, new employers and regions

OR

Same model, different body parts, same region and employer, followed by....

Expansion to...other health authorities, large employers, the entire province....

THE GRAND FINALE

- Roll-out of a new model of acute care physiotherapy services for Injured Workers province wide.
  - Early/immediate access to care
  - Early RTW
  - Functional focus of assessment and treatment
  - Psychosocial evaluation and support
  - Expedited access to specialist care

THE FUTURE

Certainties:
Many 'tweaks' required
Regional differences
Employer/industry differences

THANK YOU

- QUESTIONS?

Notes

Notes

• Scott McCloy •

Scott McCloy is Director of Community Relations for WorkSafeBC. He is responsible for working with stakeholders and communities to promote understanding of WorkSafeBC and its mandate and goals, and to create mutually beneficial relations across the province.

Scott has more than 30 years of communications experience in both the public and private sectors with large, complex organizations, such as the Canadian Broadcasting Corporation, as well as the Canadian Imperial Bank of Commerce. Scott led the re-branding of the Workers' Compensation Board to WorkSafeBC in 2005. Under Scott's leadership, WorkSafeBC's reputation has improved significantly since he joined in the mid-1990s.

Scott holds an MBA, has taught marketing for several years at the university level, and has advised various health and safety regulators across North America on issues involving communications and marketing.

In his spare time, Scott volunteers with several community organizations

Notes

Notes

• Daniel O'Connell, Ph.D. •

Daniel O'Connell is a clinical psychologist who lives in Seattle, Washington. Over the last 35 years, Dr. O'Connell has worked as an educator, consultant, clinician, department chair, and executive director in medical, behavioural health, and educational settings. He is a consultant to The Institute for Healthcare Communication and serves on the faculty of the Foundation for Medical Excellence. He teaches in the Residency Programs at the University of Washington School of Medicine, and maintains a coaching and consulting practice working primarily with health care organizations and individual providers on all aspects of the psychology of medicine, leadership in health care settings, and professional interactions.

Dr. O'Connell develops educational programs for health care providers, groups, and institutions and has led more than 500 workshops on various topics in the psychology of relationships and communication in health care.

He created a program for the disclosure and resolution of adverse medical outcomes that is widely taught in the United States and Canada.

Topic: Cognitive Behavioural Therapy, Motivational Interviewing, and Acceptance and Commitment Therapy as Approaches to Managing Chronic Pain

The learning objectives are:

- Describe applicable frameworks of Cognitive Behavioral Therapy, Motivational Interviewing, and Acceptance and Commitment Therapy and how to borrow shamelessly
- Describe key techniques and ideas in each, as applied to chronic non-cancer pain to reduce resistance and disability and increase value driven behaviour despite discomfort
- Demonstrate strategies that can fit into exam room conversations

Practical Tips: Cognitive Behavioral Therapy, Motivational Interviewing and Acceptance and Commitment Therapy as Approaches to Managing Chronic Pain

WORKSAFEBC
JUNE 8, 2012

DANIEL O'CONNELL, PH.D.
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Objectives

- Describe applicable frameworks of Cognitive Behavioral Therapy, Motivational Interviewing and Acceptance and Commitment Therapy and how to borrow shamelessly
- Describe key techniques and ideas in each as applied to chronic non-cancer pain to reduce resistance and disability and increase value driven behavior despite discomfort
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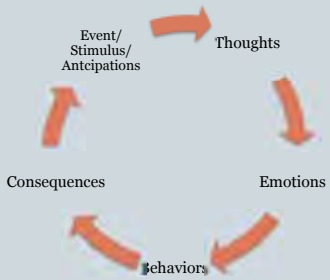
Cognitive Behavioral Therapy



Events/Stimuli

- Sensation:
  - "I felt a twinge…"
- Anticipation:
  - "I will have to go back to work."
  - "I have a doctor's appointment."
- Event:
  - "My wife is complaining about me."
  - "I just got a letter from my disability insurer."
  - "Another year has passed since I last worked."

Maladaptive Cognitions/Thoughts are the Distortions to be Addressed

- Catastrophizing
- Emotional Reasoning
- All or nothing thinking
- Mind reading/projection/jumping to conclusions
- Postponement
- Entitlement
- Magnifying/Amplifying
- Victim-Persecutor-Rescuer
- Fear Avoidance
- Mental Filter
- Hopelessness

What are equally plausible but more hopeful and less distorted thoughts?

- Key clinician demeanor:
  - The patient is helped to reflect on his/her own cognitions and their impact.
  - The clinician does not argue with the patient.
    - But does ask the patient to debate within himself and assess rationality of thoughts and dispute/replace as needed to move in a more constructive direction
  - Empathy for the dilemma
    - Comes with letting the patient own the problem and remain "second most motivated person in the room"

Exploring maladaptive cognitions

- What makes them maladaptive?
  - Thinking that way interferes with best recovery and accommodation possible
- What is the evidence for their truth/usefulness?
  - What about exceptions? What do they suggest?
- Is there a distortion working here? Which one(s)?
  - Labeling distortions/teaching labels can be helpful tool
- Focus most on cognitions that affect functioning.
  - Let's examine some now…

Feelings/Emotions

- Thoughts and emotions are intertwined
- What emotions would you expect a patient to have who thought/behaved that way?
- If the patient were to come to feel differently, how would he/she have to be thinking?
  - Desired Feelings
    - Hopeful, willing, persevering, challenging self, maximizing life's roles and opportunities, coping with emotional distress, relating to spouse/family, using less narcotic, participating wholeheartedly in physical therapy, getting back to work

Changing emotions typically comes from changing thinking and/or behavior

- E.g., If the patient is catastrophizing less about the intolerability of discomfort, then he/she is more likely to feel less fearful of PT and more likely to wholeheartedly participate.
- E.g., If the patient goes to PT, he/she may have a direct experience that counters fears and builds hopefulness.

Behavior

- Many different behaviors possible in chronic pain
  - Destructive/Limiting
    - Avoidance of feared situations
    - Pain medication over-reliance
    - Descent into constriction of normal life roles, goals
    - Justification of disability, Blaming pain for everything
  - Constructive Coping
    - Tolerating/distancing/distracting from painful sensations
    - Engaging in closest approximation of normal roles and activities despite "discomfort"
    - Making habit of the least "disabling" way of thinking about one's situation. Avoiding disability identity with its coherent and restricting story about life's possibilities and choices

Consequences

- If pain becomes overshadowing (in part because of distortions that magnify its power) then consequences are somewhat predictable.
  - Activity, return to work, relationship, mood, life satisfaction, medication use
- If pain can be managed as constructively as possible consistent with reality then
  - Best approximation of normal roles, values, activities is discovered and maintained and adapted to

And those consequences…

- Becomes the next stimuli/events/situations that further energize and shape the next round of thoughts, emotions, behaviors and consequences
  - Which is how the spiral either descends or ascends.

But if the clinician is not going to argue, then what does he/she do?

- Respectfully set limits on yourself
  - Medications
    - criteria of "Safe/Effectiveness/Not doing more harm than good"
  - Disability Forms/Evaluations:
    - Clear, transparent criteria
      - "There are 4 criteria that the state/province requires us to use in assessing the extent to which a person is disable. Let's go over those criteria together and see where you stand.
  - Further testing, surgery, procedures
    - Again criteria of Safe/Effective/More Harm than Good

What else from a CBT perspective?

- Conversation with the patient in which you ask questions in a non-rhetorical manner:
  - "How are you thinking about this?"
  - "What is the evidence for and against that idea?"
  - "What about exceptions? How are we to understand them?"
  - "What has been the impact of thinking this way?"
  - "What do you imagine will be your situation at some future point?" (challenges the short term pain relief now focus)
  - "How does _____ (important people in patients life) think about this? "What requests have they been making of you?" "How open are you to trying to meet their needs despite your discomfort?"
  - "How do you imagine you might be thinking and feeling if your spouse were the one with the pain problem and you were trying to make sense of the way he/she was behaving?"

More CBT things for the clinician to do:

- Stay respectful, avoid arguing, roll with resistance while holding to limits on yourself as discussed in previous slide
  - "I could see where you would not want to cut back on narcotics if you believed that they were the only thing that got you through the day. If I thought that was necessary and also safe and effective without causing more harm than good, then I would be willing to prescribe them."
- Express *concern* about current and future consequences
  - "I am concerned that if you continue in this way you will look back on this as terrible mistake. For instance, the belief that only after your pain has subsided, will it be possible for you to become more active with your children. What do you think?"
- Extend your relationship to include others. Propose/require
  - "I think we need to get the help of a good psychologist/psychiatrist/addiction counselor/ pain specialist to be sure we are not overlooking the role _____is playing in making this all unmanageable for you."
  - "I would be willing to continue as your doctor if you would agree to _____ in the next _____. Is this something you are open to?"
  - "With your wife/daughter/etc., as important as they are in all this, I think it is essential that we have a chance to include them in your next visit with me. Is that something you are open to?"

Acceptance and Commitment Therapy

- Offshoot of CBT. "3rd Wave" therapy
- Emphasis on differentiation of "self/thinker" from the "content of thought" which is vulnerable to the limitations & consequences of language and verbal reasoning.
- Goal is increasing flexibility to follow chosen values despite fears, history etc.
- Identify with the "transcendent self" which is separate from the content of mind and therefore able to examine thoughts and feelings as distinct from self.
- Processes of mindfulness/present moment awareness and acceptance of painful thoughts/feelings where CBT encourages appraisal of and disputation of maladaptive cognitions

Acceptance and Commitment Therapy

- ACT promotes flexibility in differentiating the function/workability of thoughts rather than their "truth"
- The Commitment of ACT is persevering at actions intended to lead to a more full and vital life that are consistent with valued directions
- While ACT does not call it out, strong similarities to Buddhist acceptance of some suffering as normal, developing mindfulness and healthy skepticism about the contents of mind, while focusing on a life committed to right action, right thought etc.

Key ACT Goal is Greater Flexibility

- Pain of all kinds is inevitable in life
- Trying to control/avoid suffering leads us to develop inflexible (usually avoidant) responses.
- Willingness to accept and tolerate pain without experiential avoidance is the key.
  - E.g., breathing through contractions
- To do this we must de-fuse words/thoughts from automatically directing behavior
  - E.g., "I am having the thought that…
    - I am not the thought. I am the self/thinker in whom thoughts and feelings arise and change and are workable or limiting.
      - "So, I can go to the event and focus on the performance and friendships even while having the thought/feeling of some discomfort?"
- Living fully is the best competitor to thoughts and feelings about the pain. Paradoxically, accepting the presence of pain and pursuing valued directions anyway, reduces the focus upon, perception of and need to try to control the pain itself.

ACT Processes

- Increase *flexibility*. Truth is defined on the basis of *workability* which is linked to *Chosen Values*.
- *Awareness, mindfulness, being present*, not getting stuck in past or future, out of touch
- *Acceptance and Willingness* (to choose to experience, to try, rather than control/avoid)
- *Cognitive defusion*: Create distance between the thought and thinker, the feeling and the feeler."
- Must step *outside the literal meaning* to examine their function and workability.
  - "I can't stand another minute."
  - "I am disabled."
  - "My family doesn't respect me."

More ACT Processes

- *Defusion* also addresses the directive power of stories and "history". Ultimately ACT is encouraging *getting in contact with the present moment through mindfulness and acceptance*. (Unlike CBT which might encourage disputing as irrational/maladaptive and replacing).
- *Self is the context*, the arena, location in which experience happens
  - "As you watch that pattern unfold, what stands out to you?"
- One can/should choose and lead their life in accord with *Valued Directions*.
  - "What is most important to you in your role as…?"
  - "What are the hallmarks of life worth living to you?"
  - "If you were coming as close as possible to the behavior of an ideal father/husband who also has frequent pain, what would you be doing now?"

How ACT would handle these thoughts

- "I can't have intimacy because I was sexually abused as child." (ACT- "And when you notice yourself having that thought what happens next?" the assumption being it provokes inflexible responding/avoidance)
- "I can't get my life going again as long as I have this pain." (ACT would not argue with this as maladaptive- ACT would ask the person to look at this thought, its behavioral and emotional affect (function). Then ACT would ask how this thoughts interferes with pursuit of *Valued Directions*

Committed Action

- ACT is a behavior therapy. It asks people to take action consistent with their valued directions and to do it while accepting any painful thoughts or feelings that "show up".
- The Acceptance part of ACT focuses on a willingness to be present, and not avoid or flee from uncomfortable thoughts and feelings.
- The Commitment part of ACT asks people to clarify their values in each role and then to take committed action towards that valued direction in specific areas agreed upon.

Clinician using ACT in the Exam Room

- Expect pain avoidance/reduction as patient's main/ only goal (despite consequences)
  - hyper focus on pain reduction (narcotics/procedures) and protection of disability status.
- You will be predisposed to *Fight/Flight* in the face of these strong demands
  - *fight* being to argue/lecture and get angry, *flee* being to cave in or avoid crucial issues)

Constructive Clinician ACT Behavior

- Be mindful in the moment of your own fight/flight reactions
- Set defensible limits on pain meds/procedures and disability demands while normalizing patient pushback, "If I thought that there was a safe and effective way to alleviate this pain, I would certainly offer it to you."
- Encourage discussion of patients' values in important roles, "What would you like to be doing in your life with your wife, kids etc. that you are missing now?"
- Ask, "Would you be willing to commit yourself to a manageable step towards in these valued directions regardless of pain. E.g., "Help your children with homework for one hour each evening and not mention any physical discomfort."

Constructive Clinician ACT Behavior

- Differentiate with the patient that he, the thinker and feeler is distinct from the content to his thoughts and feelings and so they can be examined and their impact on (limiting) his life (usually through inflexible belief that avoidance of feared activities is required to cope with the pain/risk of re-injury).
- Make referral to an ACT therapist and self help book "Get Out of your Mind and into Your Life" by Steven Hayes (2005) to get started.
- If you already a therapist read "Learning ACT" by Luoma, Hayes and Walser (2007) and check out www.contextualpsychology.org.

Thank you

Notes

• Dr. Hugue Ouellette, MD, FRCP •

Dr. Ouellette is a Musculoskeletal Radiologist at both Vancouver General and UBC Hospitals, and he is an Assistant Professor at the UBC Department of Radiology. He graduated from the University of Ottawa, Faculty of Medicine and also completed his residency there.

Before coming to Vancouver, Dr. Ouellette was a Musculoskeletal Radiologist at Massachusetts General Hospital, Harvard Medical School, and remains a visiting lecturer and Assistant Professor at Mount Auburn Hospital, Harvard Medical School.

Dr. Ouellette is the book review editor for Radiology, the most widely distributed radiology journal worldwide. He is also an American Board of Radiology examiner in Musculoskeletal Radiology.

Dr. Ouellette has authored numerous peer-reviewed articles and four books including the Musculoskeletal: Expert Consult, and the bestselling Clinical Radiology Made Ridiculously Simple.

Workshop session: Musculoskeletal (MSK) imaging on the back, shoulders, and knees

The learning objectives are:

- To learn about indications for MSK imaging including Magnetic Resonance Imaging
- To learn about indications of contrast use in MSK imaging
- To learn about indications for image-guided MSK procedures

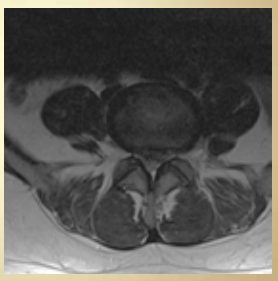
Musculoskeletal imaging on: back, shoulder and knee

Dr. Hugue Ouellette, MD, FRCP

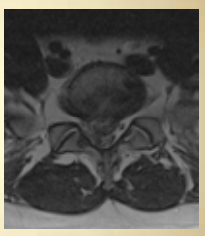
Musculoskeletal Radiologist at both Vancouver General and UBC Hospitals, Assistant Professor at the UBC Department of Radiology

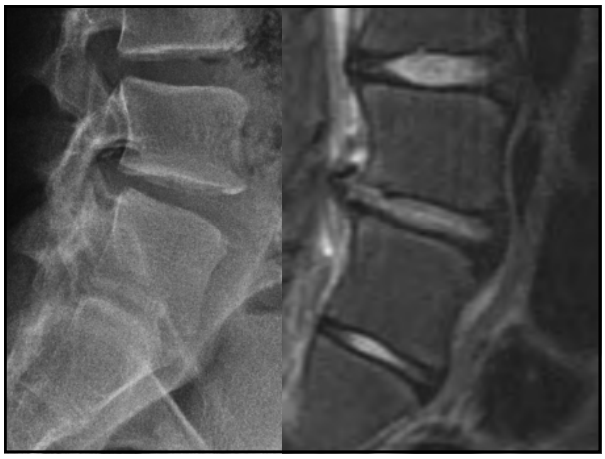
Spine

Teaching Point 2 – Looks like a simple disc herniation?

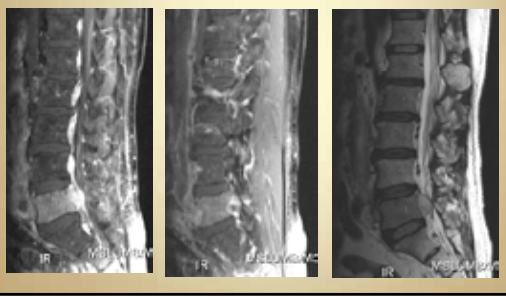


Another case of EHAD





Teaching Point 5 – HCC met to bone considering surgical decompression

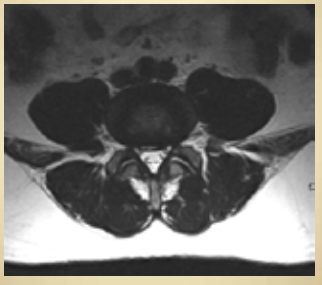


MRI and Low Back Pain

- Patients with Red Flags Imaged Urgently
  - Cauda equina
  - Significant trauma
  - Concern regarding infection
  - Concern regarding tumor
  - Widespread neurological signs

MRI and Low Back Pain

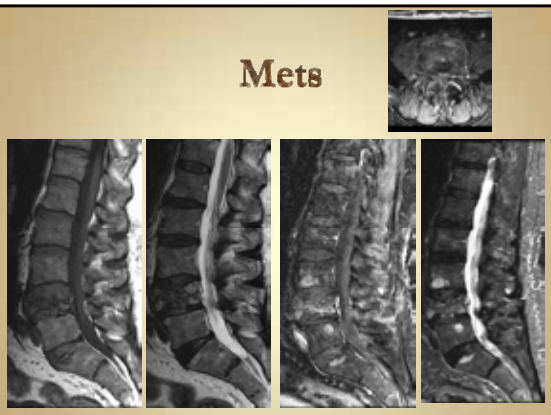
- Patients with Red Flags Imaged Urgently
- Patients with leg dominant pain (radiculopathy) for over weeks
  - Classic findings



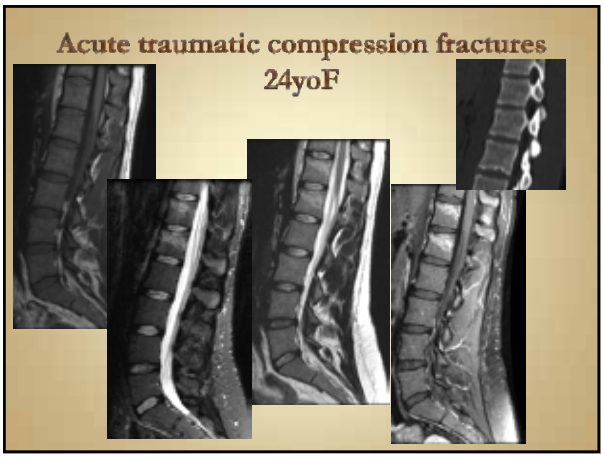
Typical Hemangiomas

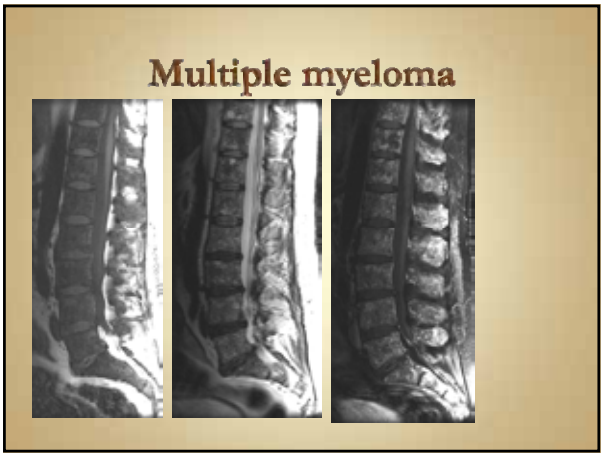
T1 T2 STIR T2

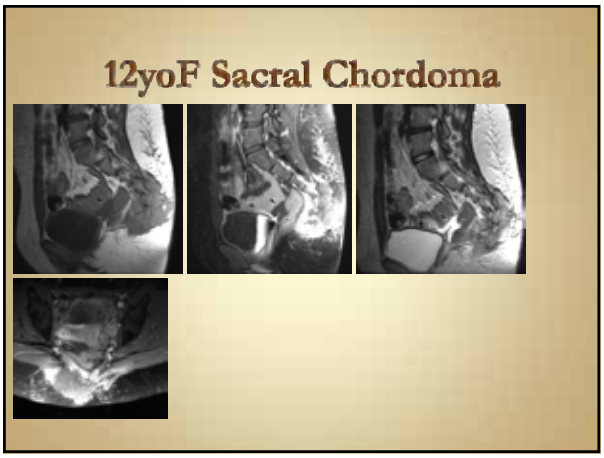
Mets

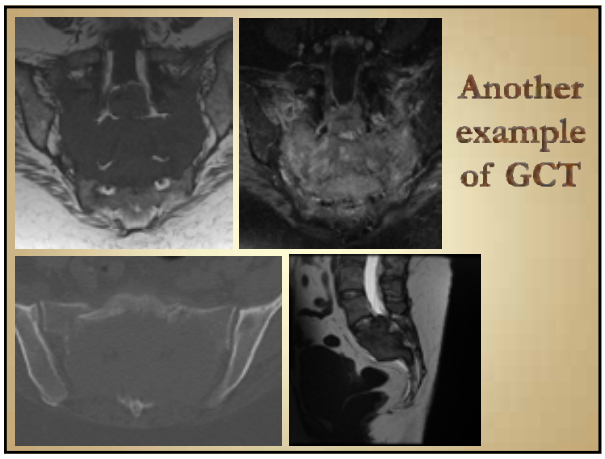


Benign Chronic Osteoporotic Fracture

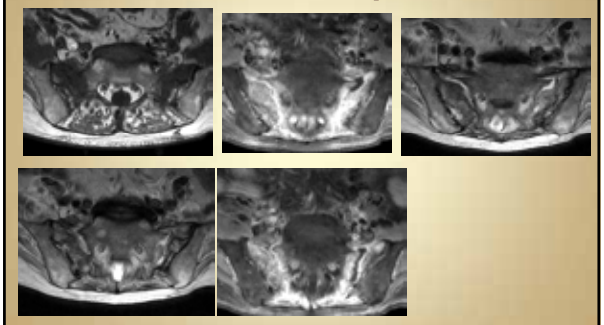

Acute traumatic compression fractures
24yoF


Multiple myeloma


12yoF Sacral Chordoma



Sacral Insufficiency Fracture



Chronic Axial Back Pain

- Lets look at myths and facts surrounding
  - Annular tears
  - Facet Arthropathy
  - Degenerative Endplate Changes
- Any other important imaging features in chronic axial back pain?

Objectives

- Review standard procedures done for spinal pain management (*excluding* augmentation eg. vertebroplasty)
  - *Technique*
  - *Complications*
- Discuss areas of controversy related to these procedures

Introduction

- Spinal pain and radiculopathy very common
- Etiology important
- Conservative management preferred to surgery in many cases

Introduction

- Acute non-traumatic spinal pain good prognosis
  - 1/3 typically recover within 1 week
  - 1/3 recover within 2 months
- In those with disc herniations and spinal pain
  - 90% better within 6-8 weeks
- Only a small proportion will have symptoms beyond 3 months

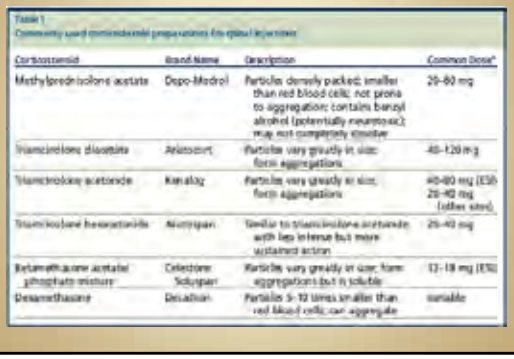
Goals of Percutaneous Intervention

- Diagnostic
- Therapeutic
- Combined

Types of Procedures

- Nerve root block
- Facet block

Steroids and Spinal Injections



Corticosteroid	Brand Name	Description	Common Dose*
Methylprednisolone acetate	Depo-Medrol	Particles densely packed; smaller than red blood cells; not prone to aggregation; contains benzyl alcohol (potentially neurotoxic); may not completely dissolve	20–80 mg
Triamcinolone diacetate	Aristocort	Particles vary greatly in size; form aggregations	40–120 mg
Triamcinolone acetonide	Kenalog	Particles vary greatly in size; form aggregations	40–80 mg (ESI) 20–40 mg (other sites)
Triamcinolone hexacetonide	Aristospan	Similar to triamcinolone acetonide with less intense but more sustained action	20–40 mg
Betamethasone acetate/ phosphate mixture	Celestone Soluspan	Particles vary greatly in size; form aggregations but is soluble	12–18 mg (ESI)
Dexamethasone	Decadron	Particles 5–10 times smaller than red blood cells; can aggregate	Variable

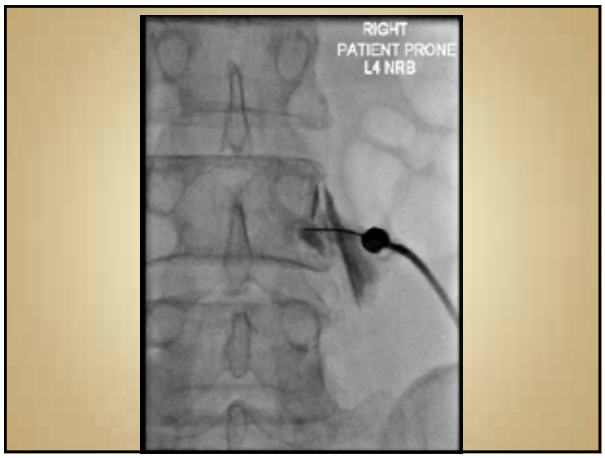
Nerve Root Injections

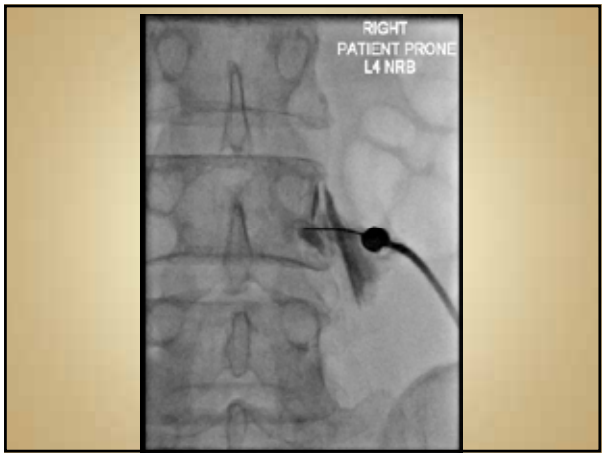
- Nerve root inflammation central unifying concept
- Efficacy dependent on type of pathology

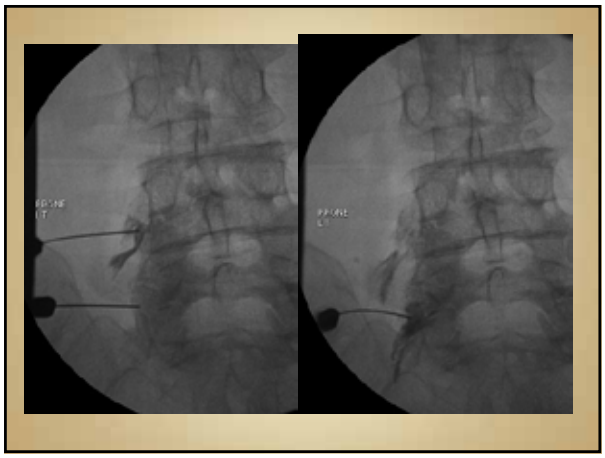
- Goal of procedure:
  - allow injectate to contact locus of pain generator Injection efficacy same adjacent to foramen as in foramen according to some authorities

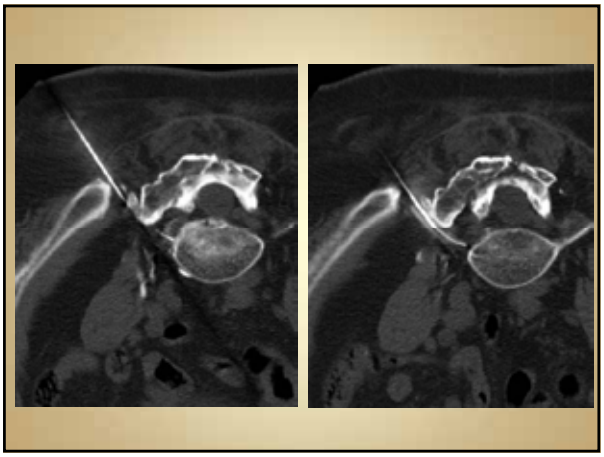
Nerve Root Injections

- Patients have radicular pain
- Should have MR or CT to evaluate for cause
- Pain score measurement before and after injection using standard scale eg. VAS


RIGHT
PATIENT PRONE
L4 NRB

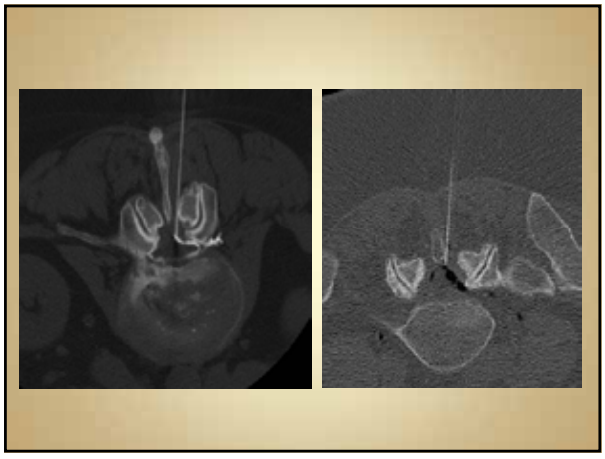

RIGHT
PATIENT PRONE
L4 NRB





Epidural Steroid Injections

- 1930: first intra-sacral ESI
- 1952: first description of direct ESI
- 1972: first cervical ESI



Facet Injections

- Done for mechanical facet-mediated back pain
- Weak correlation between imaging findings and symptoms
- Goal of procedure:
  - direct facet therapy
- Type of imaging used dependent on facet appearance

Facet Injection

- Selective block of facet joint capsule nerves for treatment of paravertebral back pain with limited radiation in most instances
- Pain worse on extension, relieved by standing

Notes

• Cara Rodrigues, BSc, BSc (OT) •

Cara graduated from Dalhousie University in Halifax, Nova Scotia, and after driving across Canada, she started her career working in Occupational Rehabilitation 2 at IMS Injury Management Solutions in Surrey, B.C. For five years, she assisted clients in returning to work before moving on to work in chronic pain. For the past six-plus years, Cara has worked at OrionHealth Vancouver Pain Clinic, where she's the Team Lead of the Pain Management Program.

Over the years, Cara has also enjoyed working with students in various aspects through the University of British Columbia Occupational Science and Occupational Therapy program, where she's a Clinical Faculty Member.

• Heather Watson, BEd, BSc, MPT •

Heather Watson joined the LifeMark Health Pain Management Team as a physiotherapist in 2008. She holds an MPT and a BEd. from the University of British Columbia and a BSc. (Biology) from the University of Victoria. She was a winner of the Silver Quill Award and is currently trying her hand at parenthood.

Workshop session: Management of the Chronic Non-Cancer Pain Patient — the Physiotherapist/ Occupational Therapist Approach

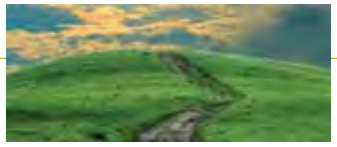
The learning objectives are:

- To recognize the sign and symptoms of chronic pain and what clients typically say during assessment and the course of treatment
- To identify various pitfalls of working with persons with chronic pain
- Strategies for effectively navigating the pitfalls of chronic pain management
- The importance of work as an attainable goal and strategies to promote RTW success

Management of the Chronic Non-Cancer Pain Patient - the Physiotherapist/Occupational Therapist Approach…

or as we like to say…

Helping persons with Chronic Pain Navigate a pathway to Recovery



Heather Watson, PT, Physiotherapist—LifeMark Health
Cara Rodrigues, B.Sc.(OT), Occupational Therapist—OrionHealth

Today. We beg you...

Have fun...with lots of informal discussion ☺

What our clients' pain probably feels like…

How clients probably see us…

Or maybe like this…

Objectives:

- **Recognize the signs and symptoms of chronic pain and what clients typically say during assessment and the course of treatment.**
- **Identify various pitfalls of working with persons with chronic pain.**
- **Learn strategies for effectively navigating the pitfalls of chronic pain management.**
- **Learn how to focus clients on the importance of work as an attainable goal and to apply strategies to promote RTW success.**

Recognizing the signs and symptoms of Chronic Pain

- Everything hurts
- Nothing seems to work
- Baseline activity tolerance is low
- Bad experiences in past rehabilitation programs
- Present as being 'on guard'.
- Psychosocial stressors
- Pain behaviours
- Guarding and compensatory movements
- Frustrated

Today:

1. Common Pitfalls
2. What clients will say or do
3. Strategies

Pitfall #1

Client believes that they are causing tissue damage if they have pain.

What will the client say and do?

- "I can hear the tendons tearing when I move."
- "Every time I move I am causing more damage."
- "That exercise isn't safe for me".
- "I need an MRI or a second opinion".
- "My surgeon said not to move."
- "Whenever I have tried to exercise, I can't move for days".
- "I was reinjured in OR2/by my past therapist".
- Avoids any motions / activities that give pain.
- Over time activities are becoming increasingly restricted / limited

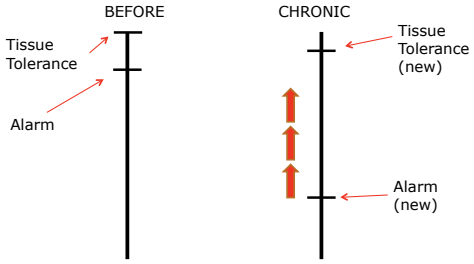
Strategies:

- Education!!!...chronic vs acute pain
- Pain neurophysiology—so IMPORTANT: groundwork from which progress can be made—gives an alternative reason for pain, beyond tissue damage. Allows you to address—it's not in my head!
- How to get buy-in re pain neuro—Ask them to identify current triggers for their pain—these are not DANGEROUS activities or exercise.
- Idea of training your nervous system like training for a marathon—you won't wake up one day able to run a marathon, nor will you wake up one day pain-free and ready to exercise.
- When there is an understanding of nervous system involvement, this opens up room for discussion of other pain triggers (not just PHYSICAL!)

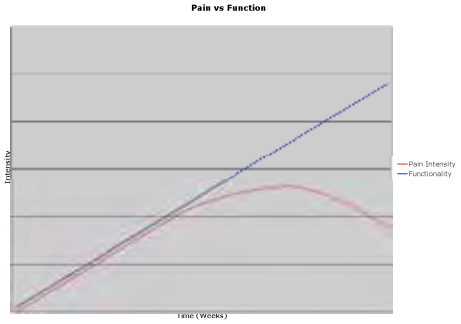
Strategies:

- Hurt vs. Harm education.
- Review the anatomy as it pertains to their specific injury.
- Relate anatomy to reasons for ongoing pain
- Discuss forces required for original injury and how to avoid predisposing factors.
- Relate sensations to physiological factors (joint cavitation, tendons).

Pain Neuro overview…



Pain vs. Function Graph



Pitfall #2

Client believes they need to 'get better' before they can progress in life (further medical).

What the client says / does:

- "I need another MRI or second opinion".
- "I'm lying in bed all day, how can I be expected to exercise?"
- "Something has to be done."
- Continue to report increasing pain concerns and symptoms.
- Ask for referral to specialist or to talk to case managers on their behalf.
- Insist that the specialist they saw didn't have all the facts or didn't spend adequate time with them.
- Refuses to activate because, "I am still broken."
- Does not consider alternate ways to accomplish tasks or activities.
- Does not plan upcoming events.

Strategies:

- Ask: "What do you feel you need to get better?"
- Review the medical professionals they have seen and the outcome.
- Discuss treatment options and why/how these did not apply to them.
- Discuss limitations of medicine.
- Suggest an alternate strategy, such as activation
- Set them up for early successes with exercise

Pitfall #3

Client believes they need retraining.

What client says/does

- "My doctor and I both know I need to be retrained".
- "I know a friend of mine went through this, and they got retrained—I need the same".
- Reminisce about what retraining they hope to receive, "I wanted to change careers anyway".
- "My Employer has to accommodate me, I know about *duty to accommodate*.
- Limits/refuses functional tasks related to work.
- Brings note from family physician to cease activation.
- Talk about the different types of job they could do instead.
- State why they can't go back to their former work

Strategies

- Right away (before they arrive if possible!) confirm WorkSafeBC/ Case Manager expectations for RTW—take out the guess work (and don't feed into myths).
- Be familiar (REAL familiar) with the WorkSafeBC claims process and entitlement piece.
- When pre-injury work is on the table (most likely):
  - Identify what the barriers for RTW
  - Position the client as the expert…they know their jobs best—we are here to help them get there.
  - Be the *safe messenger* to explain the consequence of holding out for retraining.
  - Find the right starting point with exercise.

Pitfall #4

Client believes they can't return to work with their current pain.

What the client says/does

- "This may work in the clinic, but it won't transfer in my workplace".
- "My Employer expects me to be 100%".
- "My job is heavy, these exercises are nothing compared to my job".
- "I can't lay down or ice all day at work".
- Does not take functional tasks seriously or does not perform tasks.
- Focus on reasons why treatment won't work.
- "Yes, but…"

Strategies:

- Don't assume they just don't like their job or aren't motivated (it will cause your treatment to misfire)
- Reinforce pain neuro education—that pain can decrease with training of the nervous system (graded activity/exercise).
- Have an open discussion, "if you don't return to work, what does this mean when your claim ends...how will you manage?"
- Important that client knows the consequence of not returning to work.
- Discuss this notion of being "100%"—who really is.
- Active symptom management works! Long term and in a functional way.
- Take the focus off PAIN and place on FUNCTION.

Strategies:

- Get down to the real barriers—what are they (seeking retraining or *you just don't know my job*…)
- Regarding exercise/treatment:
  - Explore why the task doesn't transfer
  - Get a JSV done (it shows an investment in 'getting it right', empowering the client that someone comes in to see their work/job)
  - Change the task to best simulate work
  - Discuss ways to implement active coping
- Regarding the work:
  - Talk to the Employer, get their side re expectations
  - Gain GRTW support
  - Educate re chronic pain and expectations re active pain management in the workplace

Pitfall #5

Passive approach

What the client says/does:

- "The only thing that helps is… (passive treatment)."
- "What treatments will you do?"
- Blames lack of progress on others.
- Insists there must be something more you can do or another therapist they can see.
- Waits to be told what to do
- Does not seek help/treatment

Strategies:

- Ask how far these treatments have gotten them
- Financially feasible long term?
- Chronic pain = different approach—we are not talking tissue!
- "Teach you how to treat yourself."
- Expectation: they will become more independent and active.
- Phase out passive forms and increase self treatment forms.
- Only undertake passive forms if it leads to a functional, measurable improvement.

Take home messages…

- Foster trust, *Be curious not right!*
- Understand pain neurophysiology and relate it to your clients—give clients a reason for their ongoing pain.
- Work is important! *Clients don't get better, then RTW, they return to work to get better.*

Resources

Questions

Notes

Massage Therapists' Association of British Columbia

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