

Maximizing Performance and Minimizing Injury

Sarah Dobrowolski, MD, MKin, BScH

“The deeper the roots, the higher the reach”

– Anonymous

Injuries (acute and chronic) occur when there is an imbalance between the stress (force) placed on the body and its resilience to withstand that stress (STRESS > RESILIENCE).

Acute Injuries (e.g. sprained ankle) occur quickly, usually accidental, but can be prevented by keeping the training environment safe, being well-trained and well rested.

Chronic injuries (e.g. “shin splints”) occur due to repetitive stress that exceeds the body’s ability to cope with that stress and repair itself over a long period of time.

Prevention, therefore, aims to reduce stress and increase resilience (RESILIENCE > STRESS).

Reduce Stress through building muscular strength, appropriate training load and progressions, using proper technique, wearing cushioned footwear, jumping on “sprung” floors, avoiding high-risk and high-impact skills when fatigued.

Increase Resilience through proper TRAINING and RECOVERY. The body is smart and adapts to training, strengthening its tissues (muscles, bones and tendons). Of course, this recovery and “super-compensation” or re-building can only happen with sufficient rest and nutrition.

Pre-Season Screening for RISK FACTORS by a physiotherapist, athletic trainer and/or medical doctor helps to identify athletes who are at risk of injury. Risk Factors are anything that increases stress on the body or reduces the body’s resilience (e.g. high training loads before the body is ready, un-cushioned footwear, lack of sleep and nutrition, psychological or emotional stress, etc.). Physiotherapists or athletic trainers can suggest “pre-hab” according to an athlete’s risk factor profile in the pre-season to prevent injuries (see the PPE questionnaire provided below). Psychological screening should also be done to identify athletes who are at risk of emotional disturbances that may worsen with intense training. A good tool for this is the “Training Distress Score” (TDS) also found below.

Screening during the Season should monitor an athlete’s progress and identify physical and psychological problems early, before they become a big problem. This includes asking the athlete about any recent injuries, sleep and nutrition habits as well as their mood and sense of well-being (TDS can be repeated several times during a season).

Treatment of acute injuries reduces swelling and minimizes tissue damage using “PRICE”:

Protection against further injury

Rest or reduce using the affected area

Ice for 15 minutes four times daily for 48 hours then twice daily for several days

Compression with a bandage

Elevation above the heart

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The mainstay of treatment for chronic injuries is RELATIVE REST and reversing any biomechanical imbalances that may be contributing to the problem (e.g. flat feet in the case of shin splints) which can be assessed and treated by a physiotherapist, athletic trainer or other health professional.

AVOID ANTI-INFLAMMATORY MEDICATIONS (e.g. NSAIDs such as Aspirin, Ibuprofen, Naproxen, etc.) unless absolutely necessary because they SLOW HEALING and have other negative side effects.

Visit a medical doctor or physiotherapist as needed.

Psychological stress works in the same way; if mental stress exceeds mental resilience, problems arise.

Overtraining/Under-Recovery Syndrome (OTS) is a syndrome characterized by a LONG TERM PERFORMANCE DECREASE usually with psychological symptoms. It occurs when (physical and psychological) stress exceeds the athlete's ability to cope and recover. The first symptom is normally fatigue, and then other symptoms develop. Physical symptoms may include: performance decrease, hormonal changes, frequent illness, persistent muscle soreness, weight loss. Psychological symptoms may include: irritability, depression, apathy, lack of motivation, loss of appetite, decreased sleep, high levels of self-reported stress. Unfortunately, athletes often react to decreased performance by increasing their training. If an athlete continues to train during recovery periods, they risk developing the OTS. OTS requires months or even YEARS TO RECOVER. RISK FACTORS include excessive training loads, monotony in the training program, too many competitions, personal and emotional stressors (e.g. school, work, relationships), athletes who are new to a sport, athletes who do not have a coach.

Training according to some basic rules helps maximize performance and minimize injury:

Periodization is breaking up the season into phases to maximize performance gains. Four phases are usually described; preparatory, transition, competition, recuperation. Generally, **EARLY IN THE YEAR TRAINING SHOULD INCLUDE A LOT OF LOW-INTENSITY ACTIVITIES WITH LITTLE REST, GRADUALLY PROGRESSING TO HIGHER INTENSITY ACTIVITIES WITH MORE REST.** The PREPARATORY phase includes a lot of cross training such as running, swimming, cycling, strength training, low-intensity freestyle routines and long duration speed drills. This builds the **FOUNDATION** for the rest of the season. The TRANSITION phase includes higher intensity and longer duration freestyle routines, faster speed drills and some cross training as mentioned above as well as plyometric exercises. Less time may be spent actually working during these practices, with longer rest periods between strenuous bouts. Training during the COMPETITION phase aims to maintain fitness gained throughout the year, and perfect sport-specific skills. The RECOVERY phase is described below. Recommendations for improving and maintaining different elements of an athlete's fitness are found in the table below:

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| Training Focus | Training Volume for Improvement | Training Volume for Maintenance | Required Recovery Time |
|----------------------------|---|---|------------------------|
| Strength | 2+ sets of each exercise 2-3 days per week, spread out “Core” training should be focus Sport-specific exercises are ideal | 1 day per week | 24-72 hours |
| Power (plyometrics) | 1-3 days per week, spread out | 1 day per week | 48-72 hours |
| Anaerobic Endurance | 10-40s intervals, near max intensity, 1:5 work to rest ratio, 3-12 reps, 2-3 sessions per week | 5-90s intervals, near max intensity, 1:1 – 1:3 work to rest ratio, 2-25 reps, 1-2 sessions per week | 24-48 hours |
| Aerobic Endurance | 20-60 minutes, 3-5 days per week Intensity of 65-90% MHR Sport-specific activity, Interval training is ideal for anaerobic athletes | 2-3 per week | 24 hours |

Progressive Overload should occur as the body adapts to the stress of training. Ideally, either the DURATION or INTENSITY of practices should be INCREASED by APPROXIMATELY 10% EACH WEEK. This maximizes performance gains and decreases injury risk.

Rest should occur ONE DAY PER WEEK, ONE WEEK PER MONTH, ONE MONTH PER YEAR. Light activity can be useful for recovery on “off days”, but it should not be strenuous or sport-specific (e.g. pool running or swimming are great alternatives to skipping). Recovery weeks follow the same schedule as training weeks, however, the duration and/or intensity of the workouts is decreased significantly. Recovery months normally follow the year’s major competition and should include fun activities that are not sport-specific to allow for full physical and psychological readiness for the new season. Adequate SLEEP and NUTRITION are essential elements to maximizing recovery for optimal performance at all times.

Warming Up can reduce injury risk by 50%. There is no “right way” to warm up. Therefore, athletes should tailor their warm up to meet their own needs. Generally, a warm up should include both general and sport-specific activities. It should start at a low-intensity, gradually becoming more intense. E.g. 5-10 minute light-moderate running or active games, stretching (static and/or dynamic), low-intensity freestyle skills and/or light speed work, higher intensity freestyle skills and speed drills. 5-10 minutes should then be given to athletes to complete their warm up as per their own needs.

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References

1. Brunkner P, Khan K, eds. *Clinical sports medicine*. 3rd ed. Australia: McGraw Hill; 2006.
2. Powers SK, Howley ET. *Exercise physiology: Theory and application to fitness and performance*. Sixth Edition ed. New York, USA: McGraw Hill; 2007.
3. International Association for Dance Medicine and Science. www.iadms.org. Updated 2012. Accessed 01/02, 2013.
4. American College of Sports Medicine. www.acsm.org/. Updated 2012. Accessed 01/02, 2013.
5. Joint Consensus Statement. Prevention, diagnosis, and treatment of the overtraining syndrome: Joint consensus statement of the european college of sport science and the american college of sports medicine. *Medicine & Science in Sports & Exercise*. 2013:186-205.

Resources

International Olympic Committee (IOC) Sport Health Videos

http://www.youtube.com/watch?v=1sm95tKwilE&feature=player_embedded

http://www.youtube.com/watch?v=a7erGI_weAE&feature=relmfu

<http://www.youtube.com/watch?v=Pl2P9VVv6oE&feature=relmfu>

<http://www.youtube.com/watch?v=UDGqM0GwFYy&feature=relmfu>

Informative Websites

<http://www.stopsportsinjuries.org/>

<http://www.acsm.org/>

<http://www.iadms.org/>

Informative Twitter feeds

@Sportsmd

@CAC_ACE

@CS4L_ACSV

@BJSM_BMJ

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PREPARTICIPATION PHYSICAL EVALUATION HISTORY FORM

(Note: This form is to be filled out by the patient and parent prior to seeing the physician. The physician should keep this form in the chart.)

Date of Exam _____

Name _____ Date of birth _____

Sex _____ Age _____ Grade _____ School _____ Sport(s) _____

Medicines and Allergies: Please list all of the prescription and over-the-counter medicines and supplements (herbal and nutritional) that you are currently taking

Do you have any allergies? Yes No If yes, please identify specific allergy below.

Medicines Pollens Food Stinging Insects

Explain "Yes" answers below. Circle questions you don't know the answers to.

| GENERAL QUESTIONS | Yes | No | MEDICAL QUESTIONS | Yes | No |
|--|------------|-----------|---|-----|----|
| 1. Has a doctor ever denied or restricted your participation in sports for any reason? | | | 26. Do you cough, wheeze, or have difficulty breathing during or after exercise? | | |
| 2. Do you have any ongoing medical conditions? If so, please identify below: <input type="checkbox"/> Asthma <input type="checkbox"/> Anemia <input type="checkbox"/> Diabetes <input type="checkbox"/> Infections Other: _____ | | | 27. Have you ever used an inhaler or taken asthma medicine? | | |
| 3. Have you ever spent the night in the hospital? | | | 28. Is there anyone in your family who has asthma? | | |
| 4. Have you ever had surgery? | | | 29. Were you born without or are you missing a kidney, an eye, a testicle (males), your spleen, or any other organ? | | |
| HEART HEALTH QUESTIONS ABOUT YOU | Yes | No | 30. Do you have groin pain or a painful bulge or hernia in the groin area? | | |
| 5. Have you ever passed out or nearly passed out DURING or AFTER exercise? | | | 31. Have you had infectious mononucleosis (mono) within the last month? | | |
| 6. Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise? | | | 32. Do you have any rashes, pressure sores, or other skin problems? | | |
| 7. Does your heart ever race or skip beats (irregular beats) during exercise? | | | 33. Have you had a herpes or MRSA skin infection? | | |
| 8. Has a doctor ever told you that you have any heart problems? If so, check all that apply: <input type="checkbox"/> High blood pressure <input type="checkbox"/> A heart murmur <input type="checkbox"/> High cholesterol <input type="checkbox"/> A heart infection <input type="checkbox"/> Kawasaki disease Other: _____ | | | 34. Have you ever had a head injury or concussion? | | |
| 9. Has a doctor ever ordered a test for your heart? (For example, ECG/EKG, echocardiogram) | | | 35. Have you ever had a hit or blow to the head that caused confusion, prolonged headache, or memory problems? | | |
| 10. Do you get lightheaded or feel more short of breath than expected during exercise? | | | 36. Do you have a history of seizure disorder? | | |
| 11. Have you ever had an unexplained seizure? | | | 37. Do you have headaches with exercise? | | |
| 12. Do you get more tired or short of breath more quickly than your friends during exercise? | | | 38. Have you ever had numbness, tingling, or weakness in your arms or legs after being hit or falling? | | |
| HEART HEALTH QUESTIONS ABOUT YOUR FAMILY | Yes | No | 39. Have you ever been unable to move your arms or legs after being hit or falling? | | |
| 13. Has any family member or relative died of heart problems or had an unexpected or unexplained sudden death before age 50 (including drowning, unexplained car accident, or sudden infant death syndrome)? | | | 40. Have you ever become ill while exercising in the heat? | | |
| 14. Does anyone in your family have hypertrophic cardiomyopathy, Marfan syndrome, arrhythmogenic right ventricular cardiomyopathy, long QT syndrome, short QT syndrome, Brugada syndrome, or catecholaminergic polymorphic ventricular tachycardia? | | | 41. Do you get frequent muscle cramps when exercising? | | |
| 15. Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator? | | | 42. Do you or someone in your family have sickle cell trait or disease? | | |
| 16. Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning? | | | 43. Have you had any problems with your eyes or vision? | | |
| BONE AND JOINT QUESTIONS | Yes | No | 44. Have you had any eye injuries? | | |
| 17. Have you ever had an injury to a bone, muscle, ligament, or tendon that caused you to miss a practice or a game? | | | 45. Do you wear glasses or contact lenses? | | |
| 18. Have you ever had any broken or fractured bones or dislocated joints? | | | 46. Do you wear protective eyewear, such as goggles or a face shield? | | |
| 19. Have you ever had an injury that required x-rays, MRI, CT scan, injections, therapy, a brace, a cast, or crutches? | | | 47. Do you worry about your weight? | | |
| 20. Have you ever had a stress fracture? | | | 48. Are you trying to or has anyone recommended that you gain or lose weight? | | |
| 21. Have you ever been told that you have or have you had an x-ray for neck instability or atlantoaxial instability? (Down syndrome or dwarfism) | | | 49. Are you on a special diet or do you avoid certain types of foods? | | |
| 22. Do you regularly use a brace, orthotics, or other assistive device? | | | 50. Have you ever had an eating disorder? | | |
| 23. Do you have a bone, muscle, or joint injury that bothers you? | | | 51. Do you have any concerns that you would like to discuss with a doctor? | | |
| 24. Do any of your joints become painful, swollen, feel warm, or look red? | | | FEMALES ONLY | | |
| 25. Do you have any history of juvenile arthritis or connective tissue disease? | | | 52. Have you ever had a menstrual period? | | |
| | | | 53. How old were you when you had your first menstrual period? | | |
| | | | 54. How many periods have you had in the last 12 months? | | |

Explain "yes" answers here

I hereby state that, to the best of my knowledge, my answers to the above questions are complete and correct.

Signature of athlete _____ Signature of parent/guardian _____ Date _____

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Training Distress Scale (TDS). This is a useful tool to screen for overtraining, under-recovery and psychological distress. Ideally, athletes complete the same questionnaire every 1-2 months to monitor for changes.

Staleness Scoring

Please respond to the following items as to how you have been feeling the last week, including today. Insert the number for each item that best describes you in the "Score Column". If you score over 14 for at least 3 days, you should consider taking a break from heavy training for two days and get a few good nights of sleep, IF POSSIBLE. Courtesy of Dr. Jack Raglin

| | Not at all | A little | Moderately | Quite a bit | Extremely |
|--------------|------------|----------|------------|-------------|-----------|
| Friendly | 0 | 1 | 2 | 3 | 4 |
| Worthless | 0 | 1 | 2 | 3 | 4 |
| Miserable | 0 | 1 | 2 | 3 | 4 |
| Helpful | 0 | 1 | 2 | 3 | 4 |
| Bad-tempered | 0 | 1 | 2 | 3 | 4 |
| Guilty | 0 | 1 | 2 | 3 | 4 |
| Unworthy | 0 | 1 | 2 | 3 | 4 |
| Peeved | 0 | 1 | 2 | 3 | 4 |
| Cheerful | 0 | 1 | 2 | 3 | 4 |
| Sad | 0 | 1 | 2 | 3 | 4 |