

## Proprioception

Meg Jacobs PT  
Momentum Physical Therapy &  
Sports Rehab  
[www.WeGetYouHealthy.com](http://www.WeGetYouHealthy.com)

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## Financial Disclosure

Mrs. Margaret Jacobs has no relevant financial relationships with commercial interests to disclose.

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## Proprioception

- Our bodies sense of it's own position, movement and balance in space.
- Provides us with "body awareness"
- A feedback mechanism
- It can be trained
- (What police officers test when they pull someone over. Without proprioception, we would need to watch our feet.)

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## Proprioceptive system

- Uses stretch and pressure receptors from our muscles, joints and skin to provide positional information to our brains
- The brain analyzes the information, then provides us with a sense of body orientation and movement.
- It can be subconscious and reflexive in nature, i.e.: if the body tilts, the person tilts their head to level out the eyes. This info comes from the cerebellum and is known as the "Law of Righting".

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## History of Proprioception

- 1557- Julius Scaliger described position movement sensation as a "sense of locomotion".
- 1826- Charles Bell broadened the term to involve "muscle sense".
- 1880 Henry Bastian coined the term "kinesthesia" meaning tendons, joints and skin were giving afferent info (back to the brain)

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## History

- 1889- Alfred Goldscheider made classification of kinesthesia into muscle, tendon and joint sensitivity.
- 1906- Charles Sherrington introduced the terms proprioception, interoception and exteroception

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## Exteroception

- Organs responsible for information from outside of the body: eyes, ears, mouth and skin.

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## Interoception

- Organs responsible for information from inside of the body: internal organs.

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## Proprioception

- Information/awareness of movement from muscle, tendon and joint/articular surfaces.

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## Kinesthesia

- Can be interchangeable with proprioception as meaning sense of body motion.
- Can be differentiated from proprioception by excluding the sense of equilibrium or balance, i.e.: ear infection decreases balance which decreases proprioception, but not kinesthesia.
- Kinesthesia is the sensation that a body part has moved, proprioception determines where the body part is in space.

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## Following Injury to Joints and Ligaments

- Receptors in the joints, ligaments and muscles are damaged and demonstrate deficits.
- Information to the brain is impaired.
- Leaves the athlete with decreased coordination and prone to reinjury.

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## Proprioception Can Be Trained

- Teaching the body to react appropriately to sudden changes decreases the chance of reinjury.
- It increases balance and coordination skills.
- It increases agility/quick direction changes.
- It increases the speed with which athletes return to sport.
- Want to initiate as soon as it is appropriate.

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## Proprioception Progression

- It includes balance, coordination and agility.
- Various equipment: floor, balance boards, BOSU...
- Eyes open to eyes closed.
- Double limb to single limb.
- Static to dynamic to coordination and agility.

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## Static Training

- Tandem stance (heel to toe): EO, EC
- SL stance: EO, EC
- Stab trainer (half moon foam): progression 2 limbs to single limb
  - Stance
  - Calf raises
  - Mini squats
  - Hip x 4way
  - Lunges

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## Static Training

- Golf squats- large ball, marble
- Bridges on Swiss ball- double to single
- Wobble Board
  - Stand both legs progressing to SL
  - Add ball toss
  - Add weighted ball
  - Add twist at trunk
  - Move ball one hand to other

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## Static Training

- BOSU- change difficulty by inflating or deflating dome
  - Balance B with EO/EC
  - Balance SL with EO/EC
  - Sport specific activities...FB, soccer

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## Dynamic Training

- Sport specific in nature including lateral movements, running and backward movements
- Start simple and progress in difficulty
- Start at slow speeds progressing to quick.
- Run forward with quick change of direction backward.
- Progress speed and distance, maintaining proper form.

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## Agility & Coordination

- Pivoting, twisting, cutting and jumping.
- Plyo boxes, agility ladder
- Progress double limb to single limb activities
- Focus on sport simulation specific movements essential for return to sport.

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### Program Design

- Make sure the proprioceptive program is appropriate for your clients age, body weight and level of competition.

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### Program Design- Age

- Kids < 16 yo CNS- Central Nervous Systems are not fully developed and do not send info to the brain as quickly as an adult, just as older adults have a similar problems due to a slowing of their CNS.
- Kids/seniors are also more prone to injuries during proprioceptive training due to less muscle strength than adults.

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### Program Design- Body Weight

- Increased weight of the client can limit what they can do. Make it appropriate for each individual client.

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### Emphasize Technique

- It is essential to do activities correctly.
- Good alignment.
- No compensatory movements.
- Proper landing techniques
- If they can not perform technique correctly, need to decrease the difficulty.
- Improper form can lead to injury/reinjury.

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### Contraindications

- Acute inflammation, post op.
- Joint instability
- Inability to perform techniques correctly

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### Proprioceptive Training Benefits

- Increases athletes/clients skill levels including balance, coordination, agility and speed.
- Reduces risk of future injuries.

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## Conclusion

- Start simple and progress in complexity.
- Change the variables to include surface, distance, speed, duration of activity and weight of objects.
- Be creative and appropriate for each athlete/client.
- Have Fun!!!

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## Bibliography

- ^ Jerosch, Jörg; Heisel, Jürgen (May 2010) (in German). *Management der Arthrose: Innovative Therapiekonzepte*. Deutscher Ärzteverlag, p. 107. ISBN 978-3-7691-0599-5. Retrieved 8 April 2011.
- ^ Singh, Arun Kumar (September 1991). *The Comprehensive History of Psychology*. Motilal Banarsidass Publ.. p. 66. ISBN 978-81-208-0804-1. Retrieved 8 April 2011.
- ^ Dickinson, John (1976). *Proprioceptive control of human movement*. Princeton Book Co.. p. 4. Retrieved 8 April 2011.
- ^ Foster, Susan Leigh (15 December 2010). *Choreographing Empathy: Kinesthesia in Performance*. Taylor & Francis. p. 74. ISBN 978-0-415-59655-8. Retrieved 8 April 2011.
- ^ Brookhart, John M., Mountcastle, Vernon B. (Vernon Benjamin); Geiger, Stephen R. (1984). *The Nervous system: Sensory processes: volume editor: Ian Darian-Smith*. American Physiological Society. p. 784. ISBN 978-0-683-01108-1. Retrieved 8 April 2011.
- ^ *kinesthesia* at eMedicine Dictionary
- ^ *proprioception* at eMedicine Dictionary
- ^ Costello J. T., Donnelly A. E. (2010). "The effects of cryotherapy on joint position sense in healthy participants: A systematic review". *Journal of Athletic Training* 43: 306–316.
- ^ Costello J. T., Donnelly A. E. (2010). "The effects of cryotherapy on joint position sense in healthy participants: A systematic review". *Journal of Athletic Training* 43: 306–316.
- ^ <http://erikdalton.com/NewslettersOnline/Feb06Newsletter.htm>
- Brooks, D., & Brooks, C.C. 2002. *Integrated Balance Training*. DW Fitness, LLC.
- Houglum, P.A. 2001. *Therapeutic Exercise for Athletic Injuries*. Champaign, IL: Human Kinetics.
- [IDEA Health Fitness Source. Volume 2004, Number 5](#)

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