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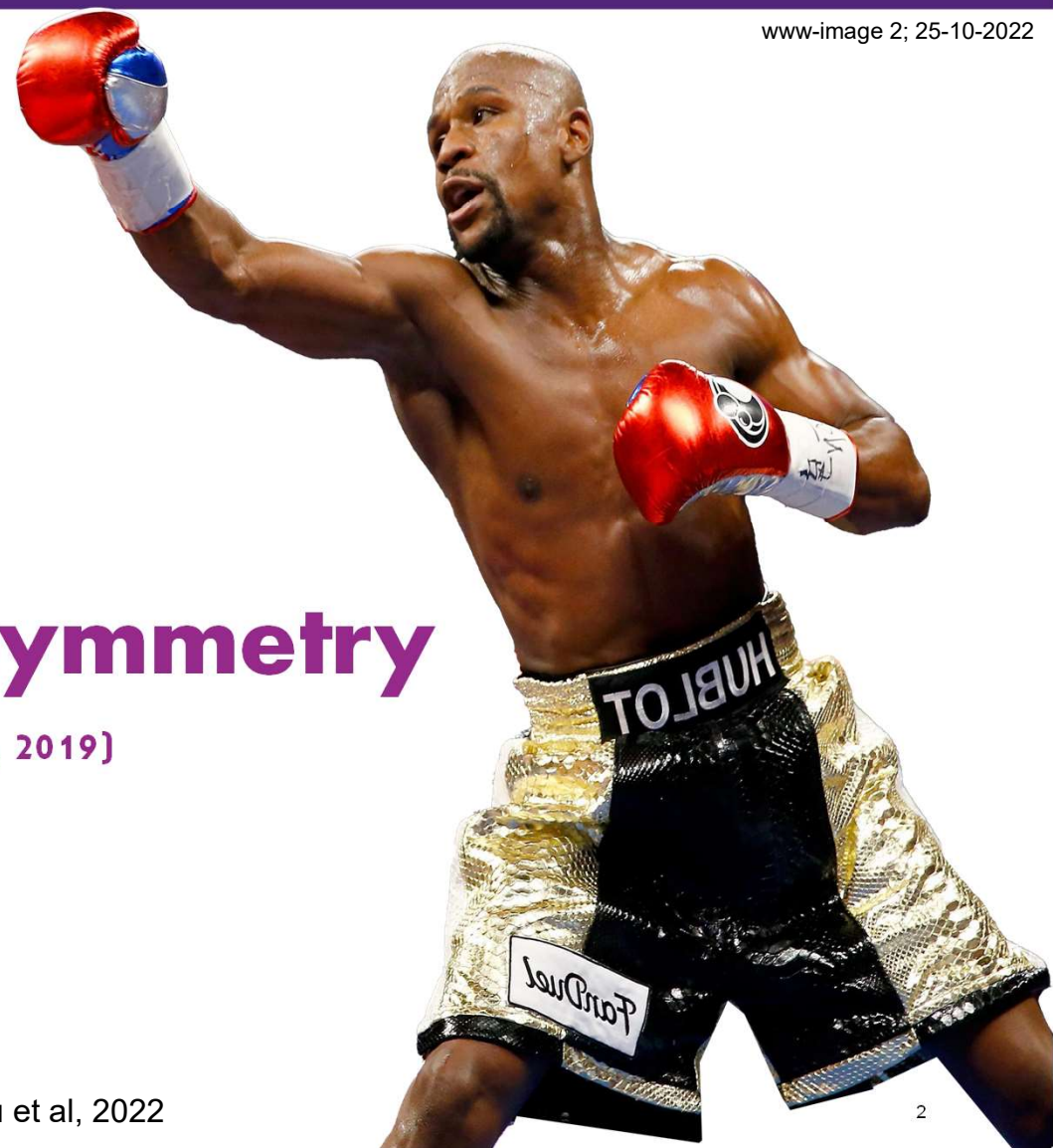
# Why do we strive for symmetry in rehabilitation of sports injuries?

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www-image 1; 25-10-2022

www-image 2; 25-10-2022



# Sporting Asymmetry

(Maloney, 2019)

Hellem et al, 2019; Zhou et al, 2022

# Topics to cover today



What's the evidence?



Flaws of chasing symmetry



What can we use instead?



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# What's the evidence?

Performance and injury prevention

## When do we use symmetry indices?



### Return to Sport Criteria

www-image 3; 20-10-2022



### Monitoring Progress

www-image 4; 20-10-2022



### 'Screening' Tool?

Greenberg et al, 2020; Rohman et al, 2015; Bodkin et al, 2022

## Does asymmetry increase injury risk?

“....the relationship between asymmetry and injury risk could not be conclusively established ....”  
(Helme et al, 2021)

### Prospective Longitudinal Cohort Studies:



Level III Evidence  
Olivier et al, 2020  
www-image 5; 20-10-2022



Level II Evidence  
Eagle et al, 2020  
www-image 6; 20-10-2022



Level I Evidence  
Opar et al, 2015  
www-image 7; 20-10-2022



Level I Evidence  
Bodkin et al, 2022<sup>6</sup>  
www-image 8; 28-10-2022



## Does asymmetry impair sport performance?

“..A clear link between asymmetry and athletic performance cannot be determined..”  
(Maloney, 2019)

### Cross-Sectional Studies (Level III Evidence):



Bailey et al, 2013 & Maloney et al, 2017

www-image 9; 20-10-2022



Lockie et al, 2014, Lockie et al, 2012

& Meyers et al, 2017

www-image 10; 20-10-2022



Hoffman et al, 2007

www-image 11; 20-10-2022

## Important to note

The maximum asymmetry present in these studies was

**20%**

Is there a threshold?





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# The flaws of chasing symmetry

When the “good” side isn’t “good”  
Limb dominance & sporting asymmetry



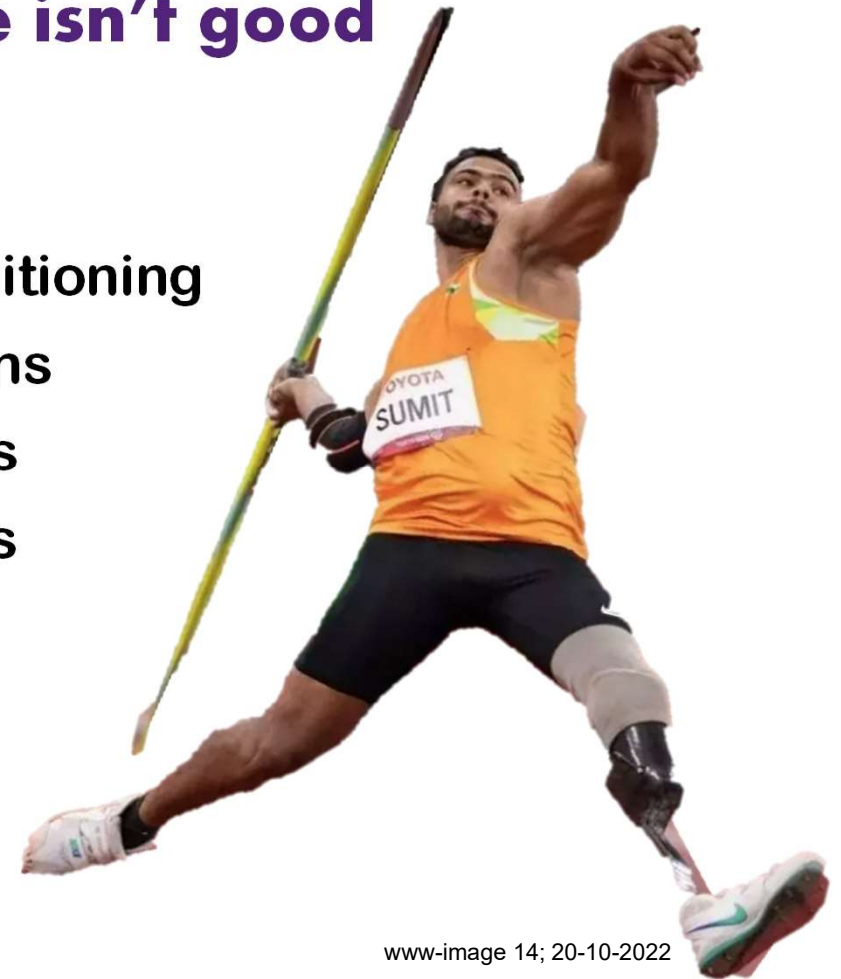
www-image 12; 20-10-2022

## When the “good” side isn’t good

Post-operative deconditioning  
Chronic conditions  
Overuse injuries  
Bilateral injuries  
Comorbidities



www-image 13; 20-10-2022



www-image 14; 20-10-2022

Patterson et al, 2020; Bodkin et al, 2022; Zore et al, 2021; Runciman et al, 2015

## Limb Dominance & Sporting Asymmetry

**Does the sport require asymmetry?**

**Dominant vs non-dominant**



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# What can we use instead?



www-image 15; 20-10-2022

## When the “good” side isn’t good: Case study 1



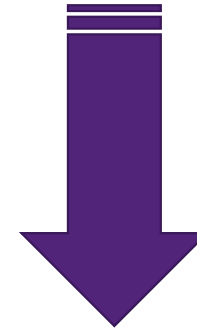
25 year old female elite soccer player  
3/12 history of high ankle sprain of right ankle  
Chronic ankle instability of left ankle  
Goal: Reduce risk of re-injury when return to next  
soccer season in 6 months

**Is symmetry a valuable tool to use?  
What will RTS criteria be?**

## Case 1: female elite footballer



**PROBLEM:**  
cannot rely on limb symmetry index



**SOLUTION:**  
baseline +/- normative data

# What can we use instead?

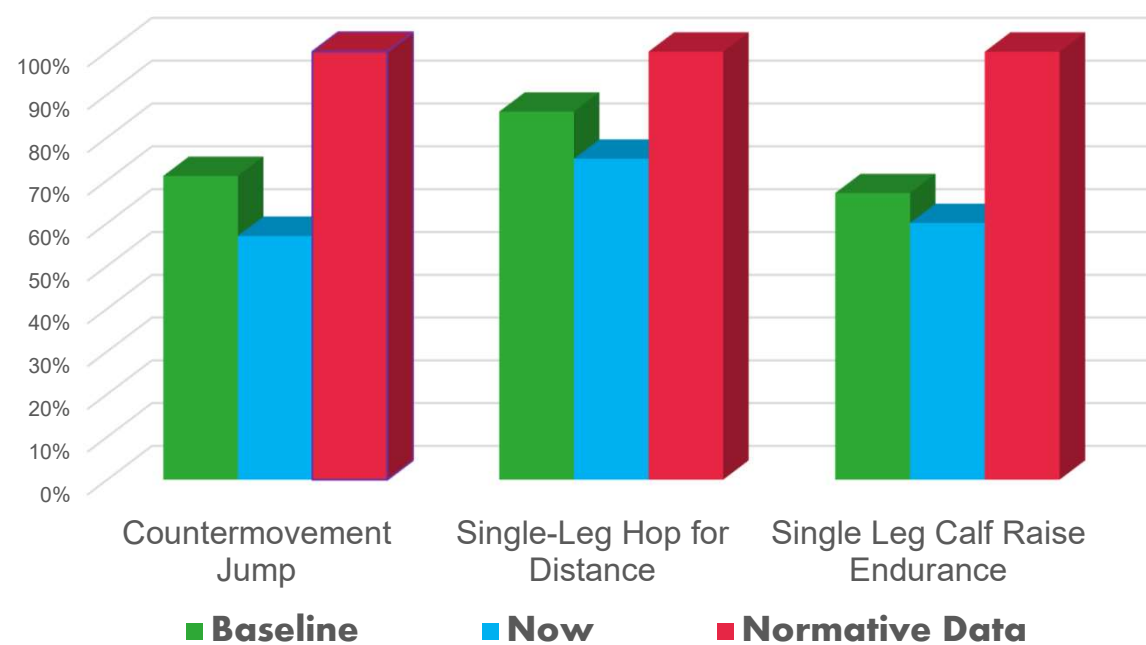
## Case 1: female elite footballer



Limb symmetry index (right/left)  
>110% for all functional tests

**BUT....**

Current function compared to baseline and normative data



Turner et al, 2013; Hebert-Losier et al, 2017



## Sporting Asymmetries/Limb Dominance: Case study 2

30 year old Male Elite Boxer

4/52 history of right boxer's knuckle #

Right side dominant

Deconditioned/untrained

Goal: Return to performance for title fight against  
known rival in 8 months

**Is attaining symmetry enough?**

**What will RTS criteria be?**



## Case 2: male elite boxer

### **PROBLEM:**

**no baseline measures, scarce normative data**



### **SOLUTION:**

**analyse requirements of sport**



## Case 2: male elite boxer

### NEEDS ANALYSIS

(mini version)



**~60 punches per round**



**Punch Force = 2000-4000N**



**Punch Velocity = 9-12m/s**

Dinu et al, 2020



## Take Home Messages

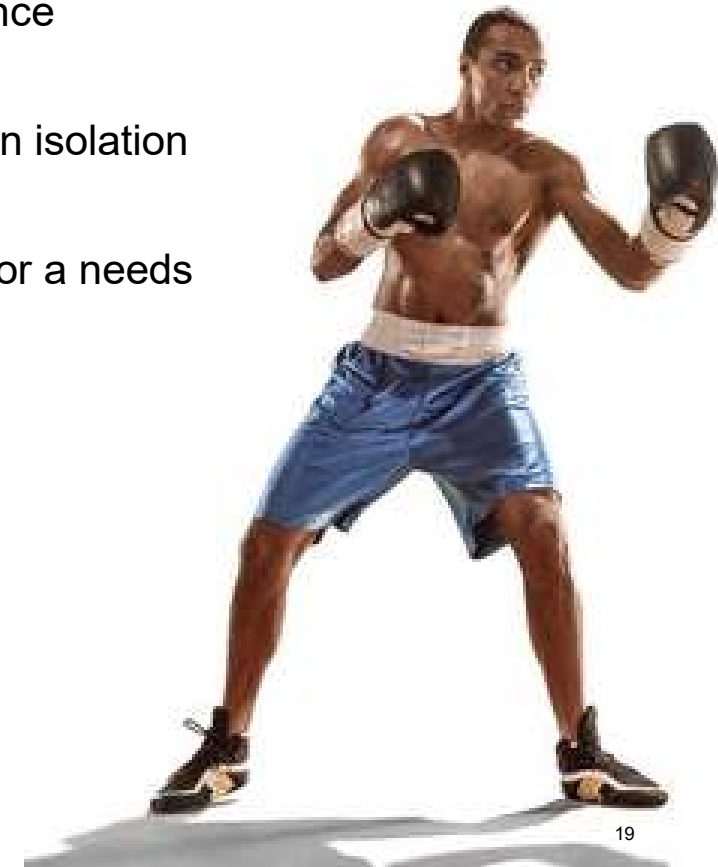
Not enough evidence to definitively conclude that symmetry reduces injury risk or enhances performance

Limb Symmetry Index (LSI) should not be used in isolation

Alternatives: baseline measures, normative data or a needs analysis

Consider specific context of athlete

More research needs to be done





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# Thank you

## Questions?

## REFERENCES

- Bailey C, Sato K, Alexander R, Chiang C-Y, Stone M. Isometric force production symmetry and jumping performance in college athletes. *Journal of Trainology*. 2013;2:1-5.
- Bodkin SG, Hertel J, Diduch DR, Saliba SA, Novicoff WM, Brockmeier SF, et al. Predicting Anterior Cruciate Ligament Reinjury From Return-to-Activity Assessments at 6 Months Postsurgery: A Prospective Cohort Study. *J Athl Train*. 2022;57(4):325-33.
- D'Hooghe P, Gokeler A. Syndesmosis Injuries in Athletes: Return to Sports Continuum is Linked to High Quality Rehabilitation. *Aspetar Sports Medicine Journal*. 2022;11.
- Dinu D, Louis J. Biomechanical Analysis of the Cross, Hook, and Uppercut in Junior vs. Elite Boxers: Implications for Training and Talent Identification. *Frontiers in Sports and Active Living*. 2020;2:598861.
- Eagle SRMATATC, Kessels MMS, Johnson CDMS, Nijst BMS, Lovalekar MP, Krajewski KMS, et al. Bilateral Strength Asymmetries and Unilateral Strength Imbalance: Predicting Ankle Injury When Considered With Higher Body Mass in US Special Forces a. *Journal of Athletic Training*. 2019;54(5):497-504.
- Finlay MJ, Greig M, Page RM, Bridge CA. Acute physiological, endocrine, biochemical and performance responses associated with amateur boxing: A systematic review with meta-analysis. *Eur J Sport Sci*. 2022;ahead-of-print(ahead-of-print):1-15.
- Gatt I, Allen T, Wheat J. Quantifying wrist angular excursion on impact for Jab and Hook lead arm shots in boxing. *Sports Biomechanics*. 2021:1-13.
- Greenberg EM, Dyke J, Leung A, Karl M, Lawrence JT, Ganley T. Uninjured Youth Athlete Performance on Single-Leg Hop Testing: How Many Can Achieve Recommended Return-to-Sport Criterion? *Sports Health*. 2020;12(6):552-8.
- Hébert-Losier K, Ngawhika TM, Gill N, Balsalobre-Fernandez C. Validity, reliability, and normative data on calf muscle function in rugby union players from the Calf Raise application. *Sports biomechanics*. 2022;ahead-of-print(ahead-of-print):1-22.
- Hellem A, Shirley M, Schilaty N, Dahm D. Review of Shoulder Range of Motion in the Throwing Athlete: Distinguishing Normal Adaptations from Pathologic Deficits. *Curr Rev Musculoskelet Med*. 2019;12(3):346-55.
- Helme M, Tee J, Emmonds S, Low C. Does lower-limb asymmetry increase injury risk in sport? A systematic review. *Physical Therapy in Sport*. 2021;49:204-13.
- Hoffman JR, Ratamess NA, Klatt M, Faigenbaum AD, Kang J. Do Bilateral Power Deficits Influence Direction-Specific Movement Patterns? *Res Sports Med*. 2007;15(2):125-32
- Lockie RG, Callaghan SJ, Berry SP, Cooke ERA, Jordan CA, Luczo TM, et al. Relationship Between Unilateral Jumping Ability and Asymmetry on Multidirectional Speed in Team-Sport Athletes. *The Journal of Strength & Conditioning Research*. 2014;28(12).

- Lockie RG, Schultz AB, Jeffriess MD, Callaghan SJ. The relationship between bilateral differences of knee flexor and extensor isokinetic strength and multi-directional speed. *Isokinetics and exercise science*. 2012;20(3):211-9.
- Maloney SJ. The Relationship Between Asymmetry and Athletic Performance: A Critical Review. *J Strength Cond Res*. 2019;33(9):2579-93.
- Maloney SJ, Richards J, Nixon DGD, Harvey LJ, Fletcher IM. Vertical stiffness asymmetries during drop jumping are related to ankle stiffness asymmetries. *Scand J Med Sci Sports*. 2017;27(6):661-9.
- Martin Rudolf Z, Nevenka Kregar V, Mohsen H. Pre- and Post-Operative Limb Symmetry Indexes and Estimated Preinjury Capacity Index of Muscle Strength as Predictive Factors for the Risk of ACL Reinjury: A Retrospective Cohort Study of Athletes after ACLR. *Applied sciences*. 2021;11(8):3498.
- Meyers RW, Oliver JL, Hughes MG, Lloyd RS, Cronin JB. Asymmetry During Maximal Sprint Performance in 11- to 16-Year-Old Boys. *Pediatr Exerc Sci*. 2017;29(1):94-102.
- Olivier B, Lala B, Gillion N. The cricketer's shoulder and injury : asymmetries in range of movement and muscle length. *S Afr J Physiother*. 2020;76(1):1-6.
- Opar DA, Williams MD, Timmins RG, Hickey J, Duhig SJ, Shield AJ. Eccentric Hamstring Strength and Hamstring Injury Risk in Australian Footballers. *Med Sci Sports Exerc*. 2015;47(4):857-65.
- Parry GN, Herrington LC, Horsley IG, Gatt I. The test–retest reliability of bilateral and unilateral force plate–derived parameters of the countermovement push-up in elite boxers. *J Sport Rehabil*. 2021;30(7):1106-10.
- Patterson BE, Crossley KM, Perraton LG, Kumar AS, King MG, Heerey JJ, et al. Limb symmetry index on a functional test battery improves between one and five years after anterior cruciate ligament reconstruction, primarily due to worsening contralateral limb function. *Phys Ther Sport*. 2020;44:67-74.
- Rohman E, Steubs JT, Tompkins M. Changes in involved and uninvolved limb function during rehabilitation after anterior cruciate ligament reconstruction: implications for Limb Symmetry Index measures. *The American journal of sports medicine*. 2015;43(6):1391-8.
- Rubens S-J, Emerson F. Developing strength-endurance for combat sports athletes. *Revista de artes marciais asiáticas*. 2021;16(1s):174-91.
- Runciman P, Derman W, Ferreira S, Albertus-Kajee Y, Tucker R. A Descriptive Comparison of Sprint Cycling Performance and Neuromuscular Characteristics in Able-Bodied Athletes and Paralympic Athletes with Cerebral Palsy. *Am J Phys Med Rehabil*. 2015;94(1):28-37.
- Turner E, Munro AG, Comfort P. Female soccer: Part 1- A needs analysis. *Strength and conditioning journal*. 2013;35(1):51-7.
- Xiaohua L, Jianbo L, Meifang Z. Therapeutic Effect of Nanotitanium Oxide Combined with Exercise Rehabilitation Training on Wrist Joint Injury of Boxers. *Journal of nanomaterials*. 2022;2022.
- Zhou Z, Chen C, Chen X, Yi W, Cui W, Wu R, et al. Lower extremity isokinetic strength characteristics of amateur boxers. *Frontiers in Physiology*. 2022:1589.



## IMAGES/PHOTO REFERENCES:

Image 1: Shutterstock 2019, Baseball Pitcher Transparent, digital image, accessed 25 October 2022, [https://www.pngfind.com/mpng/ixJimbi\\_baseball-pitcher-transparent-png-download-baseball-pitcher-transparent/](https://www.pngfind.com/mpng/ixJimbi_baseball-pitcher-transparent-png-download-baseball-pitcher-transparent/)

Image 2: IMGBIN 2016, Mike Tyson Boxing PNG, digital image, accessed 25 October 2022, <https://www.pinterest.com.au/pin/791507703253365940/>

Image 3: iprsmediquipe 2016, ACL Sports Injuries, digital image, accessed 20 October 2022, <https://www.iprsmediquipe.com/news/new-next-generation-isokinetic-software-advantage-bx/>

Image 4: Andy McHugh 2016, Measuring Progress, digital image, accessed 20 October 2022, <https://www.teachingandlearningguru.com/measuring-progress/>

Image 5: Canstock photo 2022, Cricket Bowler Bowling Front, digital image, accessed 20 October 2022, <https://www.canstockphoto.com/cricket-bowler-bowling-ball-front-10313221.html>

Image 6: iStock 2022, US Special Forces Cartoon, digital image, accessed 20 October 2022, <https://www.istockphoto.com/photos/us-special-forces-cartoon>

Image 7: Clipart Library 2019, Football Players Clipart, digital image, accessed 20 October 2022, <http://clipart-library.com/clipart/Xdc4o9dTe.htm>

Image 8: Elite Sports Medicine + Orthopedics 2022, ACL Injuries, digital image, accessed 28 October 2022, <https://www.eliteorthopaedic.com/services/acl-tear>

Image 9: Twinkl 2022, Standing Vertical Jump, digital image, accessed 20 October 2022, <https://www.twinkl.com.au/teaching-wiki/standing-vertical-jump>

Image 10: FreePik 2022, Runner Athlete Sprinter, digital image, accessed 20 October 2022, [https://www.freepik.com/premium-vector/runner-black-man-athlete-sprinter-illustration\\_6511853.htm](https://www.freepik.com/premium-vector/runner-black-man-athlete-sprinter-illustration_6511853.htm)

Image 11: BaseballSA 2022, Home Workouts, digital image, accessed 20 October 2022, <https://www.baseballsa.com.au/programs/week-1-day-6/>

Image 12: Bransch Blog 2011, Sprinting to the London Olympics, accessed 20 October 2022, <http://blog.bransch.net/?p=2845>

Image 13: Alamy 2022, Football on Crutches, accessed 20 October 2022, <https://www.alamy.com/stock-photo/football-on-crutches.html?sortBy=relevant>

Image 14: THG 2021, Javelin Thrower breaks world record, accessed 20 October 2022, <https://thehindustangazette.com/sports/javelin-thrower-sumit-antil-breaks-world-record-wins-gold-at-tokyo-paralympics-5158>

Image 15: FreePik 2022, Woman Thinking, accessed 20 October 2022, <https://www.freepik.com/free-photos-vectors/black-woman-thinking>

Image 16: AdobeStock 2022, Leg kick, accessed 20 October 2022, <[https://stock.adobe.com/images/leg-kick-one-sportive-girl-female-soccer-player-training-with-football-ball-isolated-on-white-studio-background-sport-action-motion-fitness/488591535?as\\_campaign=ftmigration2&as\\_channel=dpcft&as\\_campclass=brand&as\\_source=ft\\_web&as\\_camptype=acquisition&as\\_audience=users&as\\_content=closure\\_asset-detail-page](https://stock.adobe.com/images/leg-kick-one-sportive-girl-female-soccer-player-training-with-football-ball-isolated-on-white-studio-background-sport-action-motion-fitness/488591535?as_campaign=ftmigration2&as_channel=dpcft&as_campclass=brand&as_source=ft_web&as_camptype=acquisition&as_audience=users&as_content=closure_asset-detail-page)>

Image 17: AdobeStock 2022, Boxer White Background, accessed 20 October 2022, <https://stock.adobe.com/ee/search?k=boxer%20white%20background>