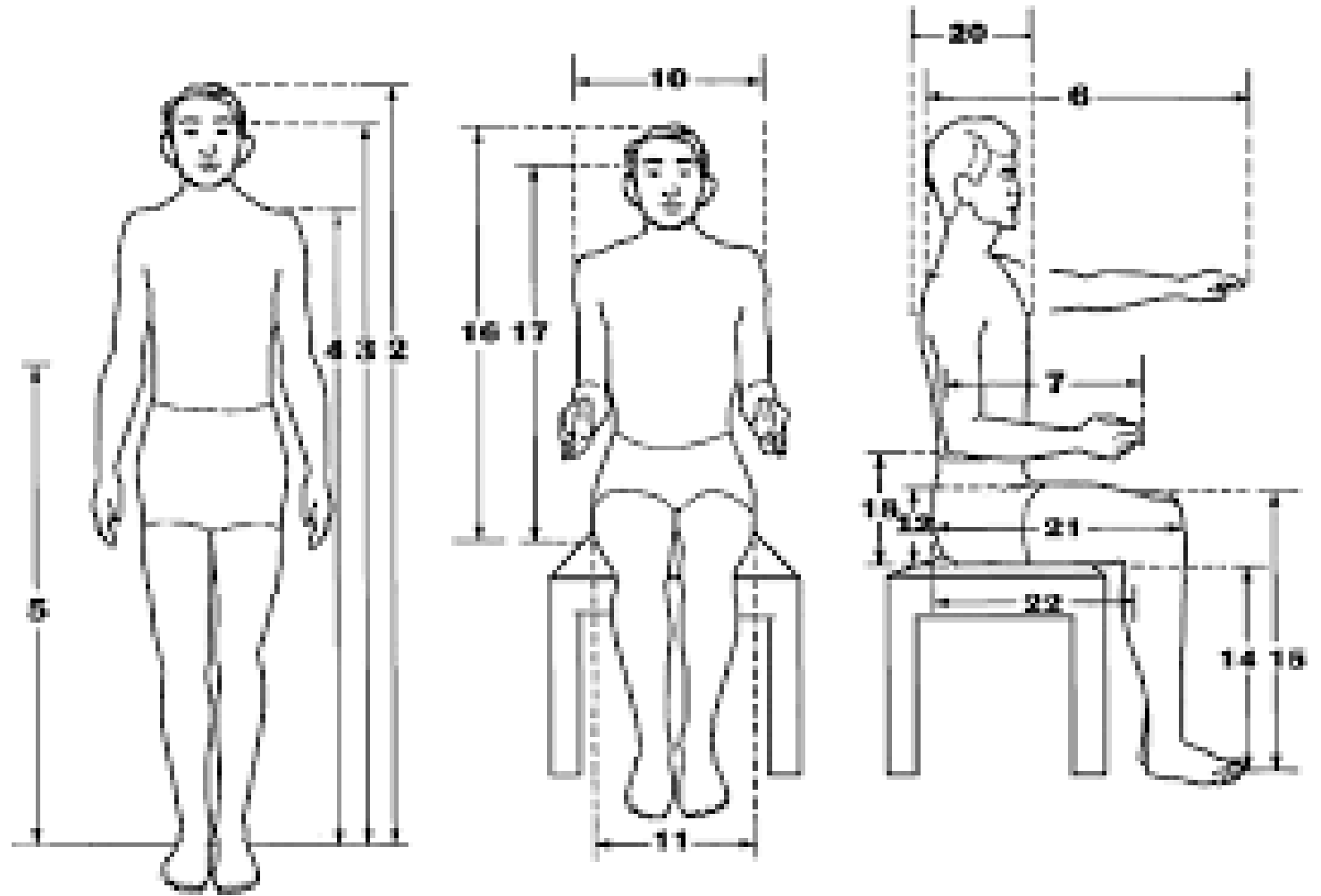




Asymmetries as a risk factor
for injuries in gymnastics

Anthropometry of a gymnast

- Research by Ivan Čuk and others
- Anthropometric parameters (40 competitors, WC in Ljubljana 2000)



Anthropometry of a gymnast

- Weight = 66kg
- Height = 168cm
- No left/right side asymmetries

Found differences in:

- Elbow diameter
- Circumference of forearm
- Skinfold thickness of biceps brachii
- Skinfold thickness of triceps brachii

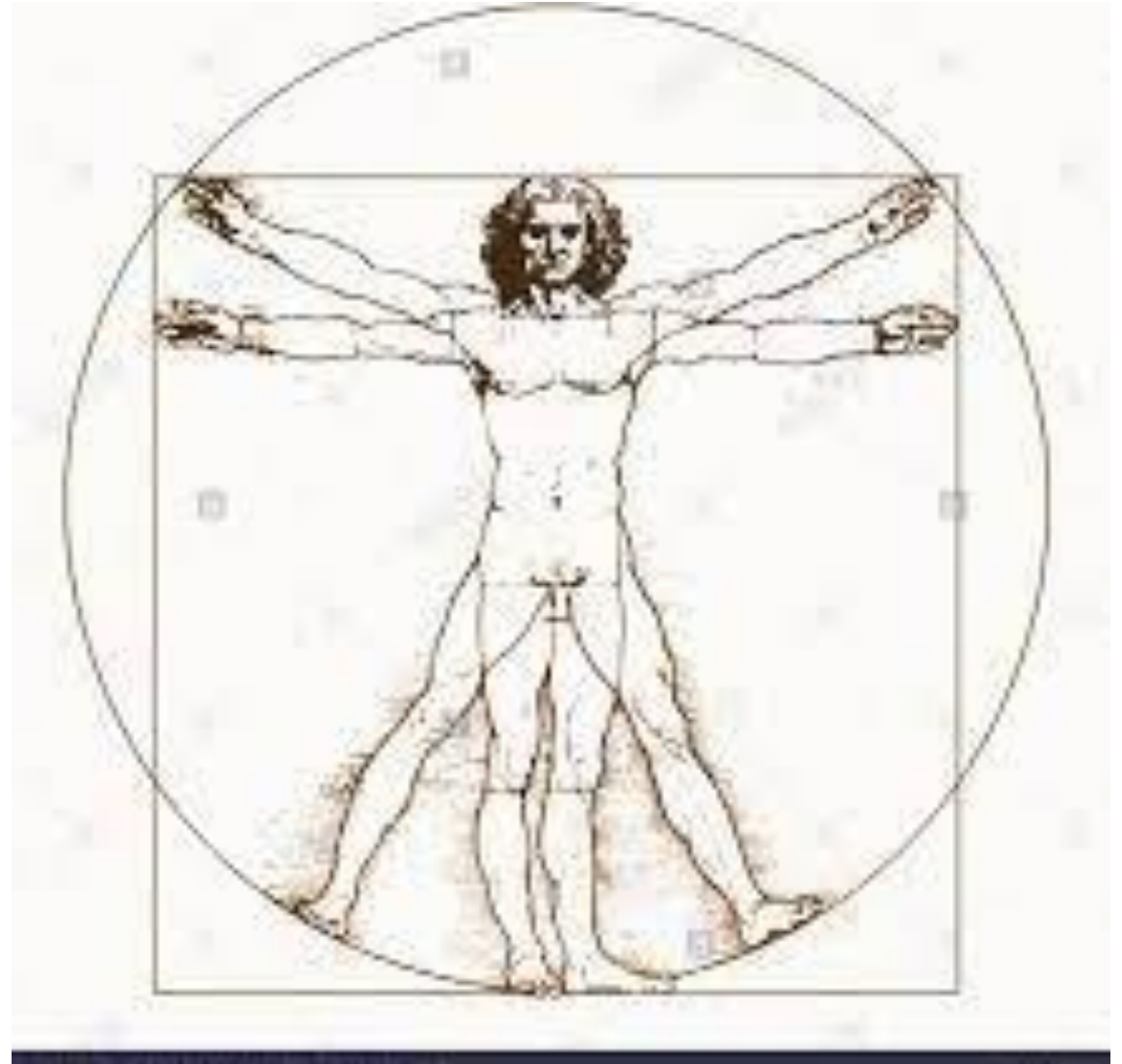


Table I. Descriptive statistics and t-test.

Variable	X	SD	Max	Min		
Age (years)	23.40		30	17		
Body height (cm)	168.08	6.25	185.50	157.40		
Body weight (kg)	66.45	8.15	84.80	51.90		
	Left side		Right side		t	Sig.
	Mean	SD	Mean	SD		
Wrist diameter (cm)	6.04	0.36	6.08	0.37	-1.706	.096
Elbow diameter (cm)	6.79	0.41	6.86	0.43	-2.808	.008*
Knee diameter (cm)	8.79	0.54	8.78	0.54	.333	.741
Ankle diameter (cm)	6.94	0.59	6.90	0.65	1.397	.170
Circumference of thigh (cm)	54.07	2.84	54.02	2.85	-.640	.526
Circumference of calf (cm)	35.50	1.87	35.55	1.88	-.339	.736
Circumference of forearm (cm)	27.78	1.49	28.09	1.53	-3.069	.004*
Circumference of relaxed upper arm (cm)	33.15	2.12	33.26	2.16	-.896	.376
Skinfold thickness of thigh - ventral (mm)	7.22	2.04	7.03	1.74	1.143	.260
Skinfold thickness of calf (mm)	5.01	1.31	4.88	1.27	1.261	.215
Skinfold thickness of biceps brachii (mm)	3.26	0.51	3.10	0.45	2.050	.047*
Skinfold thickness of triceps brachii (mm)	4.63	1.03	4.94	1.19	-3.407	.002*
Skinfold thickness of forearm - volar (mm)	3.40	0.72	3.43	0.69	-.483	.632

*significant differences between left and right side.

Table II. Anthropometric characteristics of top gymnasts at World Championships in Rotterdam 1989 (N=165) (Claesens *et al.* 1991).

Measurement	X	SD	Max	Min
Body height (cm)	167.0	6.3	183.8	153.2
Body weight (kg)	63.6	6.2	80.5	50.0
Knee diameter (cm)	9.2	0.4	11.0	8.2
Circumference of thigh (cm)	51.1	2.7	58.0	36.9
Circumference of forearm (cm)	27.5	1.2	30.1	24.0
Circumference of relaxed upper arm (cm)	31.2	1.7	36.5	26.3
Circumference of calf (cm)	34.7	1.7	40.0	31.0
Skinfold thickness of calf (mm)	4.7	1.2	10.2	2.8
Skinfold thickness of biceps (mm)	3.3	0.5	5.0	2.4
Skinfold thickness of triceps (mm)	5.4	1.1	10.2	3.7

Comparison of measurements from 1989 WC and 2000 WC

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Types of asymmetries

- Muscle asymmetries (strength, Flexibility)
- Anthropometric asymmetries (shortened limb due to previous injury...)



Muscle asymmetries

- **Due to strength:**
 - Left/right arm
 - Antagonist/agonist muscle
 - Lack of strength in larger muscle groups such as quadriceps or biceps...
- **Due to flexibility:**
 - Left/right arm
 - Antagonist/agonist muscle
 - Lack of flexibility in larger muscle groups



Strength ratios of
antagonist/agonist
muscle

Ankle	Plantar/Dorsal	3:1
Ankle	Pronation/supination	1:1
Knee	Extension/flexion	3:2
Hip	Extension/Flexion	1:1
Shoulder	Extension/flexion	3:2
Shoulder	Internal/external rotation	3:2
Elbow	Extension/Flexion	1:1
Abdominal/back muscles	Extension/Flexion	1:1
Whole body	Left/Right side	1:1

Ankle injury

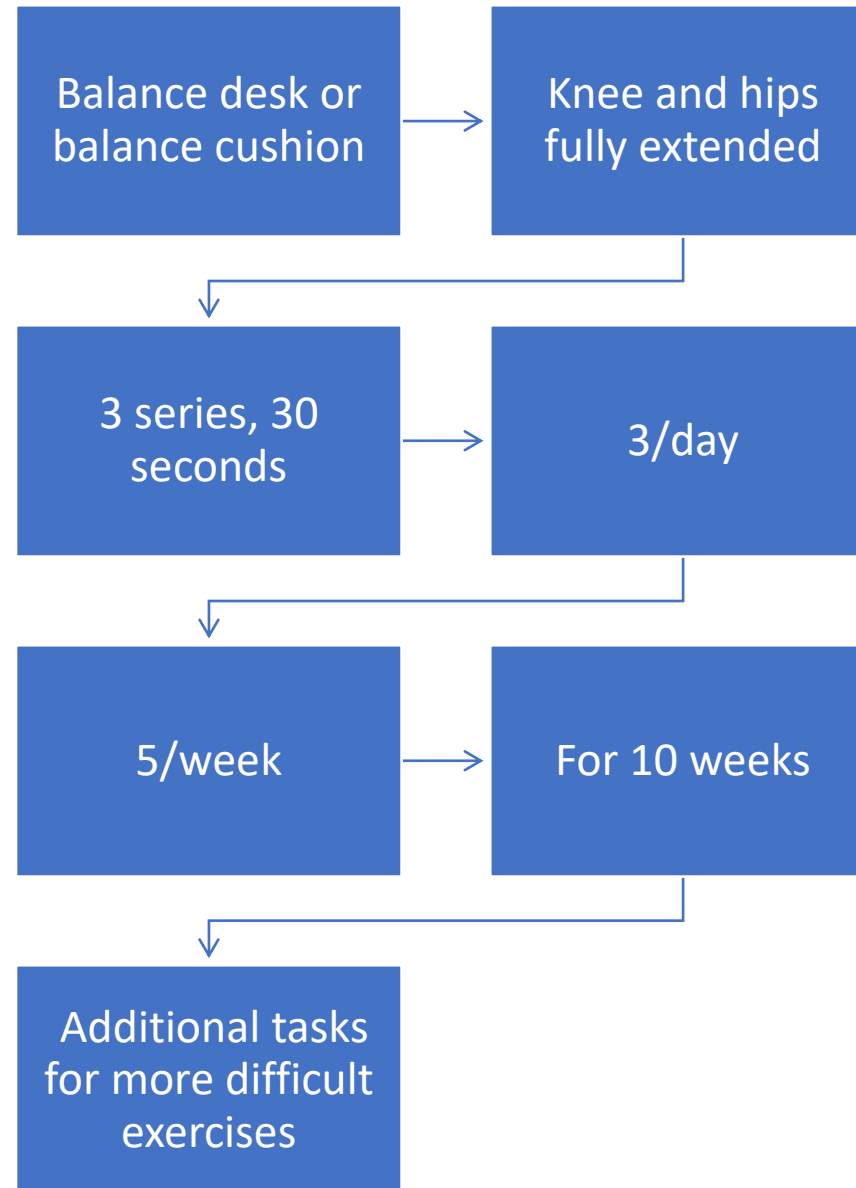
Weakness of the ankle stabilizer muscles often results in ankle injuries

Proprioception is the first to be lost after an ankle sprain

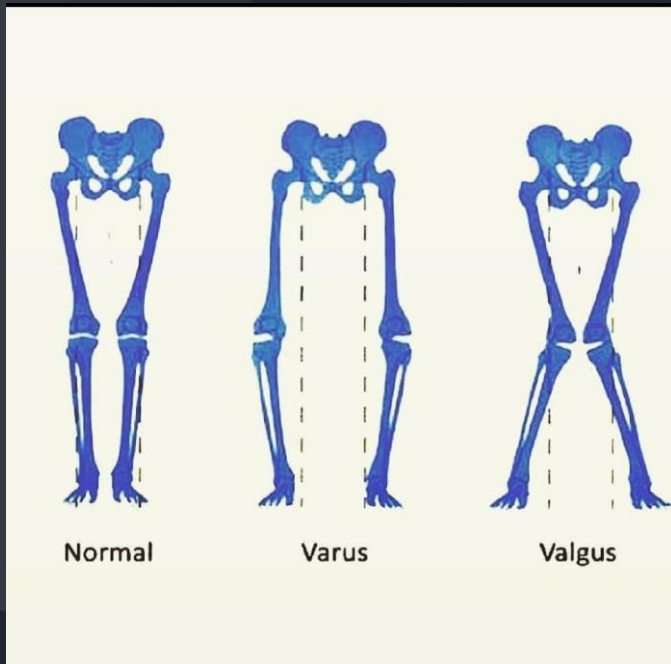
Possibility of weakened tendons and risk of further injuries

Prevention

<https://www.youtube.com/watch?v=CzyfFfleRU0>



Knee injury



Knee injuries are usually the result of excessive force and our muscles are no longer able to compensate

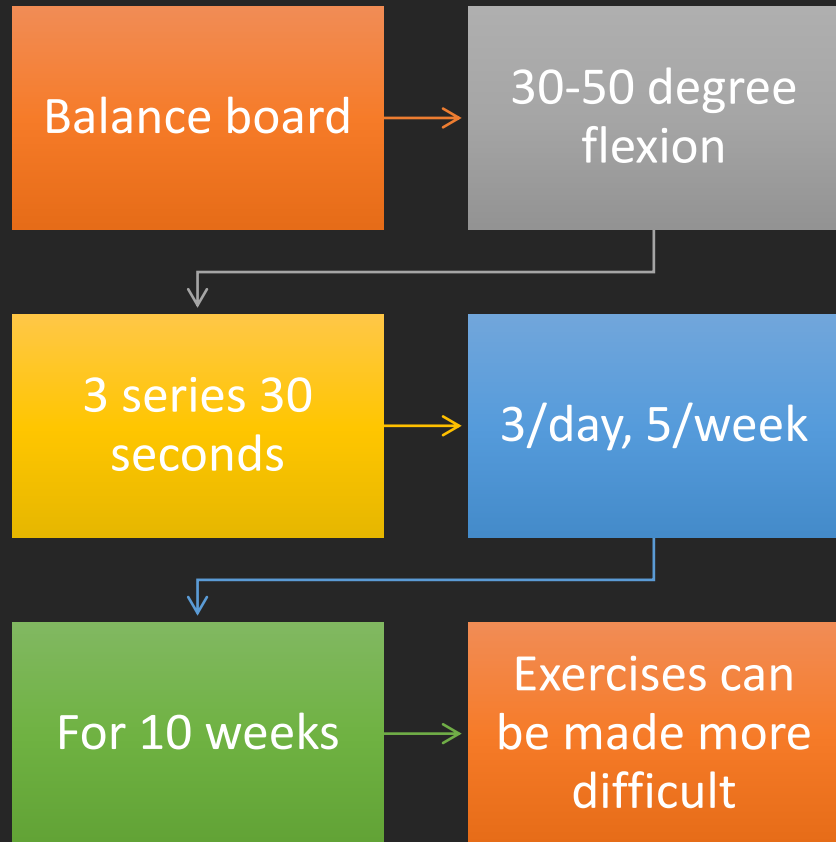
May happen in case of incorrect knee position in Valgus while landing a jump

Inhibition of inhibitory mechanisms (can be achieved with strength trainings)

Balance between muscle strength and flexibility should be maintained

Compensation between mass and strength

Prevention





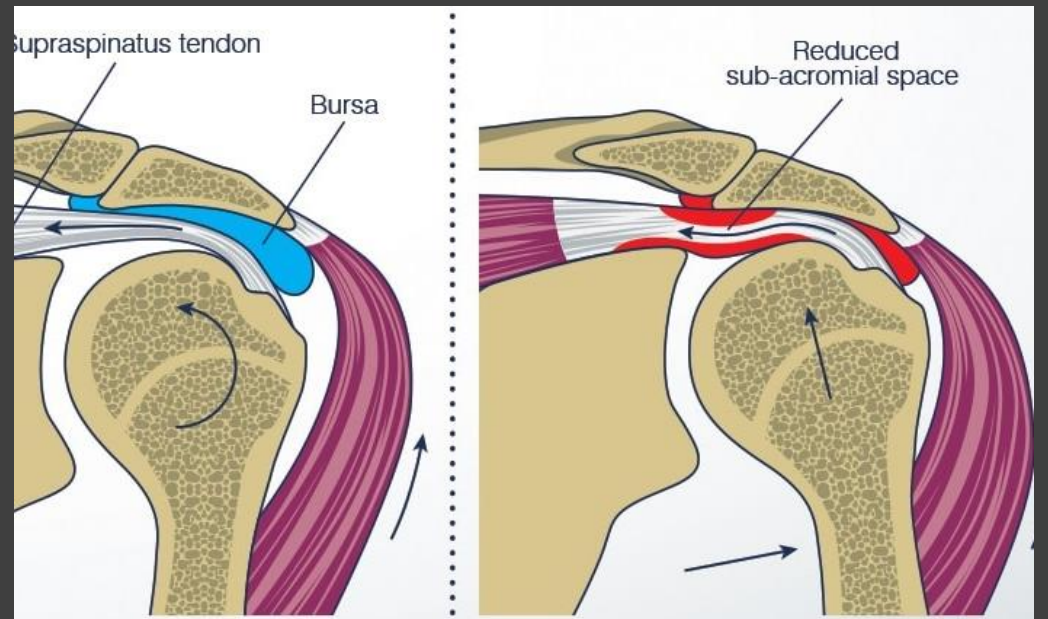
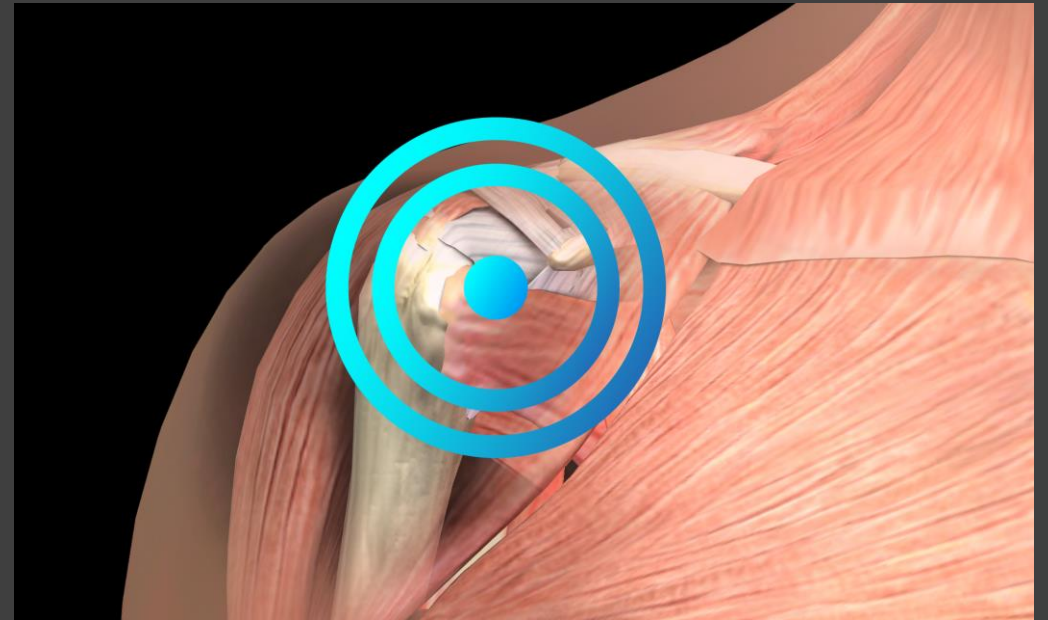
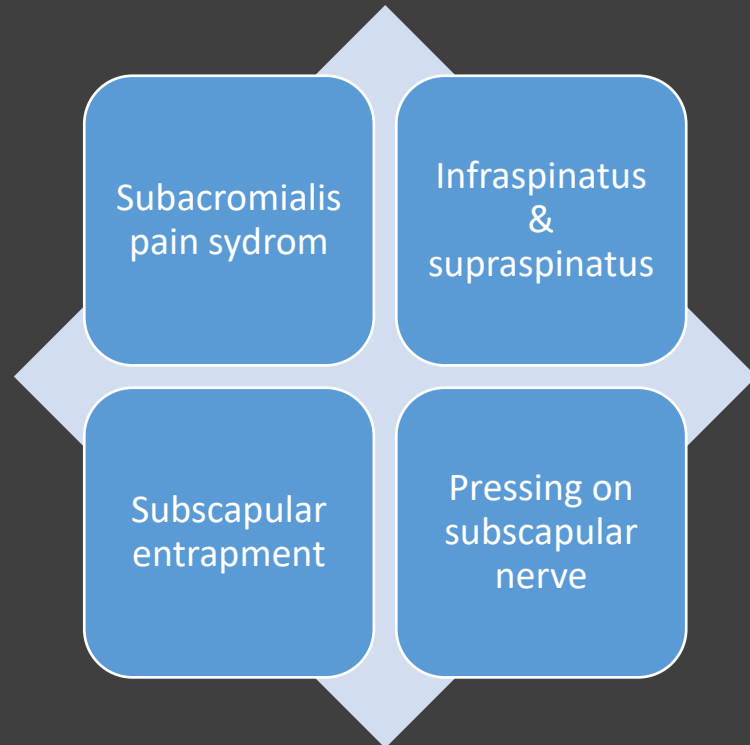
Shorter leg

Uncommon

May be a cause
of dysplasia

Rehabilitation
and prevention
programs

Shoulder pain



Prevention

<https://www.youtube.com/watch?v=PVDgjHqAes8>

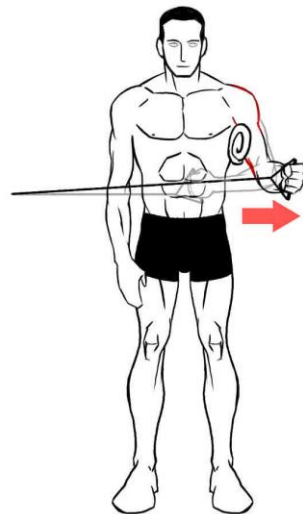
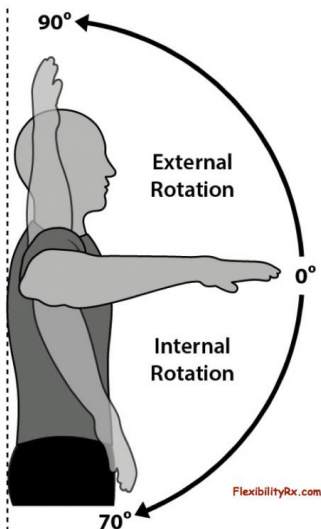
internal and external rotation


Include exercises in every warm-up

3 series

10 repetitions

1 second of concentric and 2 seconds of eccentric contraction





Thank you for your
attention!