A Systematic Review on the Effect of Squat Variations on Vastus Medialis (Oblique) & Vastus Lateralis Activation, and Vastus Medialis (Oblique)/Vastus Lateralis Ratio

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Background

- Patellofemoral joint pain syndrome (PFPS) is prevalent worldwide (Boling et al., 2010; Dey et al., 2016; Xu et al., 2018)
- squat exercises ➔ maximising vastus medialis (oblique) (VM(O)) strength and vastus medialis (oblique)/vastus lateralis (VM(O)/VL) ratio (Dong et al., 2021)
- no conclusive answer ➔ any squat variations can provide a superior effect for PFPS rehabilitation
- several squats' biomechanical variables ➔ VM(O) & VM(O)/VL ratio ? (Contradicted in different studies)

Objective

1. Gather and analyse electromyography (EMG) studies focus on squat and VM(O)/VL activation or VM(O)/VL ratio
2. Conclude the influence of the selected muscles activation and the ratio during various squats
3. Provide an insight into exercise selection for PFPS rehabilitation

Methodology

Electronic database search

Search Terms	
1.	VM(O) OR VM [Title / Abstract] AND
2.	VL [Title / Abstract] OR
3.	VM(O)/VL ratio OR VM/VL ratio [Title / Abstract] AND
4.	Squat OR squat variation OR back squat OR Spanish squat OR mini squat OR semi-squat [Title / Abstract] AND
5.	electromyography OR EMG [Title / Abstract]

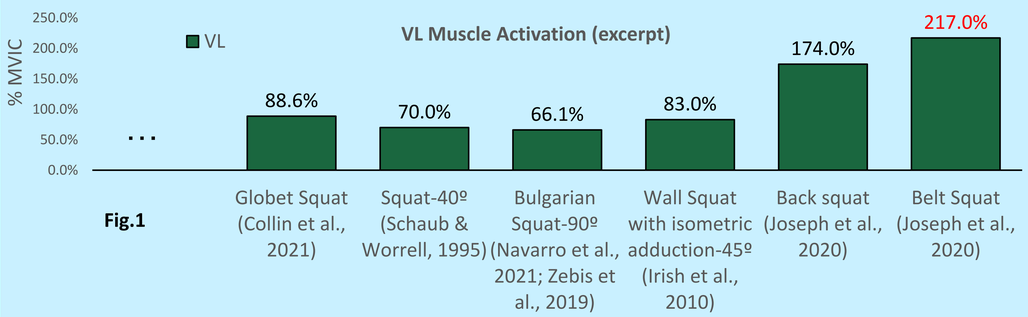

Fig.1

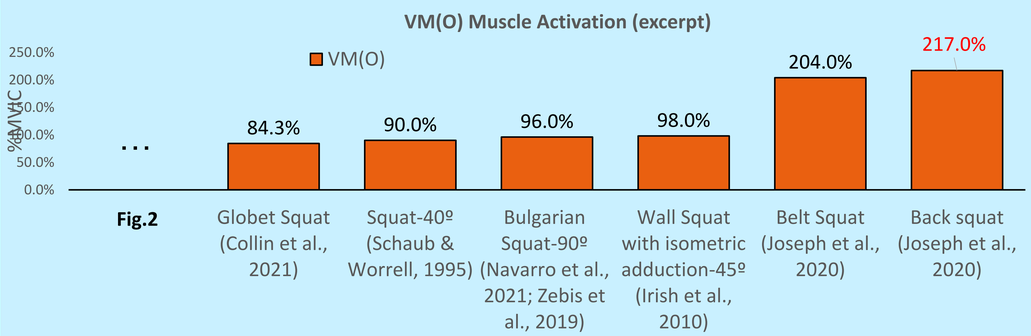

Fig.2

Fig.3

Findings

✓ Database search Identified 1313 studies ⇢ 20 studies remained for further process

✓ VM(O) & vastus lateralis (VL) percentage of maximum voluntary isometric contraction (%MVIC) (19 studies ➔ 37 variations)

VM(O)/VL ratio (7 studies ➔ 25 variations)

✓  ➔ Different activations and ratio

1. Belt squat ➔ VL activation (with loading) (Fig. 1)
2. Back Squat ➔ VM(O) Activation (with loading) (Fig. 2)
3. Wall squat with isometric add. -45º ➔ VM(O) activation (Fig. 2)
4. Wall squat exercises ➔ VM(O)/VL ratio (Fig. 3)

Conclusion

- ✓ back squat effective exercise for VM(O) isolation & PFPS rehab
- ✓ knee torque, external loading, optimal squat depth and Valgus knee ➔ VM(O)
- ✓ Erect trunk position ➔ ⇑⇑ knee torque ➔ superior VM(O)/VL ratio in wall squat