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The trunk muscles are the primary generators of force within the spine during both static and dynamic exertions (Chaffin; Schultz and Andersson; SM and RW; Marras and Sommerich; JH and I; Arjmand, Gagnon, et al.; Gagnon et al.). Additionally, the direction or 'path' of the muscles plays an important role in defining loads and moments imposed on the spinal units and discs since changes in muscle length, muscle velocity, muscle moment arms and muscle force lines of action are important contributors to force generation (Garner and Pandy). Historically, the torso's muscle lines of action have been represented by straight-line force vectors defined by connecting the anatomical origin and insertion of the muscles (Chaffin; Schultz and Andersson; SM and RW; Marras and Sommerich; Granata and Marras). While straight-line muscle representations are relatively easy to implement within a model and are reasonable approximations for some exertions, these representations could become problematic for more complex or extreme exertions where straight-line muscle representations may not align well with anatomical structures (Garner and Pandy; Arjmand, Shirazi-Adl, et al.)

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