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## **Knees over Toes: Promoting Functional Range of Motion**

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### **Editorial**

Movement patterns and optimal techniques have been controversial topics in the human performance field for many years of those, knee trajectory during squat patterns has been one of the most scrutinized. In general, there is a consensus among organizations and professionals regarding a more neutral trajectory from a lateral standpoint, thus mitigating knee valgus and varus. Despite research supporting the benefits of anterior knee displacement exceeding the toes [1], some organizations and professionals still discourage such patterns which continue to be expressed in research [2].

In recent years, this “Knees Over Toes” concept has been more widely accepted thanks to the marketing techniques of industry professionals like Ben Patrick, CEO of The Athletic Group [3]. In short, industry professionals like Patrick have promoted the application of full ankle and knee range of motion while promoting anterior displacement of the knee exceeding the toes during various squatting and lunging patterns. For example, Patrick incorporates exercises like the KOT Calf Raise, the Patrick Step, and the ATG Split Squat which all encourage anterior knee movement surpassing the toes [4]. Interestingly, many rehabilitation professionals have been using similar techniques for years but, by anecdote, had not marketed the concept successfully to the general population.

Squatting with the knees past the toes anteriorly has shown increases in quadriceps force and patellofemoral joint stress [5]. Research has also noted an increase in rectus femoris and gastrocnemius activation with increasing decline angles in decline/slant board squats, commonly used to promote or supplement anterior knee translation during squatting patterns [6]. Unilateral applications have also exhibited benefit by mitigating medial knee translation (knee valgus) and lateral hip translation during single-leg squats, promoting a more optimal alignment [7].

Ultimately, evidence validates the application of anterior knee translation during squatting patterns in some instances. Some researchers have distinguished the biomechanical differences between common squat formats which may have associated preferences depending on intended outcomes. For example, the traditional barbell squat typically exhibits greater anterior knee displacement than a powerlifting squat which tends to be more hip-dominant [8]. Otherwise, effective decline squat programs (eccentric or heavy, slow load) can effectively facilitate modest cases of patellofemoral pain when individuals aren't concurrently exposed to high-volume sport demands [9].

Anterior knee translation during squatting patterns requires notable ankle dorsiflexion ability [8]. Restricted ankle dorsiflexion is associated with a greater incidence of knee valgus and patellofemoral knee pain [10], reduced knee flexion [11], and increased

forward trunk lean [12] during squat and/or lunge patterns. Moreover, reduced ankle dorsiflexion has also exhibited strong correlations with reduced countermovement jump performance [13]. Considering the “Knees Over Toes” approach is aimed to enhance ankle dorsiflexion ability and knee extensor functionality, it’s unsurprising that this methodology has yielded mostly favorable results [3].

For practitioners, the use of squat and lunge patterns with anterior knee displacement exceeding the toes should generally be considered appropriate if reasonable and progressive methods are used. Additionally, further examination should investigate the medial/lateral trajectory of the knee to ensure appropriate tracking, typically over the second toe [14]. These applications may be limited by insufficient ankle dorsiflexion. Thus, squats and lunges with anterior knee displacement exceeding the toes have shown merit in both athletic and rehabilitative settings. Decline/slant boards are typically appropriate to promote greater knee flexion angles and functionality in those with restricted ankle dorsiflexion [6].

Further research should investigate the reliability of these methods in preventative contexts to mitigate patellofemoral and anterior cruciate ligament (ACL) injuries. Additionally, no clear evidence indicates the degree to which the knee should flex or translate anteriorly past the toes without repercussions to menisci or articular cartilage despite potential improvements in musculotendinous functionality [15]. It’s possible that other biomechanical factors related to knee valgus and trunk angle are greater contributors to articular knee injuries, in part related to reduced ankle dorsiflexion [7, 10, 12, 16], but this remains to be thoroughly investigated.

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