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Selective Vastus Medialis Wasting in Knee Osteoarthritis: A Clinical Sign Worth Reconsidering

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Abstract

Knee osteoarthritis (OA) is one of the leading causes of pain, disability and functional decline worldwide. Although much work has been done on the structural changes of the articular cartilage, subchondral bone and synovium, relatively little emphasis has been placed on the muscular changes that occur in disease progression. Among these changes, selective wasting of the vastus medialis has long been recognised by clinicians examining patients with symptomatic knee OA. Despite being a commonly encountered clinical finding, its significance has frequently been overshadowed by radiographic grading systems and imaging evaluations of joint degeneration. Recent evidence suggests that quadriceps dysfunction, especially the vastus medialis, may not be simply a consequence of reduced activity, but rather a complex interaction between arthrogenic muscle inhibition, pain, joint effusion, altered biomechanics and neuromuscular dysfunction. This narrative review revisits the concept of selective vastus medialis wasting in knee osteoarthritis. A critical review of the available literature on quadriceps weakness, arthrogenic muscle inhibition, muscle morphology, imaging assessment and clinical outcomes. There is particular emphasis on understanding whether vastus medialis wasting may be an under-recognised marker of disease severity, functional impairment and progression. This review identifies current evidence gaps and proposes future research directions to include muscle assessment in the routine evaluation of OA.

Keywords: Knee osteoarthritis; Vastus medialis; Arthrogenic muscle inhibition; Quadriceps weakness; Muscle atrophy; Functional outcome

Introduction

Knee osteoarthritis has long been considered a disease of cartilage degeneration. In the past decade, radiographic joint space narrowing, osteophyte formation, subchondral sclerosis, and deformity progression have been the predominant markers used to assess disease severity. As a result, much of the scientific focus has been on the changes in the structure of the joint itself. Osteoarthritis is, however, now increasingly recognised as a disorder of the whole joint organ, including cartilage, synovium, subchondral bone, ligaments, menisci and periarticular musculature [1-6].

Weakness of the quadriceps is one of the most commonly reported extra-articular manifestations of knee osteoarthritis. A number of studies have demonstrated an association between decreased quadriceps strength and pain, functional limitation, impaired gait, decreased quality of life and disease severity progression [1-6]. It should be noted that quadriceps weakness can be present in relatively early stages of osteoarthritis, which cannot always be attributed to disuse or ageing alone.

Clinical examination of patients with symptomatic knee osteoarthritis often shows a visible flattening of the medial suprapatellar contour, representing atrophy of the vastus medialis. This finding is frequently seen by many orthopaedic surgeons during the outpatient evaluation. This phenomenon is observed frequently but surprisingly receives little attention in contemporary osteoarthritis literature. Quadriceps wasting is frequently cited in textbooks as a feature of chronic knee pathology, but the idea that the vastus medialis might be selectively involved has not been extensively examined in current clinical research.

The vastus medialis is important for more than knee extension. It is important for patellar stabilisation, control of terminal extension, shock absorption and maintenance of normal lower-limb biomechanics. Dysfunction of this muscle may thus lead to a cycle of increasing pain, decreased

activity, altered gait mechanics and progressive disability. Clinically, an understanding of the association between knee pathology and selective vastus medialis wasting may offer valuable insight into disease behaviour and patient outcomes.

Evidence increasingly suggests that mechanisms other than simple muscle disuse mediate quadriceps dysfunction in osteoarthritis. Arthrogenic muscle inhibition (AMI), a reflex neural inhibition originating from the diseased joint, has emerged as a central concept to explain the persistent quadriceps weakness despite preserved muscle mass in some individuals [3,4,7]. This process has been implicated in pain, synovitis, joint effusion and altered afferent signalling. Whether these mechanisms preferentially affect the vastus medialis is an area of ongoing interest.

Furthermore, recent developments in ultrasonography, magnetic resonance imaging and muscle composition analysis have significantly enhanced our understanding of periarticular muscular changes in knee osteoarthritis [8-15]. Studies of muscle thickness, cross-sectional area, muscle volume, and fatty infiltration have shown measurable changes in the quadriceps apparatus. Some investigators have specifically identified morphological changes in the vastus medialis that are correlated with cartilage loss, disease progression, and postoperative outcomes following total knee arthroplasty [9-14].

The purpose of this narrative review is not to establish causation but to re-examine a long-standing clinical observation in the context of contemporary evidence. This review synthesises the current literature on quadriceps weakness, arthrogenic inhibition, muscle morphology, imaging findings, and clinical implications to evaluate whether the phenomenon of selective vastus medialis wasting can be viewed as a simple consequence of knee osteoarthritis, or as a clinically significant sign warranting renewed focus.

Materials and Methods

This narrative review was prepared according to the principles stated in the Scale for the Assessment of Narrative Review Articles (SANRA) to ensure methodological transparency, balanced synthesis of the literature, and clinical relevance. The aim of the review was to review the association of knee osteoarthritis and selective vastus medialis wasting including the pathophysiological mechanisms, imaging findings, functional implications and possible clinical applications.

A search of the literature was conducted in PubMed/MEDLINE and other related indexed databases. Emphasis was placed on original research articles, systematic reviews, imaging studies and mechanistic investigations that investigated quadriceps weakness, arthrogenic muscle inhibition, vastus medialis morphology, muscle atrophy, fatty infiltration and clinical outcomes in patients with knee osteoarthritis. Inclusion of landmark publications and recent studies (1997-2024) was intended to reflect historical as well as current perspectives.

References were selected based on their relevance to the question of the review, and not on formal meta-analytic criteria. Particular attention was paid to studies that addressed:

Weakness of the quadriceps in knee osteoarthritis.
Muscle arthrogenic inhibition.

Imaging assessment of vastus medialis architecture.

Functional ramifications of quadriceps dysfunction.

Changes in periarticular muscles and associated clinical implications.

Common themes, areas of consensus, conflicting evidence and opportunities for future exploration were identified through narrative synthesis of the findings.

Historical Recognition of Quadriceps Wasting in Knee Pathology

Long before the advent of advanced imaging was widely available, clinicians had identified quadriceps wasting as a hallmark of chronic knee disease. Thigh contour inspection and comparison of muscle bulk between limbs were routine parts of classical orthopaedic examination. Visible wasting of the quadriceps was often accepted as evidence of longstanding pathology, either pain-mediated disuse or chronic joint dysfunction.

Interestingly, many of the experienced clinicians reported that wasting was most marked at the medial aspect of the distal thigh, which anatomically corresponds to the vastus medialis. This observation was incorporated in the teaching of the wards and still forms an important part of the training of orthopaedic surgeons. For many years, however, objective scientific evaluation of this phenomenon has been limited.

One of the first landmark studies on quadriceps weakness in osteoarthritis was conducted by Slemenda et al. who reported a strong association of decreased quadriceps strength with knee osteoarthritis [1]. They found that muscle weakness was not simply a reflection of the progression of disease as had been assumed, but might actually contribute to the disease process itself. Further work by the same group identified reduced quadriceps strength as a possible risk factor for development and progression of knee osteoarthritis [2].

These observations turned the attention away from structural degeneration alone to the functional implications of periarticular muscular impairment. While the studies mainly measured the total strength of the quadriceps and not the strength of individual muscles, they laid a strong foundation for future studies on the activation of individual muscles.

Anatomy and Functional Importance of the Vastus Medialis

The vastus medialis is one of four parts of the quadriceps femoris muscle group and has a unique position in the biomechanics of the knee. It lies on the medial aspect of the femur and arises from the intertrochanteric line and the medial lip of the linea aspera. It inserts into the quadriceps tendon, patella and medial patellar retinaculum. The proximal long-fibre component (vastus medialis longus) has traditionally been described as a single muscle, but has often been separated from the more distal oblique fibres (vastus medialis obliquus, VMO) in functional and anatomical studies.

The VMO has received particular attention due to its contribution to dynamic patellar stability. Its distal fibres are obliquely orientated to allow it to exert a medial stabilising force on the patella, opposing the lateral pull of the quadriceps mechanism. This function is particularly important in terminal knee extension where precise neuromuscular coordination is essential for normal patellofemoral tracking.

The vastus medialis is important in shock absorption during gait, stair climbing, sit-to-stand and weight-bearing activities, besides patellar stabilisation. Thus, this muscle weakness may influence tibiofemoral and patellofemoral mechanics. Such biomechanical changes can increase joint loading, exacerbate pain and accelerate functional decline.

The importance of the vastus medialis is particularly apparent in patients with knee osteoarthritis. OA functional impairment is not limited to pain. Many patients have difficulty rising from chairs, climbing stairs, ambulating over uneven surfaces, and maintaining balance during ambulation. These activities rely heavily on efficient quadriceps activation, particularly in the terminal phases of knee extension. Thus small deficits in vastus medialis function could have a disproportional impact on overall knee function.

Several imaging studies have demonstrated measurable changes in vastus medialis

morphology in patients with knee osteoarthritis. Magnetic resonance imaging and ultrasonography have shown the reduction in muscle volume, cross-sectional area and muscle thickness [8-15]. Fatty infiltration of muscle has also been recognised as an important indicator of declining muscle quality, and may contribute to functional deterioration even when gross muscle mass is preserved [9,10].

A further anatomical point pertains to the neural supply of vastus medialis. The nerve to vastus medialis is unique among the components of the quadriceps in that it travels distally in the adductor canal and gives off both motor and articular branches around the knee. The tight coupling between the muscle and the joint has spurred speculation that pathological changes within the knee may have a particularly strong influence on vastus medialis activation patterns. This hypothesis needs further study but offers a plausible anatomical basis for selective involvement of the muscle in chronic knee disease.

Overall, the available evidence suggests that the vastus medialis occupies a strategic position at the intersection of knee stability, neuromuscular control, and functional performance. Its anatomical and biomechanical significance raises the question: why does dysfunction of this muscle seem to invariably affect patients with knee osteoarthritis?

Arthrogenic Muscle Inhibition: The Missing Link Between Knee Pathology and Muscle Wasting

The traditional explanation for muscle wasting in osteoarthritis has been that it is due to disuse. Patients develop pain, reduce activity and subsequently develop muscular atrophy. This mechanism is definitely involved in muscle loss, but recent studies suggest that it is only part of a much more complicated process.

The idea of arthrogenic muscle inhibition (AMI) has revolutionised our understanding of quadriceps dysfunction in knee pathology. Arthrogenic muscle inhibition is a persistent

reflex inhibition of muscle activation due to altered sensory input from an injured or diseased joint [3,4]. AMI is not merely a consequence of disuse but rather a neurological event in which the central nervous system actively prevents the muscle from being activated, even though the person wants to contract the muscle.

Several factors contribute to this inhibitory response in knee osteoarthritis. Abnormal afferent signals from the joint are generated by joint pain, joint effusion, synovitis, capsular distension, cartilage degeneration and altered mechanoreceptor activity [3,4,7]. These signals affect spinal reflex pathways and supraspinal motor control mechanisms leading to reduced recruitment of motor units in the quadriceps.

Rice and McNair gave one of the most complete descriptions of this process, describing the complex neural pathways responsible for persistent quadriceps inhibition in arthritic knees [3]. Importantly their work demonstrated that AMI can be maintained at relatively low levels of pain suggesting that structural and inflammatory changes within the joint may continue to influence neuromuscular function irrespective of symptom severity.

Similar results are also confirmed by experimental studies. Joint effusion alone has been shown to reduce quadriceps activation, even in normal subjects [3,4]. These results indicate that intra-articular pathology can have a direct impact on muscle performance via neural mechanisms, and not solely by mechanical limitation.

The clinical implications are profound. Knee osteoarthritis patients often demonstrate decreased voluntary quadriceps activation that cannot be explained by muscle atrophy alone [4,5]. In some people there may be marked weakness despite relatively preserved muscle bulk. The finding underscores the importance of distinguishing between muscle quantity and muscle function when assessing patients with OA.

An interesting feature of AMI is that perhaps not all components of the quadriceps are equally

involved. Clinical observation often shows that wasting is most prominent in the vastus medialis. We've had a number of explanations. Terminal extension and dynamic patellar control require the vastus medialis and depend on well-coordinated neuromuscular activation. Thus, these minor alterations in neural control may manifest clinically in this muscle before the other larger parts of the quadriceps.

Additionally, changes in gait related to osteoarthritis may lead to a preferential reduction in activation of the vastus medialis during everyday activities. Reduced knee flexion in stance, decreased stride length, and compensatory loading strategies may contribute to disuse and inhibition of the muscle. Over time these factors may create a vicious cycle. Pain leads to inhibition, inhibition leads to weakness, weakness alters biomechanics and altered biomechanics contributes to further disease progression.

The relationship between AMI and disease severity is an active area of investigation. Quadriceps weakness has been suggested to precede significant radiographic deterioration and may even contribute to the development of osteoarthritis itself [1, 2]. If this observation holds true for the vastus medialis, selective wasting may be more than a consequence of disease. Rather it may be an early marker for pathological processes already occurring within the joint.

This possibility has important clinical implications. Radiographs provide information on structural degeneration but assessment of vastus medialis function may provide insight into the neuromuscular consequences of disease. This type of information may be useful for early diagnosis, risk stratification and rehabilitation planning.

Nevertheless, evidence remains incomplete as of today. Although it is well known that the quadriceps is inhibited, the selective effect of AMI on the vastus medialis has not been studied enough. This gap in knowledge is one of the most compelling reasons for re-examining a clinical sign that generations of orthopaedic surgeons have observed but seldom studied systematically.

Table 2. Proposed Mechanisms Contributing to Selective Vastus Medialis Wasting in Knee Osteoarthritis

Mechanism	Pathophysiological Basis	Clinical Consequence
Arthrogenic muscle inhibition	Reflex neural inhibition due to pain and joint pathology	Reduced voluntary activation
Joint effusion	Altered afferent signalling from mechanoreceptors	Quadriceps shutdown
Synovitis	Persistent inflammatory stimulation	Neuromuscular dysfunction
Pain avoidance behaviour	Reduced use of affected limb	Disuse atrophy
Altered gait biomechanics	Reduced knee excursion during walking	Progressive muscle weakness
Fatty infiltration	Loss of muscle quality	Functional decline despite preserved bulk
Reduced physical activity	Lower loading stimulus	Generalised muscle wasting

Evidence for Selective Vastus Medialis Atrophy in Knee Osteoarthritis

Until recently, the idea of preferential involvement of the vastus medialis in knee osteoarthritis has been largely anecdotal. Objective evidence for this was relatively infrequent, but loss of the medial suprapatellar contour was a common finding as described by experienced clinicians on physical examination. The advent of advanced imaging modalities, in particular magnetic resonance imaging (MRI) and musculoskeletal ultrasonography, has allowed more detailed assessment of individual quadriceps muscles and has reignited interest in this long-standing clinical observation.

Early studies of quadriceps dysfunction focused mainly on overall muscle strength and paid less attention to the morphology of individual muscles. These studies consistently showed significant quadriceps weakness in patients with osteoarthritis but little information was provided on whether specific components of the quadriceps were disproportionately affected [1,2,5]. With the improvement of imaging techniques, researchers began to study individual muscle compartments separately, revealing a more nuanced pattern of muscular adaptation.

Yamauchi et al. also conducted MRI to evaluate the morphology of individual thigh muscles and showed measurable decreases in the size of muscles in patients with knee osteoarthritis [11]. Their results showed that muscular changes in osteoarthritis are not uniformly distributed around the thigh. Some muscle groups appeared to be more susceptible to atrophy, indicating that disease-associated neuromuscular adaptations may differentially affect specific muscles.

Koca et al. also evaluated quadriceps morphology using ultrasonography and found significant associations between muscle thickness and disease severity [8]. Ultrasonography was inexpensive, readily available and suitable for routine clinical practice. Importantly, the decreases in muscle thickness were associated with worsening clinical and radiographic findings, supporting the hypothesis that assessment of muscle may provide important information regarding disease state.

One of the most exciting developments is the growing recognition that muscle quality might be as important as muscle quantity. Traditionally, assessments have focused solely on muscle size, but emerging evidence suggests that fatty infiltration within skeletal muscle can have profound functional consequences. Teichtahl et al. showed that increased fat infiltration in the vastus

medialis was associated with subsequent cartilage loss in patients with knee osteoarthritis [9]. This observation is especially important as it could imply that muscle degeneration is not just a co-morbid condition of osteoarthritis but could be a factor that promotes the progression of the disease.

This was also supported by the findings from Raynauld and colleagues who demonstrated associations between the MRI-assessed vastus medialis fat content and structural progression of osteoarthritis [10]. Higher fatty infiltration was associated with an increased risk of cartilage degradation and joint pathology progression over time. These findings raise the interesting possibility that changes in the vastus medialis may be early markers of disease activity before significant radiographic progression.

From a clinical standpoint, differences in muscle quality may explain why some patients have substantial functional impairment while maintaining relatively preserved bulk. A fat-infiltrated muscle may appear to be of reasonable size when strength, endurance and neuromuscular efficiency decline dramatically. Thus, the true

extent of vastus medialis dysfunction may be underestimated by visual inspection alone.

The importance of the vastus medialis morphology is not limited to native osteoarthritis. Kim et al. [12] showed that the preoperative volume of the vastus medialis muscle was associated with postoperative results after total knee arthroplasty. Similarly, Jung et al. reported pre-operative muscle quality was associated with post-operative functional recovery after knee replacement [13]. These results suggest that the health of the vastus medialis can affect both disease progression and recovery after surgery.

These studies together provide increasing support for the idea that changes in the vastus medialis are clinically meaningful. Interpretations of the evidence, however, need to be treated with caution. While numerous studies have found changes in the vastus medialis, few were specifically designed to ascertain if this muscle is affected earlier or more severely than other quadriceps components. The data available are mainly observational and do not establish causality.

Table 1. Key Studies Evaluating Quadriceps Dysfunction and Vastus Medialis Changes in Knee Osteoarthritis

Author	Year	Study Type	Main Focus	Key Findings
Slemenda et al. [1]	1997	Observational	Quadriceps weakness and OA	Reduced quadriceps strength associated with knee OA
Slemenda et al. [2]	1998	Cohort	Strength as risk factor	Lower quadriceps strength associated with increased OA risk
Rice and McNair [3]	2010	Narrative review	Arthrogenic muscle inhibition	AMI identified as major contributor to quadriceps dysfunction
Petterson et al. [5]	2008	Clinical study	Mechanisms of weakness	Neuromuscular inhibition contributes to strength loss
Teichtahl et al. [9]	2015	MRI study	Vastus medialis fat infiltration	Increased fat infiltration associated with cartilage loss
Raynauld et al. [10]	2015	MRI longitudinal study	Muscle composition and OA progression	Vastus medialis degeneration predicts structural progression
Kim et al. [12]	2021	Clinical study	Muscle volume and outcomes	Greater vastus medialis volume associated with better TKA outcomes
Jung et al. [13]	2022	Clinical study	Muscle quality and TKA recovery	Better muscle quality associated with improved postoperative function

Nevertheless, the consistency of findings across imaging modalities, populations, and outcome measures suggests that the vastus medialis may be worthy of more attention than it has traditionally received. The available evidence supports the view that muscular changes involving this muscle are not incidental findings, but potentially important contributors to symptom severity, functional limitation and disease progression.

Clinical Relevance: Is Vastus Medialis Wasting More Than a Physical Sign?

A physical sign is clinically useful if it affects diagnosis, prognosis, treatment planning or outcome prediction. The central issue therefore is not whether vastus medialis wasting occurs in osteoarthritis, but whether its presence carries clinically meaningful information.

Radiographic findings have traditionally been the main focus of the evaluation of knee osteoarthritis. Joint space narrowing, osteophyte formation, deformity and subchondral sclerosis remain the most commonly used measures of disease severity. But clinicians often see patients with symptoms that appear disproportionate to radiographic findings. Some people with relatively minor radiographic changes experience severe pain and disability, whereas others with advanced degeneration maintain surprisingly good function.

This discrepancy points to the limitations of relying solely on structural imaging. Osteoarthritis is a disease of cartilage loss, but not exclusively. The clinical picture consists of pain perception, neuromuscular control, muscle strength, psychological factors and functional adaptation. The assessment of the vastus medialis may give valuable additional information to this broader picture.

Several studies have shown strong associations between quadriceps weakness and functional impairment in osteoarthritis [1,5,6]. Patients with reduced quadriceps strength frequently report difficulty standing up from a chair, climbing stairs, walking distances, and maintaining balance. A visible sign of declining functional

reserve can be selective wasting of the vastus medialis, which has a prominent role in these activities.

Of particular interest is the relationship between pain and muscle dysfunction. Arthrogenic muscle inhibition results in a cycle in which pain causes muscular inhibition, decreased muscular activation results in muscular weakness, and muscular weakness causes abnormal joint loading and more pain [3,4]. Visible wasting of the vastus medialis may be an external manifestation of deeper neuromuscular dysfunction within this cycle.

Assessment of the vastus medialis has several advantages from a practical point of view. Inspection and palpation do not require any specialised equipment as is the case with advanced imaging modalities. Routine clinical examination allows visualisation of the medial suprapatellar contour and can give immediate information about muscle status. Clinical decision making may be improved with assessment of vastus medialis together with thigh circumference, strength testing, and functional assessment.

The possibility that vastus medialis wasting is a reflection of severity of disease also needs consideration. Studies showing associations between muscle morphology, cartilage loss and clinical outcomes suggest that muscular deterioration may reflect disease progression [9-13]. If this association is confirmed in future longitudinal studies, vastus medialis evaluation may be a useful adjunctive marker to monitor disease evolution.

Another potential application would be in selecting patients for rehabilitation. Identification of marked vastus medialis wasting may help clinicians better target interventions. Neuromuscular retraining, quadriceps strengthening, biofeedback programs, and exercise-based rehabilitation may be particularly beneficial in those with early muscle involvement. The recognition of the problem may therefore allow for earlier intervention before the presence of profound weakness.

But it is too early to consider vastus medialis wasting as a validated diagnostic or prognostic marker at this time. The evidence is still suggestive rather than conclusive. But the collective body of literature suggests this clinical sign is deserving of more attention than it

currently receives. Selective wasting of the vastus medialis may be an important clue to the functional and neuromuscular burden of disease, rather than a routine consequence of osteoarthritis.

Table 3. Clinical Assessment of Vastus Medialis in Patients with Knee Osteoarthritis

Assessment Method	What is Assessed	Advantages	Limitations
Visual inspection	Medial suprapatellar contour	Quick, no equipment	Subjective
Thigh circumference	Overall muscle bulk	Easy to perform	Not muscle-specific
Manual muscle testing	Strength	Widely available	Examiner dependent
Dynamometry	Quadriceps force	Objective	Equipment required
Ultrasonography	Thickness and architecture	Inexpensive, repeatable	Operator dependent
MRI	Volume and fatty infiltration	Gold standard	Expensive
Functional tests	Sit-to-stand, stair climbing	Reflect real-life function	Influenced by multiple factors

Can Vastus Medialis Wasting Be Considered an Early Marker of Knee Osteoarthritis?

The prospect of vastus medialis wasting as an early clinical marker of knee osteoarthritis is an attractive one but must be treated with caution. Current evidence suggests an association between knee OA and quadriceps dysfunction, but does not yet establish that vastus medialis wasting consistently precedes radiographic or symptomatic disease.

The strongest argument comes from studies demonstrating that quadriceps weakness might not be simply a late consequence of established OA. Quadriceps weakness has been shown to be associated with knee osteoarthritis and it was later suggested that the reduced quadriceps strength relative to body weight may act as a risk factor particularly in women [1,2]. This pushed the conversation from “muscle loss due to arthritis” to “muscle dysfunction as a possible contributor to arthritis.”

The vastus medialis is important in this discussion because it is not merely another part of the quadriceps. Its role in terminal extension, patellar control and medial stabilisation means that it is very sensitive to altered knee mechanics. Pain, effusion, synovitis, or capsular distension may disturb joint afferent input, resulting in arthrogenic muscle inhibition and a decreased recruitment of the quadriceps even before a major loss of muscle bulk occurs [3,4,7]. This may first be seen clinically as poor medial suprapatellar fullness or decreased VMO definition.

The imaging studies add further weight to the argument. Fat infiltration in the vastus medialis is associated with loss of cartilage and OA progression [9,10]. This is clinically relevant as fatty degeneration may be a reflection of declining muscle quality prior to severe visible wasting. That is, the muscle may be biologically failing before the examiner sees much atrophy.

But to call vastus medialis wasting a validated early marker of knee OA would be overstating it. A clear temporal sequence has not yet been established in the literature. It is unclear whether changes in vastus medialis occur prior to OA, with early disease, or are simply a reflection of altered loading and disuse after symptoms begin. The more defensible position is:

Selective wasting of the vastus medialis may be an under-recognised clinical sign of neuromuscular involvement in knee osteoarthritis and may be of value as an adjunct marker of functional burden and disease progression.

Rehabilitation Implications

The recognition of wastage of vastus medialis has direct therapeutic relevance. If muscle dysfunction is viewed only as a secondary consequence of pain, rehabilitation may be delayed until structural disease is advanced. However, if quadriceps inhibition and vastus medialis dysfunction are considered active contributors to symptoms and disease progression, then rehabilitation becomes a key part of OA management.

Conventional strengthening in all patients alone may not be sufficient. Arthrogenic muscle inhibition can limit full voluntary activation of the quadriceps despite patient effort [3,4]. That is why some patients don't get stronger even though they seem to be doing the exercises. Rehabilitation therefore needs to focus on both strength and activation.

A more comprehensive programme may include quadriceps strengthening, terminal extension exercises targeting the VMO, neuromuscular electrical stimulation, biofeedback, balance training, gait correction, weight reduction and pain control. It is also important to reduce effusion and synovitis, as persistent joint irritation may continue to drive reflex inhibition [3, 4, 7].

The message to the clinician is simple. The wasting is not for cosmetic reasons. It works. The flat medial suprapatellar contour in OA should alert the surgeon or therapist to inhibition, weakness, patellar control, gait safety, and intensity of rehabilitation.

Future Research Directions

Some questions remain unanswered. Future studies should examine if vastus medialis wasting is in fact selective compared with vastus lateralis, rectus femoris and vastus intermedius. Longitudinal designs are needed to determine whether early vastus medialis atrophy or fatty infiltration predicts radiographic progression, worsening pain or need for arthroplasty.

Studies based on Ultrasound will be of great help in Indian clinical settings. Ultrasound is cheap, can be repeated as often as needed and is nearly universally available. A simple protocol measuring thickness, echogenicity and side to side difference of the vastus medialis could be correlated with Kellgren-Lawrence grade, WOMAC score, VAS pain score, walking speed, stair-climb ability and quadriceps strength.

There is also potential to study outcomes after surgery. Preoperative vastus medialis volume and quality have been linked to functional recovery after TKA [12,13]. This raises an important question: should the prehabilitation prior to knee replacement include specific assessment and activation training of the vastus medialis?

Conclusion

Selective vastus medialis wasting in knee osteoarthritis is more than a routine bedside observation. It may reflect the interaction between joint pathology, pain, arthrogenic muscle inhibition, altered biomechanics, and progressive functional decline.

Current evidence strongly supports quadriceps weakness and neuromuscular inhibition in knee OA, while imaging studies increasingly show that vastus medialis morphology and fat infiltration are clinically relevant [1-15].

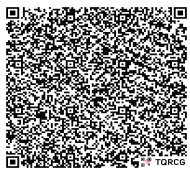
However, the idea that the vastus medialis is always the first muscle to waste remains insufficiently proven. It should be presented as a thoughtful clinical observation, not an absolute rule. The real value of this sign lies in what it tells the clinician: the osteoarthritic knee is not failing only at the cartilage surface. It is failing as a joint-muscle unit.

Recognising this may help clinicians examine better, rehabilitate earlier, counsel patients more honestly, and design future studies around a sign that has been seen for decades but not studied enough.

References

1. Slemenda C, Brandt KD, Heilman DK, Mazucca S, Braunstein EM, Katz BP, Wolinsky FD. Quadriceps weakness and osteoarthritis of the knee. *Ann Intern Med.* 1997; 127(2):97-104.
2. Slemenda C, Heilman DK, Brandt KD, Katz BP, Mazucca SA, Braunstein EM, Byrd D. Reduced quadriceps strength relative to body weight: a risk factor for knee osteoarthritis in women? *Arthritis Rheum.* 1998; 41(11):1951-1959.
3. Rice DA, McNair PJ. Quadriceps arthrogenic muscle inhibition: neural mechanisms and treatment perspectives. *Semin Arthritis Rheum.* 2010; 40(3):250-266.
4. Rice DA, McNair PJ, Lewis GN, Dalbeth N. Mechanisms of quadriceps muscle weakness in knee joint osteoarthritis: the effects of prolonged vibration on torque and muscle activation in osteoarthritic and healthy control subjects. *Arthritis Res Ther.* 2011; 13(5):R151.
5. Petterson SC, Barrance P, Buchanan T, Binder-Macleod S, Snyder-Mackler L. Mechanisms underlying quadriceps weakness in knee osteoarthritis. *Med Sci Sports Exerc.* 2008; 40(3):422-427.
6. Alnahdi AH, Zeni JA Jr, Snyder-Mackler L. Muscle impairments in patients with knee osteoarthritis. *Sports Health.* 2012;4(4):284-292.
7. Hart JM, Pietrosimone B, Hertel J, Ingersoll CD. Quadriceps activation following knee injuries: a systematic review. *J Athl Train.* 2010; 45(1):87-97.
8. Koca I, Boyaci A, Tutoglu A, Boyaci N, Ozkur A. The relationship between quadriceps thickness, radiological staging, and clinical parameters in knee osteoarthritis. *J PhysTher Sci.* 2014; 26(6):931-936.
9. Teichtahl AJ, Wluka AE, Wang Y, Wijethilake P, Davies-Tuck M, Urquhart DM, et al. Vastus medialis fat infiltration: a modifiable determinant of knee cartilage loss. *Osteoarthritis Cartilage.* 2015; 23(12):2150-2157.
10. Raynald JP, Pelletier JP, Roubille C, Dorais M, Abram F, Li W, et al. Magnetic resonance imaging-assessed vastus medialis fat content and risk for knee osteoarthritis progression. *Arthritis Care Res (Hoboken).* 2015; 67(10):1406-1415.
11. Yamauchi K, Suzuki S, Kato C, Kato T. Atrophy of individual thigh muscles measured by MRI in older adults with knee osteoarthritis: a cross-sectional study. *Ann PhysRehabil Med.* 2020; 63(1):38-45.
12. Kim HJ, Lee DH, Lee SH, Han SB. The relationship between vastus medialis muscle volume and clinical outcomes after total knee arthroplasty. *Medicine (Baltimore).* 2021;100(2):e24150.
13. Jung HJ, Kang KT, Lee SC, Kwon SK, Lee JS. Do preoperative vastus medialis volume and quality affect postoperative outcomes in patients undergoing total knee arthroplasty? *Knee SurgRelat Res.* 2022; 34(1):25.

14. Mohajer B, Dolz J, Pedoia V, Schirò S, Gersing AS, Majumdar S, et al. Role of thigh muscle changes in knee osteoarthritis outcomes. Radiology. 2022;305(1):169-178.
15. Bae KC, Son ES, Yon CJ, Park J, Kim DH. Assessment of quadriceps muscle in advanced knee osteoarthritis and correlation with lower limb alignment. Medicina (Kaunas). 2024;60(12):1983.

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