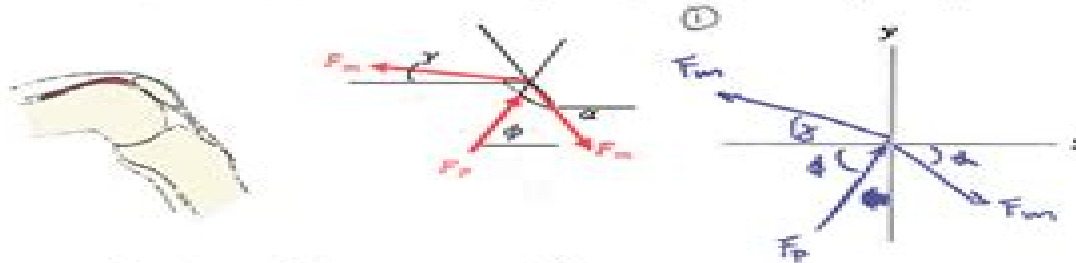


Problem 1:

As discussed in class, the patella helps to provide an additional moment arm to the quadriceps muscle to reduce the force necessary to extend the knee. Noting that the patella acts like a pulley, we can see that the muscle tension helps push the patella against the distal condyle of the femur. Using the knee diagrams below, complete the following:

1. Draw a FBD on the xy -axes assuming that the patellar compressive and muscle forces all intersect at the origin.
2. Write a set of force and moment balance equations describing the joint
3. Find expressions for the patellar contact angle, ϕ , and the patellar force F_p , as functions of muscle force magnitude and direction (F_m, γ, α).
4. How do you expect the patellar force to be different during a deep squat (high knee flexion angle) compared to standing? Justify your answer using the equations developed in (3).



$$\textcircled{2} \sum F_x = 0: -F_m \cos \gamma + F_p \cos \phi + F_m \cos \alpha = 0$$

$$F_p = \frac{F_m (\cos \gamma - \cos \alpha)}{\cos \phi}$$

$$\uparrow \sum F_y = 0: F_m \sin \gamma + F_p \sin \phi - F_m \sin \alpha = 0$$

$$\sum M = 0$$

$$\textcircled{3} \text{ FROM } \sum F_y \rightarrow$$

$$\sin \phi = \frac{F_m (\sin \alpha - \sin \gamma)}{F_p} = \frac{\cos \phi (\sin \alpha - \sin \gamma)}{\cos \gamma - \cos \alpha}$$

$$\text{TAN } \phi = \frac{\sin \alpha - \sin \gamma}{\cos \gamma - \cos \alpha}$$

$$\phi = \text{TAN}^{-1} \left[\frac{\sin \alpha - \sin \gamma}{\cos \gamma - \cos \alpha} \right]$$

$\textcircled{4}$ AT HIGH FLEXION: α INCREASES } $F_p \approx \frac{1 - \cos \alpha}{\cos \phi} \rightarrow F_p \dots$
 $\gamma \approx \text{CONST, SMALL}$ } $F_m \cos \phi$ \rightarrow INCREASED CONTACT FEMUR
 $\alpha \rightarrow 90^\circ \dots \rightarrow 45^\circ$ \rightarrow MORE = STABILITY.

Biomechanics Sample Problems And Solutions

Tao Wei



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Applied Mechanics Reviews ,1974 **Kinesiology** David Paul Greene,Susan L. Roberts,2005-01-01 Approaching the subject of kinesiology from the perspective of occupational therapy this unique text written by occupational therapists examines the everyday activities of people using the principles of biomechanics to adapt to changes in their functional abilities This new edition stresses applicability to clinical practice with the inclusion of case examples In depth coverage of wrist and hand pathokinesiology as well as normal kinesiology function of the wrist and fingers Key terms chapter outlines and applications that enhance studying and learning 12 appendices and a glossary with metric conversions review of mathematics a diagram of body segment parameters and laboratory activities New material providing explanations of the pathokinesiology of shoulder subluxation rotator cuff tear adhesive capsulitis fractures tendon injuries and shoulder problems secondary to CVA More case studies and less emphasis on heavy calculations to ensure the concepts are more easily grasped Perforated lab manual filled with activities tied directly to the chapters Enhanced illustrations for easier visualization of the concepts demonstrated *High-Performance Computing in Biomedical Research* Theo C. Pilkington,Bruce Loftis,Thomas Palmer,Thomas F. Budinger,2020-09-10 Leading researchers have contributed state of the art chapters to this overview of high performance computing in biomedical research The book includes over 30 pages of color illustrations Some of the important topics featured in the book include the following **Kinesiology of the Musculoskeletal System - E-Book** Donald A. Neumann,2016-11-03 With its focus on the normal and abnormal mechanical interactions between the muscles and joints of the body Kinesiology of the Musculoskeletal System Foundations for Rehabilitation 3rd Edition provides a foundation for the practice of physical rehabilitation This comprehensive research based core text presents kinesiology as it relates to physical rehabilitation in a clinically relevant and accessible manner It provides students and clinicians with the language of human movement and acts as a bridge between basic science and clinical management Full color anatomic and kinesiological illustrations clearly demonstrate the anatomy functional movement and biomechanical principles underlying movement and dynamic new video clips help you interpret new concepts with visual demonstration More than 900 high quality illustrations provide you with the visual accompaniments you need to comprehend the material Clinical Connections boxes at the end of each chapter in Sections II through IV highlight or expand upon a particular clinical concept associated with the kinesiology covered in the chapter Special Focus boxes interspersed throughout the text provide numerous clinical examples that demonstrate why kinesiological information is needed Critical thinking questions challenge you to review or reinforce the main concepts contained within each chapter Evidence based approach emphasizes the importance of research in physical therapy decision making Evolve site for students comes with video clips answers to study questions and references linked to Medline Evolve site for instructors includes an image collection from the text teaching tips and lab activities NEW Kinesiology of Running chapter covers the biomechanics of

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