Proximal tibia osteotomy: Biomechanics study of two techniques

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Abstract Introduction Proximal tibia osteotomy has advanced with various techniques, such as dome and modified oblique osteotomies, to correct angular deformities and redistribute knee stress, thereby slowing arthritic progression. Despite advancements, a gap remains in understanding the biomechanical strengths of these techniques, especially concerning correction angles. The study aims to compare the stability of the construct for different degrees of osteotomy. Materials and methods Eighteen synthetic tibias were osteotomised based on the dome and modified oblique osteotomy technique. For dome osteotomy, the osteotomy site was fixed with two Kirschner wires 2.0 mm for different degrees of osteotomy, which were 10 degrees, 20 degrees, and 30 degrees. Three samples from each construct were tested for rotational force. For modified osteotomy, two screws 3.5 mm were used to fix the osteotomy site and tested for rotational forces. Results The constructs were stiffest at ten degrees for rotational force, both in dome and modified oblique osteotomy (0.39 Nmm and 0.4 Nmm). The stiffness of dome osteotomy in correction angles of 10 degrees and 20 degrees is almost similar ($p > 0.95$), and it reduces significantly at 30 degrees($p < 0.001$). There were significant differences in stiffness of the oblique osteotomy construct when comparing 10 degrees with 20 degrees ($p = 0.003$), 10 degrees with 30 degrees($p < 0.001$) and 20 degrees with 30 degrees ($p < 0.001$) correction angles. This is further proved by comparing the means of stiffness between the two methods, where dome osteotomy did better compared to modified oblique osteotomy at 20 degrees and similar at 10 degrees. Conclusion In performing proximal tibia osteotomy, we recommend limiting the acute angle of correction to 20 degrees, and we suggest that for a larger correction angle, dome osteotomy exhibits better biomechanical stiffness. An angle exceeding 30o will predispose to higher rate of non-union or malunion as the stiffness of the surgical construct drops significantly, making it less resistant to rotational forces.

Keywords **Author Keywords:** dome osteotomy; modified oblique osteotomy; osteotomy; rotational force

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