CAN BIOMECHANICAL SIMULATION SUPPORT MEDICAL TRAINING?  
- A SURVEY STUDY -  

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Introduction
Due to limited access to a greater pool of patients during single training blocks an effective training of medical students or young orthopaedic physicians is difficult. There is almost no opportunity to simultaneously learn the small haptic, but clinically important, differences due to different grades of injury of the same anatomic structure (e.g. ligament lesion grade I to III). Therefore, a newly founded research group at TUM is developing virtual reality (VR) applications in biomechanics to support the education of medical students and training in orthopaedics. In order to experience more about the actual situation, deficiencies and possible future applications, we performed a survey among orthopaedic physicians.

Methods
56 orthopaedic physicians in private practice in the Munich area participated in this survey (i.e. 25.2 % out of 222) by filling out a questionnaire. Information was requested about, the frequency of affections in lower limb joints, as well as the kind of clinical tests usually performed when evaluating the knee joint. Furthermore, the physicians should comment the importance of physical evaluation tests compared to other diagnostic methods. Finally, they should express their opinion about the current medical education and training and the prospects of VR applications in orthopaedics.

Results
The main results of the survey concerning the application of physical evaluation methods are (Fig. 1):  
- The knee is affected most often, followed by ankle, shoulder, hip, elbow, and wrist joint.  
- Physical joint evaluations are indispensable and, therefore, very frequently performed tasks (e.g., flexion/extension movement and varus-valgus stress tests, Lachman test, meniscus tests, drawer tests).  
- The physical evaluation is very important to avoid unnecessary invasive interventions (arthroscopy, open surgery).  
- Instrumented knee joint evaluation (e.g., arthometer KT1000) is no alternative: Only 10 % apply it and most physicians do not recommend it.

The physicians’ individual opinions about medical education and training are (Fig. 1):  
- Learning physical joint evaluation methods is time consuming.  
- 82 % agree that there is the need to improve medical education and training in orthopaedics.  
- More than the half believe that medical education and training can be improved by VR simulation technologies. Another third says that VR has the potential to do so.  
- Only a minority (9 %) thinks that a “technical training environment” will intimidate or frighten the medical user.
**Fig. 1:** Some results of the survey performed among 56 orthopedic physicians in private practice. The survey took place in Munich, from March 1st till April 10th, 2000. (Towards 100 missing %: no response)

**Discussion**

We conclude that physical joint evaluation methods have an indispensable meaning in orthopaedics, since they are easy to perform and no practical alternatives exist. However, most of the orthopaedic physicians in this survey agree that medical education and training has to be improved, since it is rather theoretical, time consuming and ineffective. Many VR applications have the potential to support future education and training of medical students and orthopaedic physicians.