
Burt Klos, MD, PhD
ICONE, The Netherlands

Computer-assisted surgery (CAS) in anterior cruciate ligament (ACL) reconstruction has now reached >20 years of research. First publications started during the 1990s. Main goals of the navigated procedures were to improve graft position and to better understand anatomic references and graft isometry during the range of motion. Research in this field was conducted considering that 70% to 80% of the complications were due to malpositioned tunnels. The purpose of these first systems was to augment the information given to the surgeon, to better identify the anatomic landmarks that could be difficult to be recognized in an arthroscopic setup. The efficacy of this enhanced information given by computer-based ACL reconstruction was evaluated in the clinical use. Researches demonstrated the feasibility of imageless navigation in routine clinical setup. These studies, however, have not increased the interest of the orthopedic community on this field for several years. The reason for this scarce interest in navigation was probably because of the unclear goal in tunnel placement and orientation during the ACL reconstruction, and the correct positioning of graft insertions is still a matter of debate. In addition, the costs and the time-consuming problems related to the use of these devices are still the major obstacles to the widespread use in clinical practice.

The literature can be divided into 4 different categories:
(1) Drill hole placement: studies that evaluate the usefulness of CAS in performing tunnel drilling or studying native ligament insertions.
(2) Laxity measurement: studies that evaluate the use of CAS in measuring anteroposterior (AP) knee laxity, comparing with conventional arthrometers.
(3) Kinematics: studies that evaluate joint kinematics under different clinical stress tests such as pivot shift or primary rotations.
(4) Individualized surgery: studies that evaluate the effect of different surgical strategies on joint laxity.
Main topics of the papers were uniformly distributed; anatomic studies (including ligament insertions, tunnel positioning, and graft isometry) were similar to kinematic studies. Comparison (different CAS surgical techniques or conventional surgery) and descriptive papers had also similar number of publications. It is interesting to note that there has been an increase in the number of in vivo, kinematic, and comparison studies between surgical techniques in the last years, whereas the number of in vitro, validation, and anatomy studies has decreased.

Literature concerning CAS in ACL reconstruction presents a variety of topics and methodologies. All the aspects of the surgery have been covered in studies, concerning anatomic, kinematic, technical, and clinical aspects. Between the late 1990s and beginning of 2000, navigation was used to find the most appropriate graft attachments in a single-bundle reconstruction. Measurements were aiming to isometry or to tibia and femur anatomy. Most papers found no significant difference between CAS surgery and manual placement by an experienced surgeon.

In the literature, navigation showed reliable results in femoral placement. Most of the papers showed improved positioning in navigated ACL compared with manual technique, but the clinical efficacy of CAS compared with conventional techniques has not been proved.

Extensive bibliography can be founded in the references and review article.

References