



## PP-048

### The value of gait analysis in lower limb salvage surgery of children with bone sarcomas

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**Introduction:** Limb salvage options for reconstruction of lower limbs in children with high grade sarcomas are increasing over time but long-term functional results are still to be evaluated. Since these techniques are technically demanding and time consuming for both patients and surgeons, they deserve careful appraisal. Beside the assessment of surgical and oncological criteria of reliability of these techniques, it is also very important providing objective data on functional results in the long term both for clinician's feedback on surgical and rehabilitative outcome and for patients and families counseling regarding their potential recovery.

Many metrics are used to assess the outcome of limb salvage interventions: the MSTS score systems is used for musculo-skeletal impairment, limitations in activities of daily life are generally assessed using the TESS score, the quality of life by means of SF36. In the last years gait analysis emerged as assessment tool for the functional outcome of limb salvage procedures. The types of intervention and the sacrifice of different bone structures and muscle involve specific residual functional abnormalities that may influence the residual growth and can be documented through the analysis of the movement.

The **aim** of this presentation is to give an overview on the insight gait analysis can provide in long-term survivors who received different types of limb salvage surgery when skeletally immature.

**Materials and Methods:** Between 1994 and 2011, about 100 subjects who received a femur or a tibia major skeletal reconstruction in their childhood were evaluated by gait analysis at more than 2 years from surgery.

Reconstructions were: Proximal femur rotationplasty (1), Proximal femur biological reconstruction with Vascularized Fibula (1), Proximal femur composite endoprosthesis (10), Proximal femur allograft-prosthesis composite (10), Intercalary femur Massive Allografts plus Vascularized Fibula (10), Distal femur mega prostheses with hinged joints (18), Distal femur osteoarticular allografts (1) Distal femur rotationplasty (16), Proximal tibia mega prostheses with hinged knee (10), Proximal tibia composite endoprosthesis (3), Proximal tibia composite prostheses with rotating hinged joint (8) Intercalary tibia Massive Allografts plus Vascularized Fibula (8), ankle arthrodesis (3).

**Results:** Specific gait abnormalities were found according to the surgical intervention:

Proximal femur: Although both modular prosthetic replacement and allograft-prosthesis composite reconstruction procedures provide good functional outcome in the long-term follow-up, gait analysis revealed mechanical changes during gait that were probably related to the muscle reinsertion procedure. Direct fixation of the muscles to the bone graft, as in the allograft-prostheses results in a more efficient muscular recovery.

Distal femur: good gait function can be achieved in patients treated with distal femoral resection, partial excision of the quadriceps, and total knee arthroplasty with insertion of a hinged prosthesis. Patients in whom the vastus lateralis and vastus intermedius were removed have better gait performance and a more physiological knee-loading pattern than patients in whom the vastus medialis is removed

Proximal tibia: total knee modular megaprosthesis functional performance during gait is in most cases abnormal, consistent with the weakness of the extensor apparatus and knee extension lag. Although a greater rate of normal walking is present in osteochondral allograft patients, problems related to a short patellar tendon, knee instability, and joint mismatching can account for abnormal knee kinematics.

Intercalary Femur Biological Reconstructions: subtle gait anomalies in proximal versus distal site of femur reconstruction are present, mainly dependent on muscles removed.

Rotationplasty: Functional results obtained in rotationplasty patients are maintained at a follow up of about 15 years. The symmetry of the limb length seems to be a factor influencing the better motor performance.

**Conclusions:** In conclusion, gait analysis allows analyzing objectively the movement, entering into the merits of functional impairment in dynamic conditions through the study of muscle activity, of forces applied to the joints, and kinematics of primary and compensative gait patterns. This is relevant both for general information on outcome of surgery with respect to the technique, and for customizing the best rehabilitative treatment with respect to the individual patient's dysfunction.