Post-Reconstructive Surgery Gait Analysis

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Who needs it?

• Trauma
  ▫ Most common patient
  ▫ Vehicle (+50%)
  ▫ Combat

• Cancer
  ▫ Sarcoma
  ▫ 14000 new cases/yr
    • 15% child cancer
    • 45% are in lower limb
    • Osteosarcoma
      • 50% are children
Who needs it?

- Diabetes
  - 30 million affected
    - Chronic Infection
    - Neuropathy
    - Peripheral Vascular Disease
  - 15% with severe foot ulcers
  - 2/3 of amputations

- Challenge:
  - Doctors cannot tell if amputation or salvage is best
What is the reconstructive surgery?

General Format:

- Stabilization of skeletal tissue
- Radical debridement
  - Remove dead/ compromised tissue
  - Includes bone fragments
- Bone shortening/alteration
  - Shape bone for growth process
- Restore neurovascular continuity
- Cover wound w/ fasciocutaneous flap
- Attach lengthening apparatus

General Complications:

- Patient variance
- Rehospitalization
  - Late amputation
  - Fracture nonunion
  - Infection
- Additional GF Attributable
  - Hematoma, compartment syndrome, deep infection
Previous Work

Ilizarov Lengthening
  • Complication focus

  • Manageable factors:
    ▫ Knee flexion
    ▫ ROM limitation
    ▫ Axial deviation
    ▫ Shortening
Previous Work

Intramedullary Lengthening

• Improved range of motion

• Same general process
  ▫ Difference lies within leg restriction
Previous Work

PRF/BMSC Efficacy

- Bone chips retrieved from living/deceased donor
- Decellularized
- PRF (Platelet Rich Fibrin)
  - Retrieved from patients blood
  - GF rich (VEGF, TGF-β, PDGF)
- BMSC (Bone Marrow Stromal Cell)
  - Often retrieved from marrow of ipsilateral crest during surgery
- Inserted into nonunion site
- Healing improved at 1.5, 3, and 6 months
Previous Work

Ankle-Foot Orthosis (AFO)

- Tested people prescribed with AFO against control group
  - Different Stiffnesses
  - No type able to create completely normal gait
  - Reduced abnormal gait injury

- Testing
  - Constant Froude #
  - Motion Capture
  - Force Plates

- Complications
  - Decrease in knee flexion
  - 10° less ROM in knee
  - 16° less ROM in ankle
  - Large decrease in ankle power
Our Proposal

- Test the influence of injury type, growth factors, and AFOs on gait
  - Only tibia reconstruction
  - All must undergo Ilizarov lengthening
- GFs (via PRF) will only be administered during lengthening
- 3 major groups
  - Trauma
  - Cancer
  - Control
- Our goal:
  - To show which recovery procedures or treatments result in the best leg function and quality of life
Compound Hypothesis

We hypothesize:

1. Cancer patients: superior ambulation post-weight bearing stage

2. Patients with GF will have a shorter recovery time and greater ROM than the non-GF groups

3. AFO will significantly improve non-GF groups, but will have minimal effect on ROM of GF groups

4. 1 year after weight-bearing, no more significant gait variance within trauma/cancer group

5. Patients receiving GF treatment without AFO will report highest satisfaction.
Cancer (40 patients)  
- Growth Factors (20)  
  - No GF (20)  
    - Gait Analysis With and Without Orthotic (10 each)

Control (10 participants)  
- Gait Analysis With and Without Orthotic

Trauma (40 patients)  
- Growth Factors (20)  
  - No GF (20)  
    - Gait Analysis With and Without Orthotic (10 each)

Gait Analysis With and Without Orthotic (10 each)
Testing

- Measurements
  - Weight-bearing time
    - GF Dependent
  - Sickness impact profile
    - Quality of Life
    - Self-Assessment
  - ROM
    - GF Dependent
  - Froude Number = 0.2
  - Motion Capture
  - Force Plates
    - Inverse Dynamics
    - Internal forces/moments

Recovery from Surgery (6 - 8 months)

- 1st Year of Testing
  - Weight-Bearing
    - 3 mo. Visit
    - 3 mo. Visit
    - 3 mo. Visit
  - 2nd Year of Testing
    - 6 mo. Visit
    - 6 mo. Visit
Summary

Novel study aiming to determine if injury type, addition of GF source, and follow-up AFO prescription lead to significantly different results for returning normalcy of patient function and boosting perceived patient satisfaction of the process.

Achieved through 6-8 month speed of recovery analysis followed by 2 year kinetic, kinematic, and patient satisfaction analysis.


References


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