

## Introduction:

Anterior cruciate ligament (ACL) injuries are occurring with increasing frequency in juveniles, and is associated with higher rates of repeat injury after ACL reconstruction compared to adult cohorts. Over the long term the hazard for ACL graft rupture is 5 x greater in adolescent males and 2.5x greater in adolescent females compared with adults [1].

Use of a parental graft for ACL reconstruction has the theoretical advantages of allowing for a predictable graft diameter, minimizing donor site morbidity for the child, and preserving the neuromuscular structure of the child's knee, all of which may have favorable effect on reducing repeat ACL injury and facilitate a full rehabilitation. Evidence supporting this technique is currently limited [2].

This prospective longitudinal study aims to examine the clinical results of endoscopic transphyseal ACL reconstruction utilizing a living parental hamstring tendon graft in a consecutive series of 100 children.

## Methods:

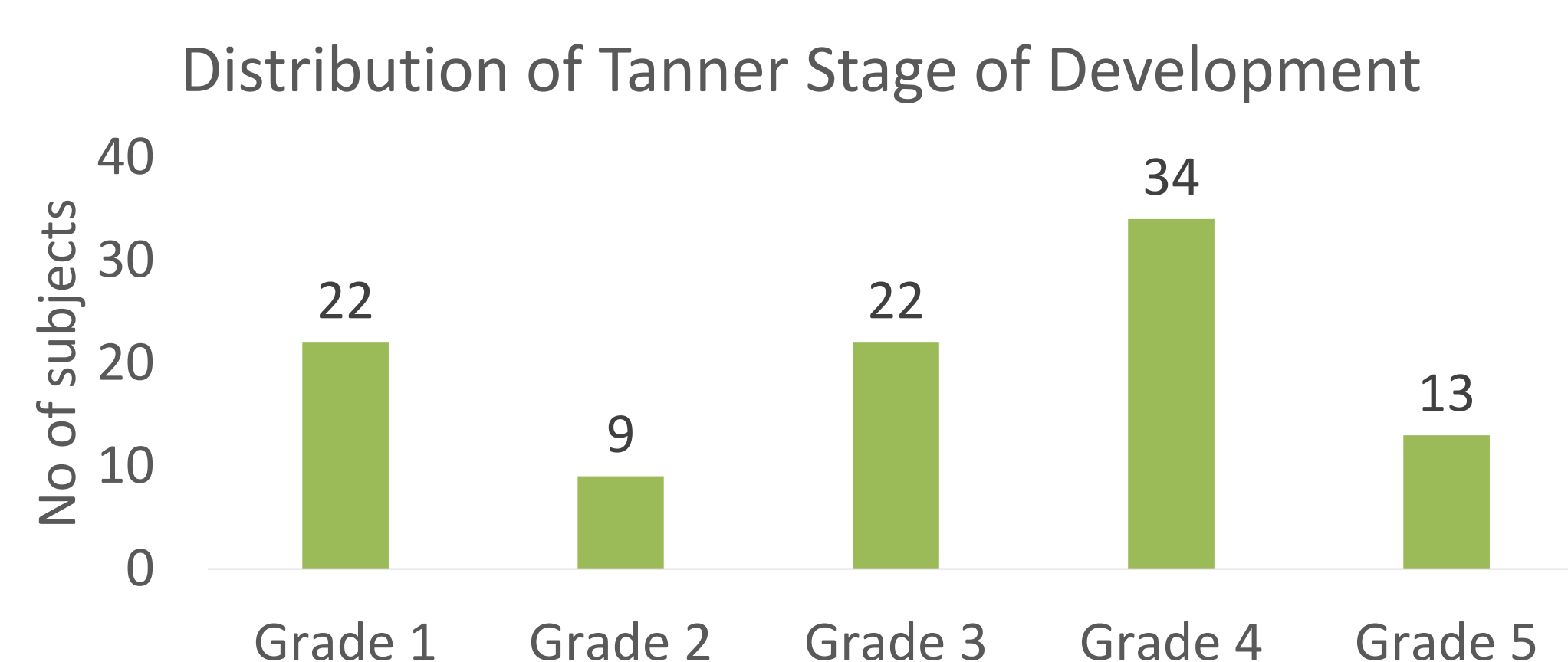
100 consecutive juveniles less than 17 years of age undergoing transphyseal ACL reconstruction with a living parental hamstring graft were recruited. After ACL reconstruction patients were reviewed at 1 and 2 years after surgery with

- IKDC Knee Ligament Evaluation & Lysholm Knee Score
- Radiographs annually of those with open growth plates
- KT1000 instrumented laxity testing

## Surgical Technique Modifications for Juveniles:

- Adjacent theatres for donor and recipient
- Donor harvest under GA as day surgery, and transferred in sterile vancomycin-soaked wrap under strict sterile condition
- ACLR - all inside technique with high anterolateral and low anteromedial portals
- Femoral tunnel drilled through anteromedial portal with knee flexed to 110° to avoid oblique crossing of femoral physis
- Aiming to fill the ACL origin and cross femoral physis at 90°
- Tibial tunnel drilled as vertical as possible, 4.5mm pilot, slow speed drill, line-to-line drilling, for as tight a fit as possible

The Tanner stage of development of the subjects is shown below.

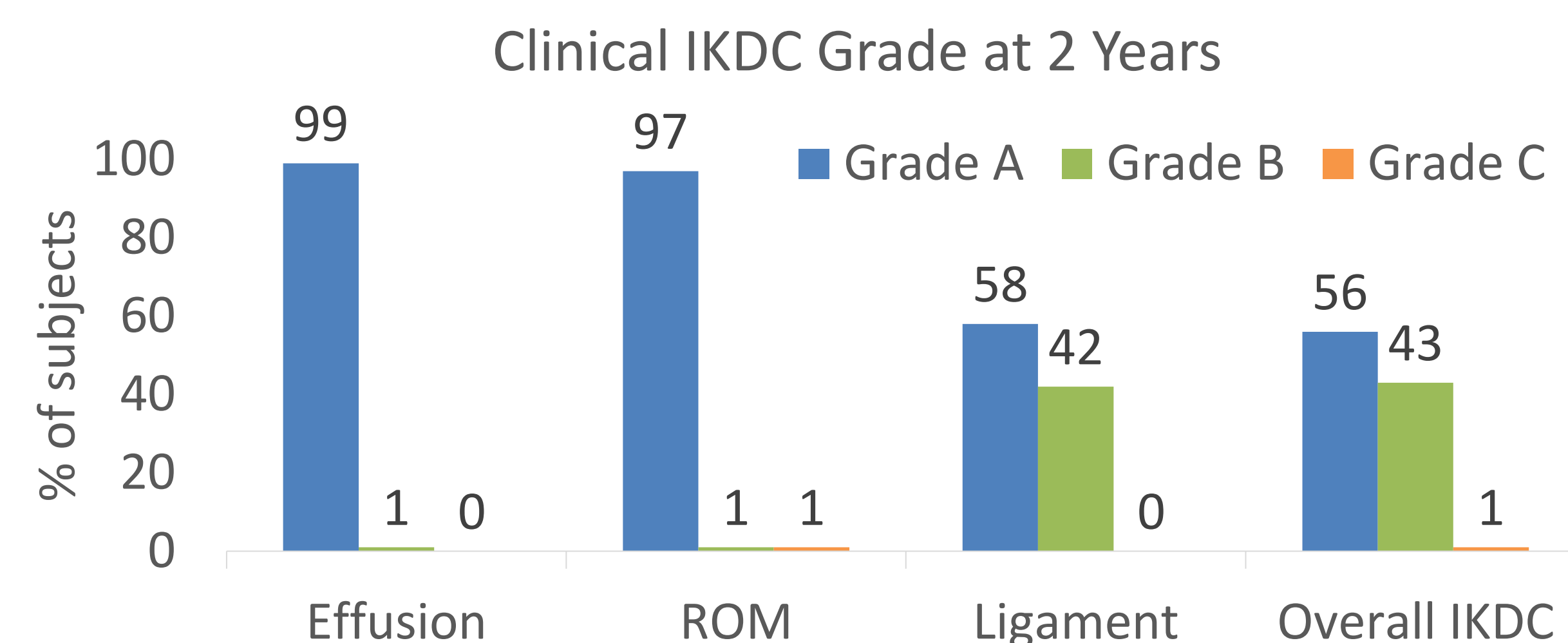


## Demographics:

- Of the 100 subjects 96% were followed to 2 years
- 69 were male
- The mean age of the was 13 years at surgery (range 8-17)
- The hamstring was donated by father in 79% and mother in 21%
- The mean HT graft diameter was 7.5mm (range 6-10mm)

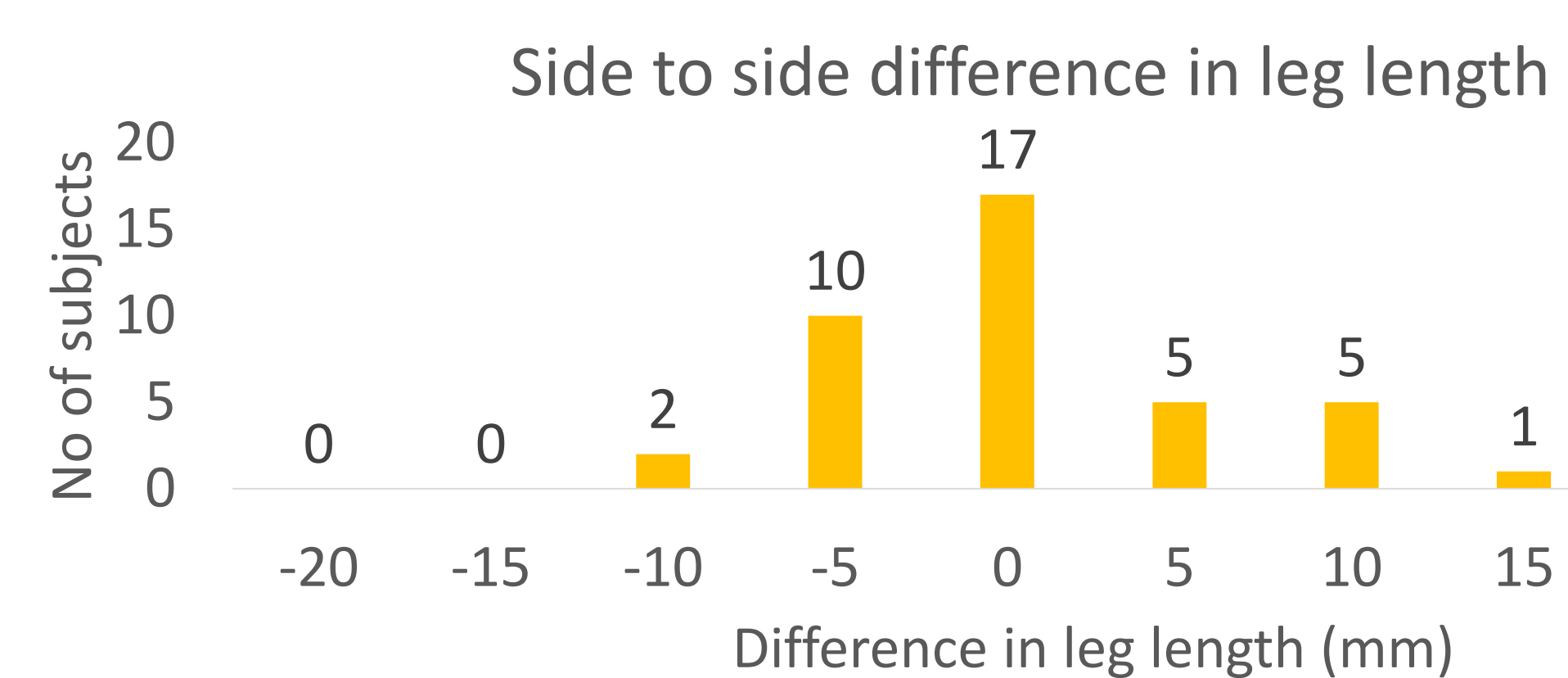
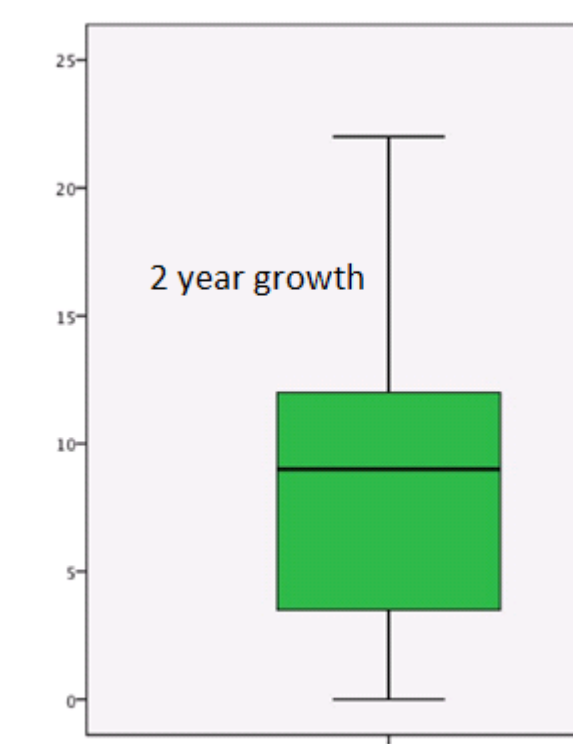
## Clinical Results at 2 years

- 12 had an ACL graft rupture
- 9 had a contralateral ACL injury
- Of the remaining 79, IKDC ligament grade was normal in 57% and nearly normal in 43%
- The mean IKDC subjective score was 96 out of 100
- 82% reported they had returned to their preinjury sport

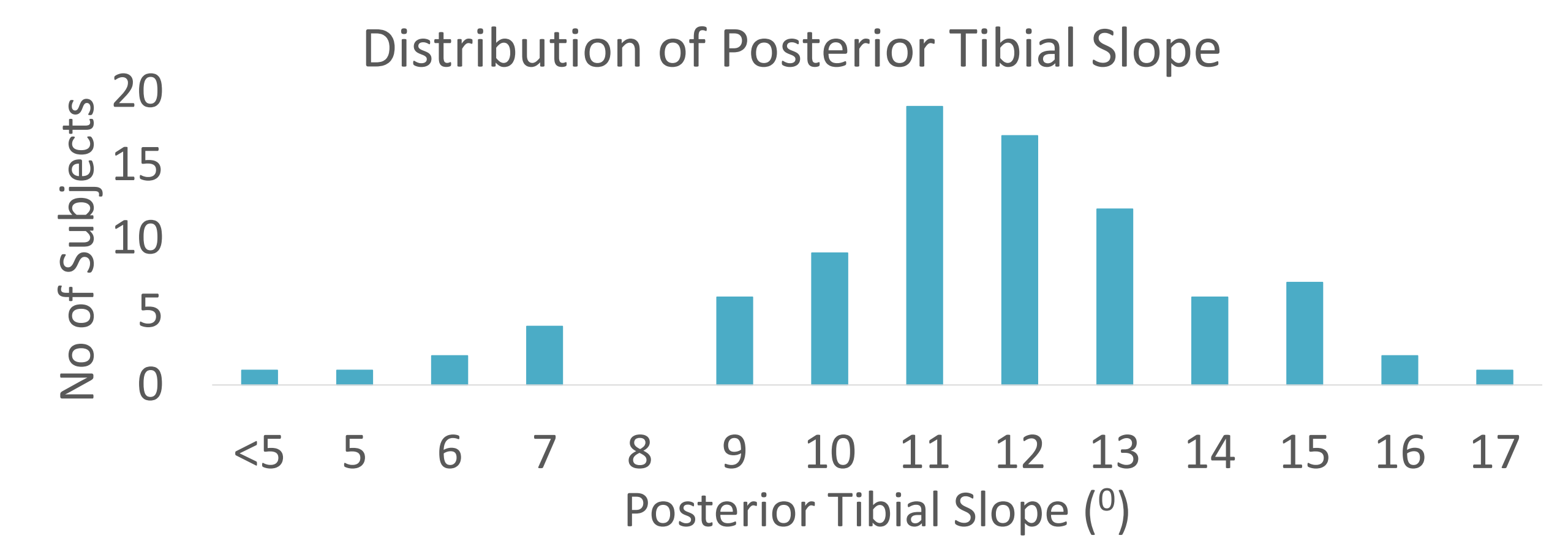


## Radiographic Assessments

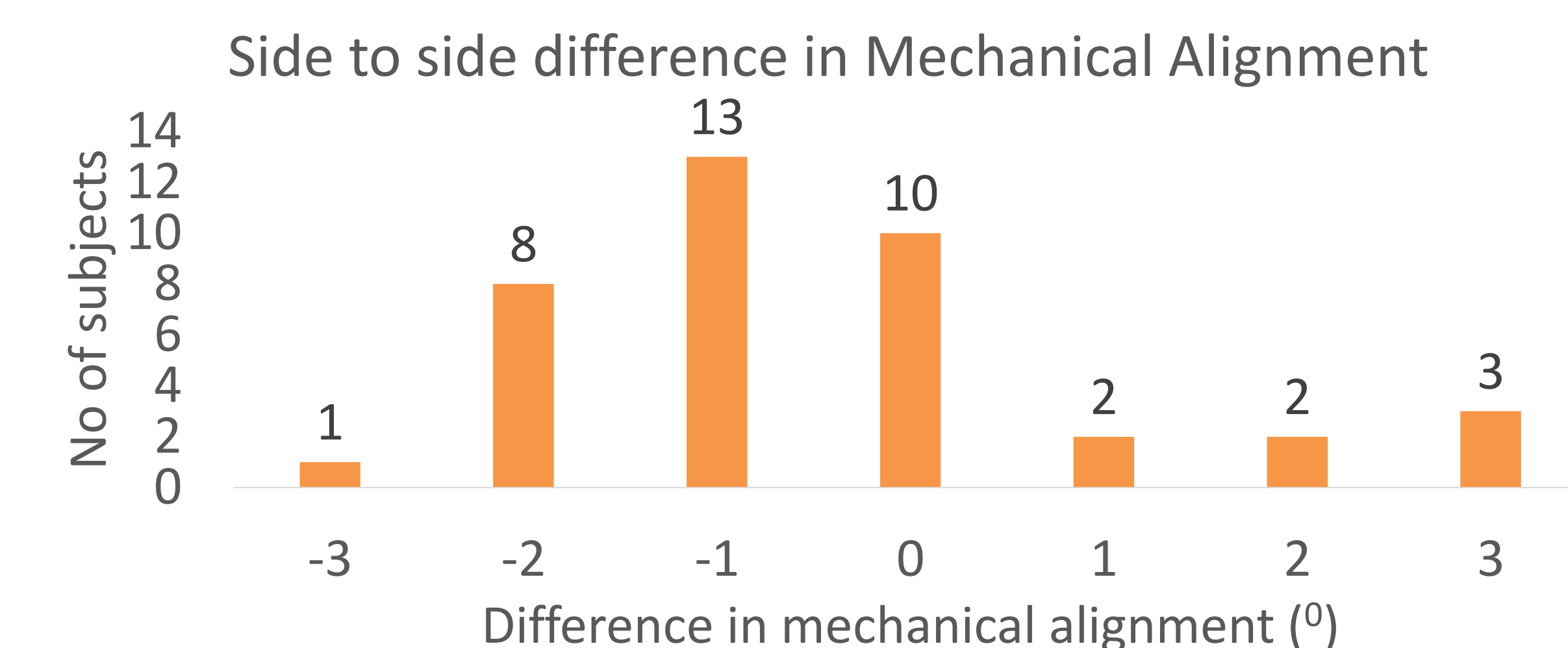
- At surgery radiographic growth plates were classified as
  - Open n = 43
  - Closing n = 23
  - Closed n = 34
- Of the 66 subjects with open or closing growth plates the mean increase in height over 2 years was 8cm (range 0-22cm)
- There were no cases of iatrogenic physeal injury or mal-alignment



- Leg length was measured at 2 years on long leg radiographs from the top of the femoral head to the centre of the tibial plafond. No subjects had more than 1.5 cm side to side difference in leg length, which is consistent with the normal population [3].



- 45% of juveniles had a posterior tibial slope (PTS) of  $>12^{\circ}$ . In adults populations 20% have PTS  $>12^{\circ}$ [4].
- Mechanical alignment was assessed on long leg radiographs. The mean side to side difference was  $-0.4^{\circ}$  (range  $-3^{\circ}$  to  $3^{\circ}$ )



## Conclusions:

- Transphyseal ACLR was safely performed in juveniles without growth disturbance in this series
- ACLR with this technique has a acceptable clinical stability, high rate of return to preinjury sport (82%) and high subjective scores at 2 years after surgery
- Parental living donor HT graft is a viable alternative graft
- A higher proportion of juveniles (45%) have posterior tibial slopes  $>12^{\circ}$ , compared to adult cohorts (20%)[4], which is strongly associated with repeat ACL injuries [1,4]
- 2<sup>nd</sup> ACL injury remains common in juveniles, occurring in 21% within the first 2 years with similar frequency on the ACLR and contralateral limb

## References:

1. Salmon LJ, Heath E, Akrawi H, Roe JP, Linklater J, Pinczewski LA. 20-Year Outcomes of Anterior Cruciate Ligament Reconstruction With Hamstring Tendon Autograft: The Catastrophic Effect of Age and Posterior Tibial Slope. *American J Sports Med* 2018 (in press). 0363546517741497.
2. Goddard M, Bowman N, Salmon LJ, Waller A, Roe JP, Pinczewski LA. Endoscopic Anterior Cruciate Ligament Reconstruction in Children Using Living Donor Hamstring Tendon Allografts. *Am J Sports Med* 2013;41(3):567-74.
3. Stanitski DF. Limb-Length Inequality: Assessment and Treatment Options. *JAAOS - Journal of the American Academy of Orthopaedic Surgeons* 1999;7(3):143-53.
4. Webb JM, Salmon LJ, Leclerc E, Pinczewski LA, Roe JP. Posterior Tibial Slope and Further Anterior Cruciate Ligament Injuries in the Anterior Cruciate Ligament-Reconstructed Patient. *Am J Sports Med* 2013;41(12):2800-04.

*This study was generously supported by the Friends of the Mater*

