A MECHANICAL MODEL FOR HIP REDUCTION VIA PAVLIK HARNESS IN NEWBORNS

INTRODUCTION
➢ Developmental dysplasia of the hip (DDH) is an abnormal condition in infants and commonly treated by the use of the Pavlik harness.
➢ 1 out of every 20 babies has some hip instability.
➢ The effectiveness of the Harness depends on physician expertise, experience and trial-and-error procedures.
➢ For a better understanding which procedure with the Pavlik harness is most effective a multi-physics computational approach has been done.
➢ To prove the results of the computational approach a mechanical model is needed which will provide physicians a better understanding of the mechanics of DDH when using the Pavlik Harness.

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ABSTRACT
Developmental Dysplasia of the Hip (DDH) refers to an abnormal hip condition in neonates characterized by anomalous development of the hip joint, in which hip joint dislocation, misalignment, and musculoskeletal instability are present in newborn infants.

Clinical reports and previous research indicate very low success rates for the Pavlik Harness for severe grades of hip dislocation; statistically, it has been shown that for reduction rate for the International Hip Dysplasia Institute (IHDI) Grades I-III is 92% while only 2% for grade IV.

In order to experimentally verify the computational model of the hip reduction and abduction via the use of the Pavlik Harness in severe cases of DDH, a mechanical bench-top model is to be designed, built and tested for the four grades of dislocation.

This approach will be repeated for three patient-specific neonate musculoskeletal models, as to corroborate the use of this experimental bench-top design in the validation of the patient-specific computational model.

The primary impact of this project on society will be to assist in the improvement to the success rate on non-surgical interventions for patients with DDH, as well as its consequences in adulthood; DDH is found responsible for 25% of primary hip replacements in people up to 60 years of age.

RESULTS
➢ A scale of 4x for the model was calculated to be practical for teaching purposes

➢ The team successfully created a 3-D printed model of the right half of the lower extremities that will be used to visualize the desired points of origin and insertion.

➢ The 3D model will also help to visually understand what is happening during the hip reduction process in order to implement this procedure on a patient-specific case.

REFERENCES

ACKNOWLEDGMENTS
Dr. Eduardo Divo, Associate Professor of Mechanical Engineering at ERAU
Dr. Victor Huayamave, Assistant Professor of Mechanical Engineering at ERAU
Dr. Charles T. Price, Professor of Orthopedic Surgery at UCF-School of Medicine