3D Printed Iliac Fossa Simulator for Advanced Open Surgical Skills

Materials: PLA (~730 grams per simulator), helping hands
Additional tools and materials: rubber mallet, Philips head driver
Manufacturing methods: 3D printing, hammering, driving
Estimated cost per model: $40 (helping hands - ~$25, PLA - ~$15)

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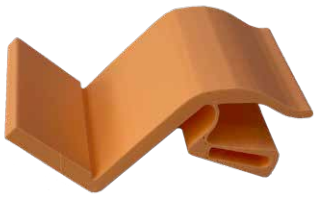
Documentation: Scott Drapeau

The 3D printed iliac fossa simulator is height adjustable to create more learning opportunities. The 3D printed parts are friction fit assembled and then attached to a helping hands device, specifically the Four Arms Helping Hands manufactured by Kotto. The helping hands are used to suspend a small sheet of fabric, latex, silicone, white spandex etc. inside the simulator. This model has been modified from the original 3D model courtesy of Dr. Seth Waits of the University of Michigan - https://pubmed.ncbi.nlm.nih.gov/32409287/

Individual parts that will be manufactured with 3D printing:

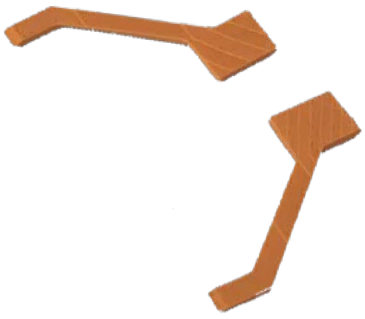
Leg



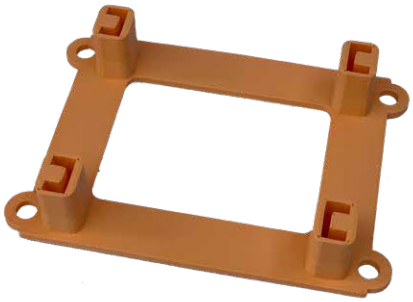
Spring

Base

Top



Latch Arms

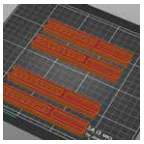
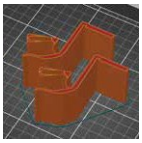
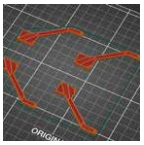
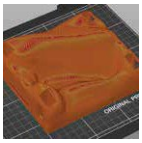
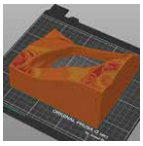
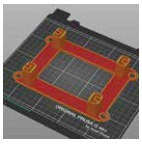


Adapter

Instructions

Print all parts in rigid plastic that will not shatter if hit with a rubber mallet, such as PLA.
*Note - These parts were originally printed on a Prusa I3MK3S+, but any FDM printer is capable of manufacturing. A minimum bed size of ~200mm x 200mm is recommended to fit the largest part.
Download STL files here

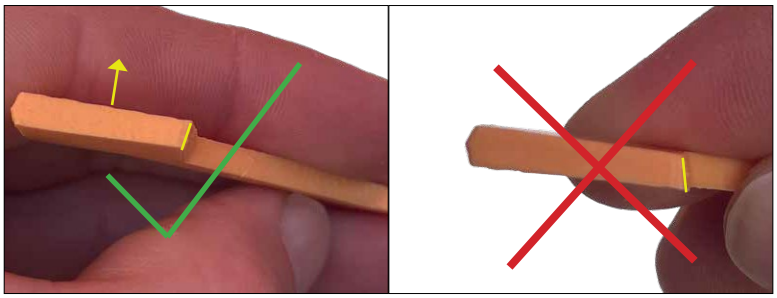
3D printed parts list information

Name of part	Grams	Perimeters	Infill %	Notes	Orientation
Leg (x4)	70	2	20		
Spring (x2)	50	2	20	The spring section will be a necessary solid 2 perimeters if printed with a .04 nozzle (standard)	
Latch arms set (x2)	<10	2	100	Full infill for structural integrity during manufacturing	
Base	257	2	20	Supports are not needed, even for the notch areas on both ends	
Top	253	2	20		
Adapter	88	4	20	Extra perimeters recommended for structural integrity during manufacturing	

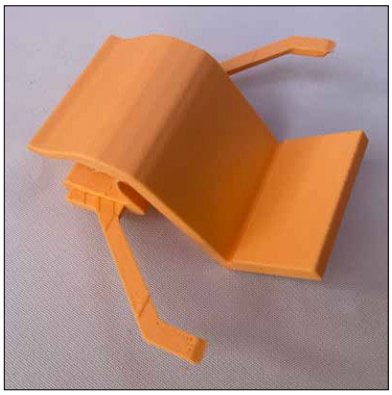
Assembling 3D printed parts

1. Place one spring on its side, and hammer in one latch arm. Pay attention to the orientation of the male end of the latch, evident by the slight pitch shown in yellow below.

Correct orientation | Upside down



2. Flip over and hammer in the second latch. Repeat for steps 1 and 2 for the second spring as well.

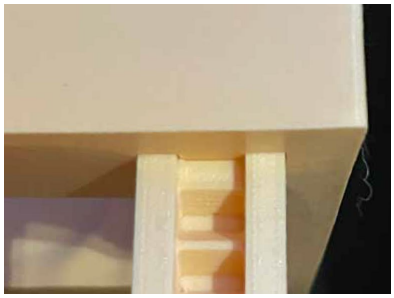


3. Push both spring and latch assemblies into the end notches on the base, and lightly hammer in until there is resistance. Set this assembly aside.

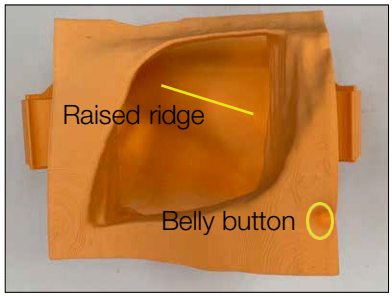
4. Place the adapter on a stable, flat surface and lightly hammer the legs into the adapter until bottom of legs are flush with bottom of adapter.

5. Slide the base assembly onto the legs while squeezing both spring handle + latch assemblies.

6. Place the top on the legs and lightly hammer each corner until the gap of the top notch of the leg is flush with the bottom face of the top.



Note the orientation of the raised ridge on the base should be on the opposite side of the belly button.



Assembly of 3D printed assembly to helping hands

1. Lay the 3D printed assembly on its side with the bottom side of the adapter holes in view.
2. Place the helping hands metal plate up to the assembly to line up the holes.
3. Push each bolt, with a foot and washer, through each hole and secure with each helping hand nut.
4. Tighten with a screwdriver and then orient in the correct standing position.

Maintenance

You may benefit from applying some 3D printer grease onto the legs to make height adjustable operation smoother. Comparable lubricant is also acceptable.

Due to the nature of varying print results from the 3D manufacturing process there may be slight size differences in some components. In the event that friction fit parts may seem loose, utilizing a small amount of super glue before assembly has proven effective.