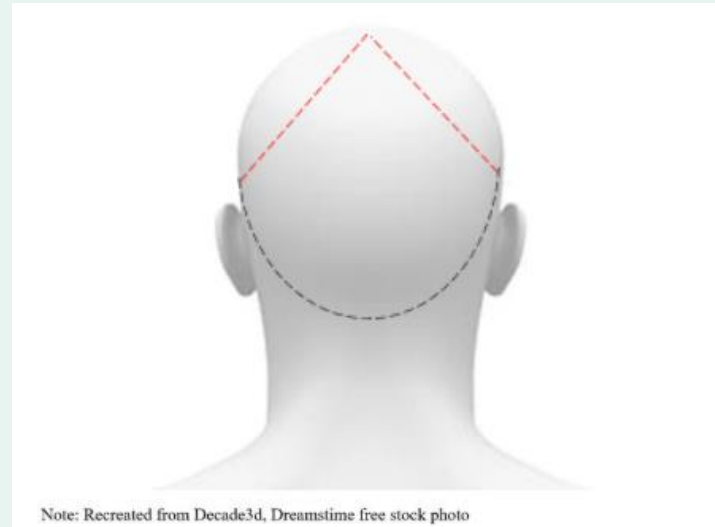


Respiratory Protection and Isolation System for Head Autopsies

Background Information

Due to COVID 19 the Nova Scotia Medical Examiners Service (NSMES) had concerns for their employee's safety during head autopsies. For a head autopsy a reciprocating saw is used to cut through the skull so the brain can be extracted for deciphering cause of death. The procedure requires a "C" shape incision made in the skin, spanning from ear to ear. The skin is peeled back and placed over the face to expose the skull. A piece of skull is then removed in the shape seen below to access the brain.



The fluid layer beneath the skull, called the dura, can become aerosolized by the saw along with blood and skull fragments. The main risks of these aerosols are CJD, HIV, Hepatitis C, viral or bacterial infections. It is unknown if these infections remain dangerous during autopsies causing concern for employee safety.

Current Method

Currently, the technicians place a plastic bag over the deceased head and performs the autopsy within. Some major issues with this method are:

- The plastic needs to be lifted away from the skull with one hand while operating the saw with the other
- Particles collect in the wrinkles of the bag, limiting visibility.
- The bag sticks to the skull and tissue as it is not supported

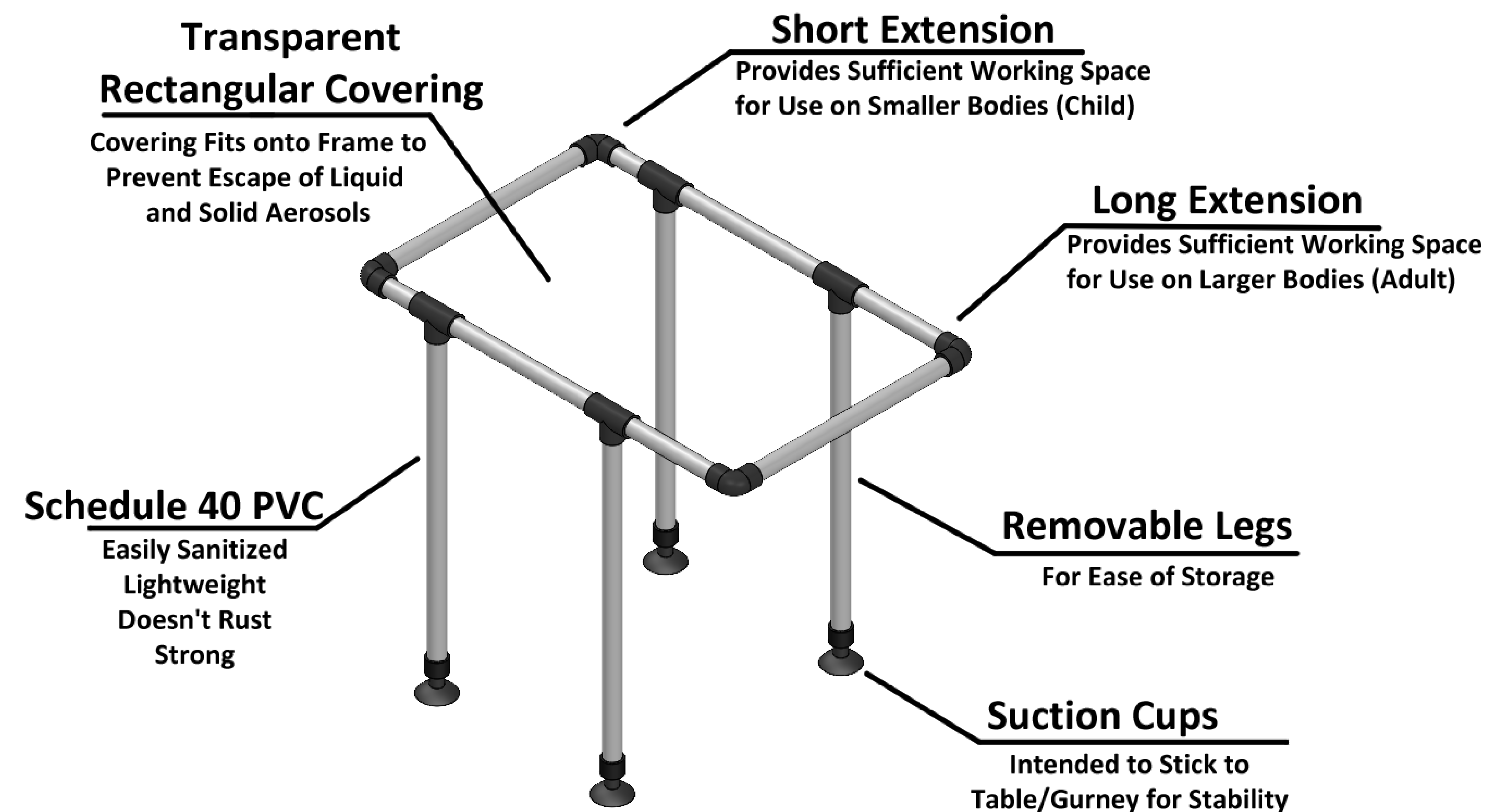
Project Scope

- Design, construct and test a respiratory protection device to protect technicians during head autopsies from aerosolized harmful pathogens by isolating the procedure.

Requirements

- Must prevent recess of harmful pathogens
- Dimensions and installation must accommodate existing gurneys used at NSMES
- Installation, removal, and cleaning time all less than 5 min.
- Device must be less than 10kg.
- Device must protect technicians while not effecting their productivity.

Design Process:



Design Summary

- The rectangular frame top supports a transparent rectangular plastic pallet covering to provide sufficient space for the user to perform an autopsy.
- Any splatter of liquid and solid aerosols is kept inside the frame by the plastic covering.
- The frame provides 30" of height for the user to accommodate the span of the saw needed for an autopsy.
- The width of the frame is 23.5" to fit within both existing gurneys.
- The extensions provide support of the covering away from the skull so that the plastic does not stick
- The PVC pipes and fitting used are readily available thus, the frame can be easily manufactured.
- Installation is simple with suction cups for stability. To engage, the technician needs to press on the frame.
- The frame was built under the respected budget provided by the client.

Testing

Once constructed, the frame was tested by the team and delivered to NSMES for further testing and completion of the following evaluation chart. Main analysis of the design's success was qualitative due to lack of research into this issue.

| Category | Rating |
|---|--------|
| Ability of suction cups to adhere to all gurney types | 4 |
| Durability of Covering | 3 |
| Sense of Safety | N/A |
| Transportation/ Storage | 5 |
| Ease of cleaning procedure | 5 |
| Effect of Extension Feature | N/A |
| Effect on Efficiency | 3 |

Main testing points

Drop test: Frame must withstand being dropped from a 4ft gurney. Tested by dropping in four orientations. Passed test.

Suction cup strength: Suction cups must be able to support the frame and withstand impacts associated with use. Cups were capable of lifting both gurney types off the ground. Passed test.

Durability of covering: Covering must prevent recess of aerosols and liquid splatter. Must also withstand stretching over frame and impact of saw. Passed criteria.

Extension: Both extensions must support covering away from skull and provide sufficient space for the operation. Passed criteria.

Safety: Must make technicians feel safe while using. Further testing required.

Recommendation

- Research and test different polymers for covering which would provide better visibility.
- Thread the legs and Tee, so that it doesn't come off accidentally while working.
- Include adjustable height and extension length to accommodate various autopsy methods.

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