Injection Infection Rejection: SteriLatch Syringe

Objective

Poor countries are unable to afford new needles and syringes so they instead must re-sterilize the ones they have. Many however, are not properly sterilized and are unsafely reused. A product which prevents unsafe reuse could reduce unintentionally poor sterilization.

Market size:
= 13 billion syringes worldwide / year

Customer Requirements:
- SOPs maintained
- Safe to use
- Prevents use if not sterile
- Intuitive
- Indication of sterilization
- Doesn’t impede standard use

Constraints:
- Force to operate
- # incidents / 1000 uses
- Accuracy of indicator
- Degree of misuse prevention

Engineering Requirements:
- Heat resistance
- No reactivity
- Conventional syringe functioning

Design

Operation:
- Guard deploys automatically after needle use
- SMA lock prevents reuse until needle is properly sterilized

Key Functionality & Innovation:
- Thermal response of SMA can guard against human error

Trade-offs:
- Number of reuses not limited

CR Satisfication:
- Prevent use if not sterile – SMA locks until sterilizing temperature is reached
- Indication of sterilization – When needle guard automatically retracts, clearly indicates syringe is sterile
- Doesn’t impede standard use – Locking mechanism is on sides of barrel and does not interfere with plunger use.

Prototype and Testing

Two Prototypes:

Testing Device:

SMA anchored in polycarbonate

SMA Resilience Test:
- SMA least reliable component
- SMA bent and submerged in boiling water

Test Analysis:
- SMA angle and angular deflection remain constant during trials 2-7
- Limit syringe to < 8 uses
- SMA ribbon would be more effective

Test Results and Future Work

Design Process Summary:
- Identified need for syringes which prevent unsafe reuse
- Iterated many concepts eventually settling on SteriLatch
- Trade-offs in number of reuses
- Tested SMA for resilience and reliability

Future Work:
- Design – limit number of reuses
- Commercialization – distribute to clinics via organizations such as World Health Organization
- Obtain feedback from medical technicians

Reflection:
- Concept Generation was helpful in evaluating various design ideas
- Prototyping aided the refinement of embodiment design concepts.

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