3D Printed Surgical Guides in Polylactic Acid: Cleaning and Drying Processes

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Problem

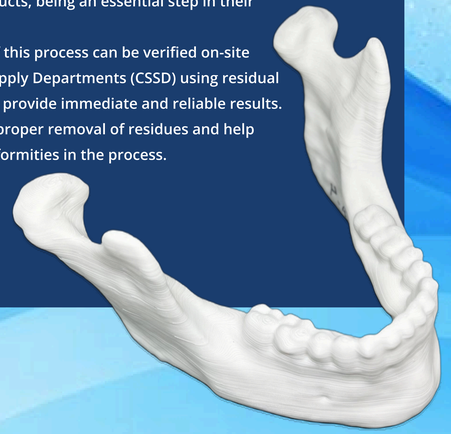
To perform cleaning and drying processes for 3D-printed surgical molds/guides, ensuring structural conformity and safety during processing.

Objective

1. To evaluate the effectiveness of the cleaning process and the structural conformity of surgical molds/guides using protein tests.

Literature Review

Cleaning removes organic and inorganic residues and reduces microbial load on health products, being an essential step in their processing.
The effectiveness of this process can be verified on-site in Central Sterile Supply Departments (CSSD) using residual protein tests, which provide immediate and reliable results. These tests ensure proper removal of residues and help detect any non-conformities in the process.



Research Question

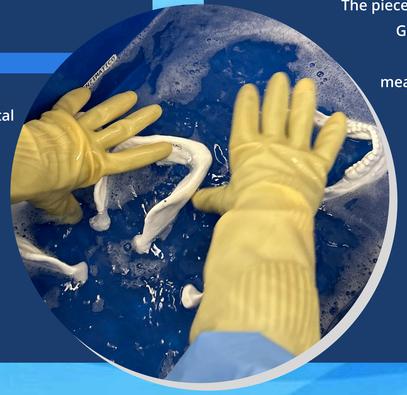
How can 3D-printed surgical molds/guides be cleaned to ensure surgical patient safety? Are there differences between manual and automated drying methods in the structural conformity of 3D-printed surgical molds/guides?

Conceptual Framework

3D-printed surgical molds/guides are anatomical replicas that provide precision in surgical procedures. To meet regulatory requirements for health product reprocessing, it is essential to ensure an effective cleaning step, still little discussed in the context of 3D-printed items. Standardizing the process, together with validating methods adapted to the nature of these materials, is essential in the context of processing 3D-printed materials.

Methods

Quasi-experimental study conducted in a private hospital in São Paulo, Brazil. The sample included 10 3D-printed surgical molds/guides made of polylactic acid (PLA), divided into Groups A and B. Upon arrival, their dimensions (height, width, and length) were recorded using a DIGIMESS® caliper. Manual cleaning was performed by immersion in Endozyme AW Plus®, with efficacy verified using the 3M™ Clean-Trace™ Protein test.



Methods

Structural conformity was checked again after cleaning. Group A underwent manual drying using WypAll® X60 towels and compressed air; Group B underwent automated drying in a CISA Trachea Dryer 1P® cabinet. At the end, all pieces were reassessed for integrity and structural conformity, totaling 30 measurements.

Data Analysis

Dimensional measurements were compared during processing, and the results of cleaning verification tests were analyzed.

Results

The pieces were identified (Group A: 1–5, manual drying; Group B: 6–10, automated drying). All presented 100% structural conformity across the three measurements. Cleaning took 3 minutes per piece; due to PLA's low weight, pieces were manually kept submerged. Protein tests were negative for all samples. Manual drying took 1 minute per piece, while automated drying took 18 minutes per piece. Both methods maintained 100% integrity and preserved dimensions.

Conclusions

The cleaning and drying processes were effective, did not cause structural alterations, and proved viable for application in hospital settings. The methodology was safe, standardizable, and replicable for processing 3D-printed surgical molds/guides.

Implications for Perioperative Nursing

This study validates a cleaning and drying protocol for 3D-printed molds/guides, ensuring intraoperative safety, reducing risks, and supporting the active role of nursing in the use of 3D-printed items—an emerging and rapidly growing global topic.

References

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