Eco-Friendly kit for handwriting rehabilitation

Second life for clinic waste (Phase II)

Laura Simões[1,2*], **Beatriz Lopes** [2,3], Catarina Santos[2], Carolina Vital[2,4], Catarina Silva[2,4], Mariana Baluarte[2], Mariana Louro[2], Vlad Tatarescu[2,5,6], Sarah Souza[7], Catarina Godinho[5,6] and Alexandra Bernardo[2,5,6]

[1] Master's in Laboratory Technologies in Forensic Sciences, Egas Moniz School of Health & Science, 2829-511 Caparica, Almada, Portugal | [2] Laboratório de Ciências Forenses e Psicológicas Egas Moniz (LCFPEM), 2829-511 Caparica, Almada, Portugal | [3] Postgraduate Programme in Intelligence Analysis: Crime Prevention and Investigation, Egas Moniz School of Health & Science, 2829-511 Caparica, Almada, Portugal | [4] Bachelor's in Criminal and Forensic Sciences, Egas Moniz School of Health & Science, 2829-511 Caparica, Almada, Portugal | [5] Egas Moniz School of Health & Science, Instituto Universitário Egas Moniz, Monte de Caparica, 2829-511 Caparica, Portugal | [6] Egas Moniz Center for Interdisciplinary Research (CiiEM); Egas Moniz School of Health & Science, Campus Universitário, Quinta da Granja, 2829-511 Caparica, Almada, Portugal | [7] Postgraduate Qualification in Upper Limb and Hand Rehabilitation, Egas Moniz School of Health & Science, 2829-511 Caparica, Almada, Portugal

*Correspondence: 118219@alunos.egasmoniz.edu.pt

INTRODUCTION

Parkinson's disease can impair fine motor control and handwriting, particularly through micrographia [1].

Graphomotor exercises may support rehabilitation [2], while recovered clinical plastics offer opportunities for more sustainable rehabilitation tools [3].



OBJECTIVES

Main Objective

To investigate the feasibility of reusing discarded clinical polymers to develop an eco-friendly handwriting rehabilitation kit for individuals with Parkinson's disease.

Specific Objectives

- Identify and assess suitable clinic polymers.
- Characterize materials (thermal behavior and melting properties).
- Develop manipulable components for fine motor exercises.
- Integrate graphomotor exercises into a rehabilitation kit.

1 PHASE I — Material Collection and Preliminary Selection

Clinical polymer waste was collected, documented and preliminarily identified through available information and literature review.



Figure 1. Examples of clinical polymer waste: (A) transparent tubing, (B) blue plastic component and (C) assorted clinical plastic components.

DOCUMENTED MATERIAL

Material (residue)	Composition
Tubes (aspiration)	Mainly plasticized PVC; silicone or TPU (some variants).
Other Components (clinical devices)	PVC and PP; possible internal metallic wire.
Sticks & Tubes	PP or PE (sticks); nylon/polyester (tips); PVC, PE or silicone (tubes).

2 PHASE II — Material Assessment and Processing

Proposed laboratory-scale work flow for polymer identification, processing and filament production.



I. Characterization

Polymer analysis and suitability assessment (visual, physical and chemical).



Shredding

Fragmentation using a benchtop blender (laboratory scale).



Thermal Characterization

Assessment of melting behavior and thermal stability of individual polymers.

Individual Materials

Thermal behavior (e.g. melting temperature and thermal stability).

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Polymer Blends

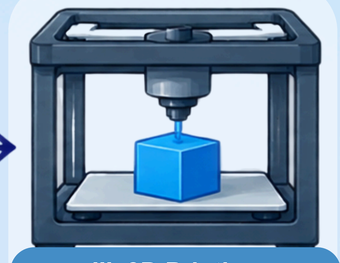
Thermal behavior and potential interactions between two combined materials, in different proportions.

! Polymer identification and thermal assessment are essential to select the material for filament production [3-5].



Filament Preparation

Laboratory-scale extrusion and filament production from the selected material(s).



III. 3D Printing

Filament production, prototyping and quality assessment (dimensions, mechanical and functional performance).

II. Processing

3 PROPOSED REHABILITATION KIT

Six components for fine motor training and a graphomotor exercise booklet.



Ping-pong ball (PP)



Beans (PP or PE)



Clips / Chain links (PP)



Elastic bands (TPU)



Anti-stress ball (TPU or silicone)



Coin (PP)

CURRENT PROGRESS & FUTURE PERSPECTIVES

Current Progress

- Waste collection and photographic documentation completed.
- Preliminary material selection documented.

Future Perspectives

- Material characterization and compatibility assessment.
- Filament production, prototyping and technical evaluation.
- Subsequent clinical validation.

A circular approach for a more sustainable future.

PP = polypropylene | TPU = thermoplastic polyurethane
PE = polyethylene | PVC = polyvinyl chloride

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