

Joint Venture Proposal: Metal 3D Printing for Medical & Dental Research

A Collaboration Between KFSHRC Research & Innovation Center and Spanish Counterpart

1. Project Overview

This proposal outlines a joint venture between the **King Faisal Specialist Hospital & Research Centre (KFSHRC) Research & Innovation Center** and a **Spanish medical research counterpart** to collaborate on metal 3D printing technology for **customized medical implants** and **dental prosthetics**. This partnership will leverage the unique strengths of both institutions, combining cutting-edge 3D printing technology with specialized expertise in biomedical research.

The project focuses on using **metal 3D printing** to drive research into personalized healthcare solutions, particularly in **titanium cranial implants** and **custom dental prosthetics**. By collaborating, both organizations can achieve breakthroughs in medical device innovation and expand the applications of metal 3D printing for research purposes.

2. Joint Venture Objectives

The joint venture will aim to:

- ✓ **Promote Collaborative Research:** Leverage the expertise of both KFSHRC and the Spanish counterpart to advance research into personalized medical and dental devices.
- ✓ **Expand Research Capabilities:** Utilize metal 3D printing to accelerate the development and testing of custom medical implants and dental prosthetics, focusing on research outcomes that can be translated into clinical practice.
- ✓ **Share Knowledge and Expertise:** Facilitate the exchange of technical expertise, research methodologies, and medical knowledge between both institutions, fostering innovation in 3D printing for biomedical applications.
- ✓ **Pursue Joint Publications and Research Funding:** Collaborate on research papers, scientific publications, and joint grant applications to secure funding from international research bodies and foundations.

3. Core Functionalities

The joint venture will center around metal 3D printing technology for research applications, focusing on two primary areas: **customized cranial implants** and **dental prosthetics**.

3D Printing Technology

- ❖ **Selective Laser Melting (SLM):** Both institutions will use SLM technology to print medical-grade metal powders, such as titanium and cobalt-chromium, to create complex, customized implants.

- ❖ **Software Integration:** The metal 3D printing system will integrate with advanced imaging technologies, such as MRI, CT, and CAD systems, enabling the production of highly accurate, patient-specific research prototypes.

Material Research

- ❖ **Titanium Alloys (Ti6Al4V):** For cranial implants, the joint venture will focus on researching biocompatibility, strength, and durability of titanium alloys, ensuring that the materials used meet international medical standards.
- ❖ **Cobalt-Chromium Alloys:** For dental prosthetics, research will explore the use of cobalt-chromium alloys to assess their suitability for high-stress dental applications, such as crowns and bridges.

4. Proposed Research Application: Customized Cranial Implants

One key research focus of the joint venture will be the development of **customized titanium cranial implants** for patients with cranial bone defects. Both KFSHRC and the Spanish counterpart will collaborate to design, print, and evaluate the performance of 3D-printed cranial implants.

Research Objectives

- ✓ **Personalization of Cranial Implants:** Explore the precision and effectiveness of using 3D-printed titanium implants designed specifically for each patient's unique cranial anatomy.
- ✓ **Mechanical Performance Studies:** Evaluate the strength, durability, and long-term performance of 3D-printed cranial implants in comparison to traditionally manufactured implants.
- ✓ **Post-Processing and Surface Finishing:** Investigate how post-processing techniques such as heat treatment and surface polishing can improve the mechanical properties and biocompatibility of the implants.

Benefits of Collaboration

- ✓ **Cross-Cultural Medical Insights:** By sharing clinical data and experiences, both institutions can develop solutions that accommodate different patient populations, benefiting from varied medical practices.
- ✓ **Shared Resources:** The Spanish counterpart can provide expertise in post-processing technologies, while KFSHRC will contribute its knowledge of patient-specific medical imaging and implant design.

5. Proposed Dental Research Application: Customized Dental Prosthetics

Another critical area of collaboration is research into **3D-printed dental crowns and bridges**. This research will focus on developing **custom dental prosthetics** using metal 3D printing to achieve superior fit, durability, and performance.

Research Objectives

- ❖ **Custom-Fit Dental Crowns:** Explore how 3D printing can produce patient-specific crowns with a perfect fit, minimizing the need for manual adjustments and reducing treatment time.
- ❖ **Material Strength Studies:** Test the performance of cobalt-chromium and titanium crowns under high-stress conditions, such as chewing, to determine their suitability for long-term dental applications.
- ❖ **Research on Aesthetics and Functionality:** Investigate the integration of aesthetic considerations into 3D-printed dental prosthetics, ensuring that the crowns and bridges not only perform well but also meet cosmetic expectations.

Benefits of Collaboration

- ❖ **Dental Research Excellence:** The Spanish counterpart, known for its leading-edge dental research, will contribute specialized knowledge of dental prosthetics and testing methodologies.
- ❖ **Expanded Research Opportunities:** By pooling research resources, the joint venture can explore novel materials and manufacturing techniques that might not have been feasible independently.

6. Joint Venture Benefits for Both Parties

Benefits to KFSHRC

- ✓ **Access to European Expertise:** KFSHRC will gain access to the Spanish counterpart's expertise in post-processing technologies and innovative 3D printing methodologies, enhancing its research capabilities.
- ✓ **Strengthened Research Credentials:** Collaborating with an internationally recognized research institution will enhance KFSHRC's reputation in metal 3D printing research and biomedical innovation.
- ✓ **Accelerated Research and Innovation:** By working together, the joint venture will shorten research timelines and foster faster development of personalized medical and dental prototypes.

Benefits to the Spanish Counterpart

- ✓ **Access to Middle Eastern Markets:** The joint venture will provide the Spanish institution with valuable insights and connections in the Middle East, potentially opening doors for future research collaborations and market access.

- ✓ **Expanded Clinical Data Access:** By collaborating with KFSHRC, the Spanish counterpart can access diverse patient populations and clinical data that will enhance the applicability and robustness of their research findings.
- ✓ **Enhanced International Presence:** Partnering with KFSHRC will increase the Spanish counterpart's visibility in international research circles, helping it establish a stronger presence in the Middle East and beyond.

7. Implementation Plan

The joint venture will follow a phased approach to establish the metal 3D printing research collaboration:

Phase 1: Initial Setup (Months 1-3)

- **Agreement Finalization:** Formalize the joint venture agreement, specifying intellectual property sharing, funding allocations, and project management roles.
- **Infrastructure Setup:** Identify and prepare facilities at both KFSHRC and the Spanish counterpart's laboratories to host the metal 3D printing equipment.
- **Equipment Procurement:** Acquire and install metal 3D printers, including selective laser melting (SLM) systems and post-processing machinery.

Phase 2: Research Launch (Months 4-12)

- **Collaborative Research Teams:** Form joint research teams comprising specialists from both institutions, focusing on cranial implant research and dental prosthetic development.
- **Prototyping and Testing:** Begin developing 3D-printed prototypes for cranial implants and dental prosthetics, testing their fit, performance, and biocompatibility in controlled lab environments.
- **Data Sharing and Analysis:** Share research data, results, and insights between KFSHRC and the Spanish counterpart to accelerate knowledge exchange and innovation.

Phase 3: Research Expansion and Publication (Months 13-24)

- **Advanced Prototyping:** Scale up research efforts, creating more complex implant designs and refining post-processing techniques.
- **Joint Publications:** Collaborate on research papers to document findings, focusing on personalized implants and dental prosthetics. Submit to international medical and dental journals.
- **Funding and Grant Applications:** Apply for joint research grants to secure additional funding for further project expansion.

8. Cost Structure

The proposed cost structure for the joint venture includes:

- ✓ **Metal 3D Printers:** \$600,000 - \$750,000 (shared investment by both parties).

- ✓ **Material Costs:** \$200 - \$400 per kilogram of titanium and cobalt-chromium powders (jointly sourced).
- ✓ **Post-Processing Equipment:** \$150,000 (procured and shared by both partners).
- ✓ **Training and Implementation Costs:** \$30,000 (costs split equally for initial training sessions and technical support).

9. Conclusion

This joint venture will enable KFSHRC and its Spanish counterpart to pioneer groundbreaking research in metal 3D printing, driving innovation in customized medical implants and dental prosthetics. By combining expertise, resources, and technology, both institutions will benefit from the collaborative research environment, creating a pathway for personalized medical solutions and future healthcare advancements.

10. Next Steps

- ✓ **Formalize the Partnership:** Schedule joint meetings to finalize the collaboration agreement and outline detailed project milestones.
- ✓ **Initiate Equipment Procurement:** Begin the process of acquiring metal 3D printing equipment and preparing research facilities at both locations.
- ✓ **Launch Collaborative Research Teams:** Assemble cross-functional research teams to define key research objectives and begin initial prototyping efforts.