You
to improve the accumulation of bone in the drill bit during surgery

Surgical Drill Bit : Bone Accumulation On Drill Bit Set

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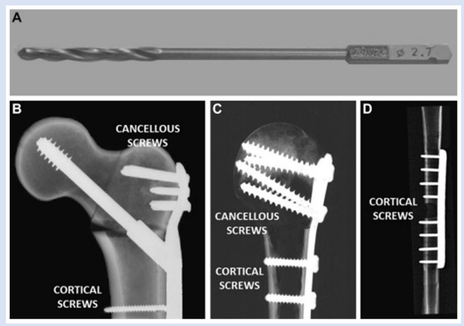
INTRODUCTION

Introduction

- Surgeons encounter challenges during bone drilling surgeries, including potential bone damage and bone tissue getting stuck in the drill bit.
- Modern technology, like 3D printing and computers, ensures top-notch quality tools for surgical precision.
- Thorough checks are conducted to verify tool perfection before surgical use.
- Techniques and tools are employed to manage bone tissue accumulation in drill bits:
- Irrigation systems flush the area with sterile fluid to clear bone debris and maintain drill bit coolness.
- Surgeons may pause to clean or replace the drill bit if bone becomes stuck, ensuring continued safe and effective surgery.



Drilling Process

TECHNICAL GAP AND OBJECTIVE

- Poor design hampers effective removal of bone debris, increasing the risk of clogging and reducing drilling efficiency.
- Existing drill bits may lack the precision required for delicate bone surgeries, potentially resulting in inaccuracies or damage.
- Off-the-shelf drill bits may not meet the specific requirements of each surgical procedure, limiting versatility and adaptability
- Current drill bits lack efficient cooling systems, leading to overheating during prolonged use.

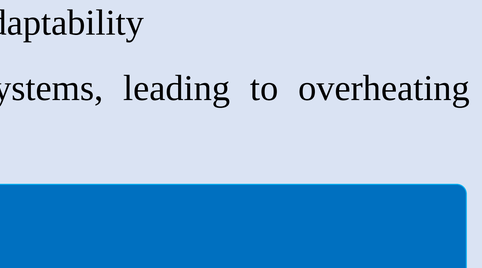
Proposed solution in one sentence

- Creating a drill bit for bone drilling with a 3D printer, especially with features like a passage for coolant and minimizing bone accumulation for better drilling and reducing tissue damage due to heat generation.

DESIGN APPROACH/METHODOLOGY

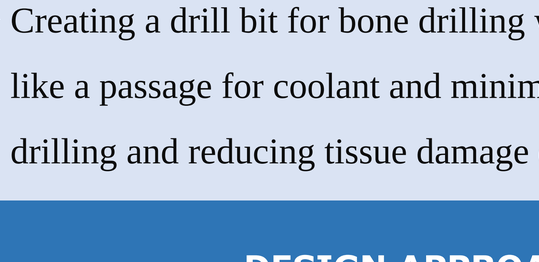
Manufacturing drill bit with passage for coolant using 3D Printer

- Allowing for the swift evacuation of bone debris to prevent clogging and maintain drilling efficiency.
- Enabling the continuous flow of coolant to dissipate heat and maintain optimal operating temperatures.
- Selecting an appropriate size based on the surgical application and bone type to achieve the desired drilling depth and precision.



Drill Bit With Passage for Coolant

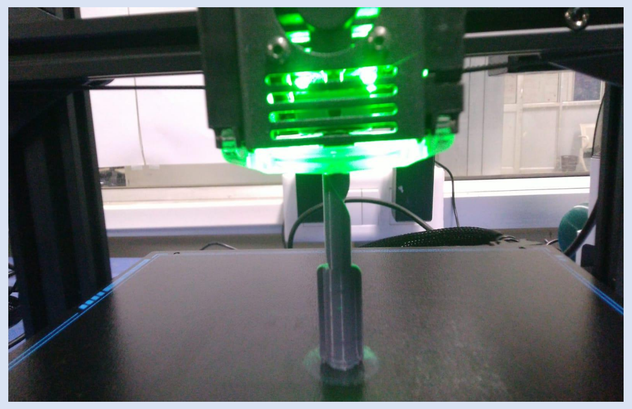
Surgical Drill Bit Geometry



a.) Twist drill bit, b.) axial view of drill bit tip

- Different angles such as point, rake, and clearance, crucial for initiating and cutting into bone.
- Features like helix angle and flute aid in chip evacuation and coolant flow, influencing drilling force, torque, temperature, and hole quality.
- Shank provides stability and compatibility with drilling equipment, ensuring precise and controlled drilling.

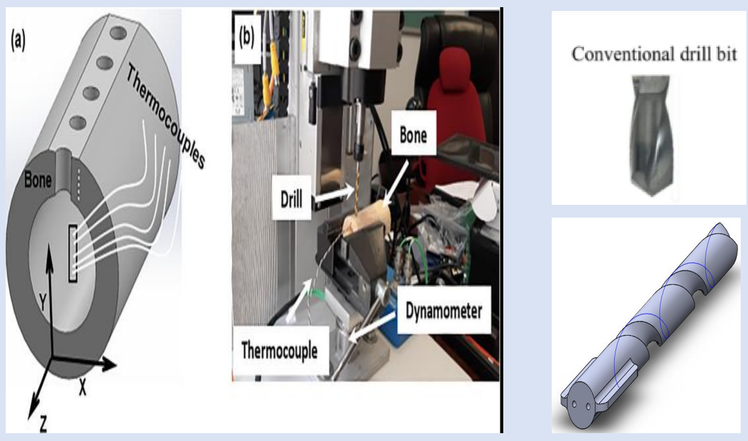
- Fabrication using Fused Deposition Modelling (FDM) involves layer-by-layer deposition of thermoplastic materials to create bone drilling tools.
- Set up FDM 3D printer with appropriate parameters, including layer height, infill density, and print speed.



Fabrication of Drill bit Using FDM (Fused Deposition Modelling)

- Remove any support structures and smooth rough surfaces to enhance functionality and biocompatibility.
- Conduct quality checks to verify dimensional accuracy and material integrity before sterilization and surgical use.

RESULTS



Thermal analysis of Conventional drill and Drill with Passage for coolant flow manufacture by 3D Printer while Bone Drilling

CONCLUSION

- Incorporating a passage for coolant flow in bone drill bits manufactured using 3D printing technology enhances surgical efficiency and patient safety.
- The design consideration of minimizing bone accumulation on the drill bit improves procedural effectiveness and reduces the risk of complications during surgeries.
- Utilizing 3D printing for manufacturing enables precise customization of drill bits, ensuring compatibility with specific surgical requirements and bone types.
- Enhanced cooling and chip removal capabilities contribute to smoother drilling operations, reducing procedure time and enhancing overall surgical outcomes.
- The integration of advanced features such as coolant passages demonstrates the potential of additive manufacturing to innovate and optimize medical device design for improved patient care.

References

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