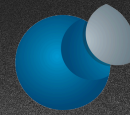


# Improving Surgical Cutting Guide in a Day

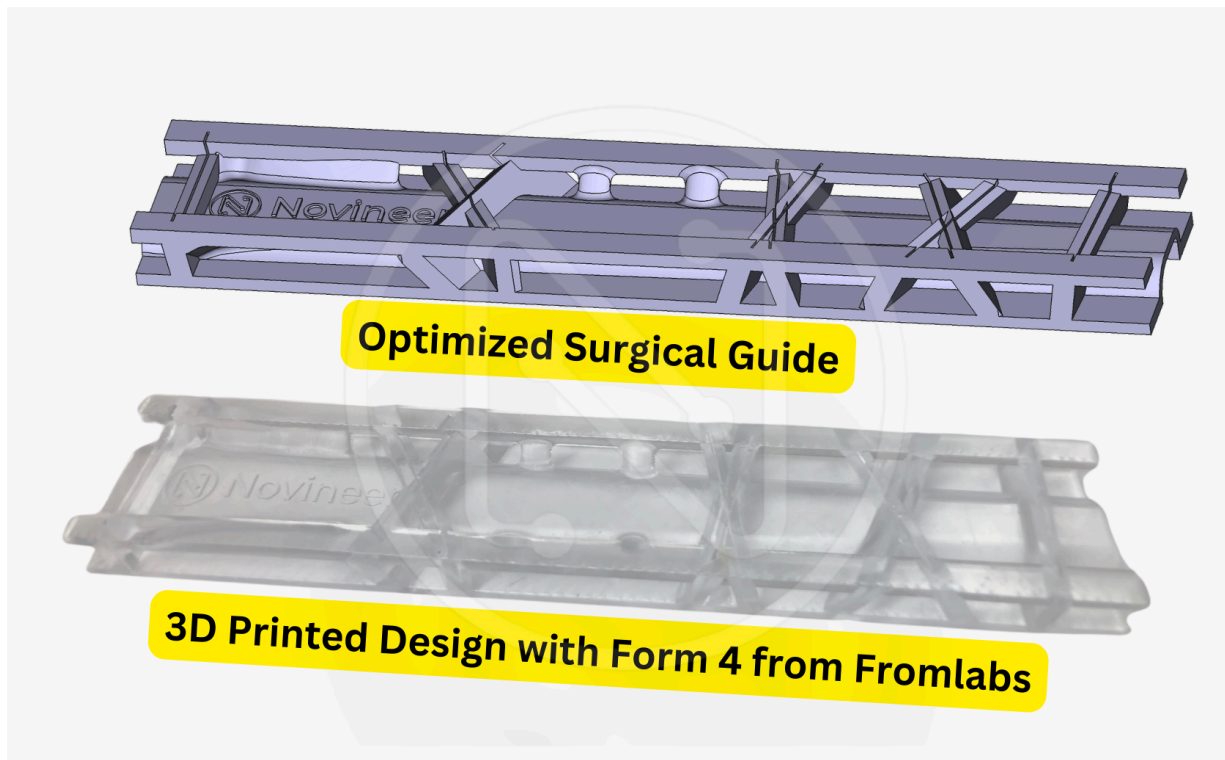
 Novineer



TECHFIT  
Digital Surgery

## Overview

Patient-specific surgical cutting guides enhance precision in orthopedic surgeries by fitting uniquely to each patient's anatomy, improving surgical outcomes. The design needs to ensure stability and accuracy during the operation, addressing potential misalignments. Novineer's technology allows for rapid design and customization of these guides, significantly increasing their stiffness and effectiveness.



Characteristic	Baseline	Novineer	Notes
Stiffness	-	90% Improvement	
Print Time (Form 4B Biomed Clear)	3:03hrs	2:59hrs	4 minutes faster
Resin Used (mL)	52.19	40.15	Stiffer part needed less support

## Enhancing Surgical Process with Patient-Specific Cutting Guides

Surgical cutting guides are specialized tools crafted to enhance precision in orthopedic surgeries, such as osteotomies, where bones are cut, reshaped, or realigned to address various conditions and injuries. These guides are designed based on digital data to fit uniquely to each patient's anatomy. This customization allows surgeons to perform surgical interventions at precise angles and specific locations, significantly improving the outcomes compared to traditional freehand methods.

The use of surgical cutting guides offers several benefits. By providing a physical template that matches the patient's bone structure, these guides ensure that incisions and modifications are made accurately, which is particularly crucial in complex cases. This not only streamlines the surgical workflow but also leads to enhanced surgical outcomes, such as reduced operating time, reduced blood loss, and easier navigation during surgery.



## Why Design is Needed for Surgical Guide

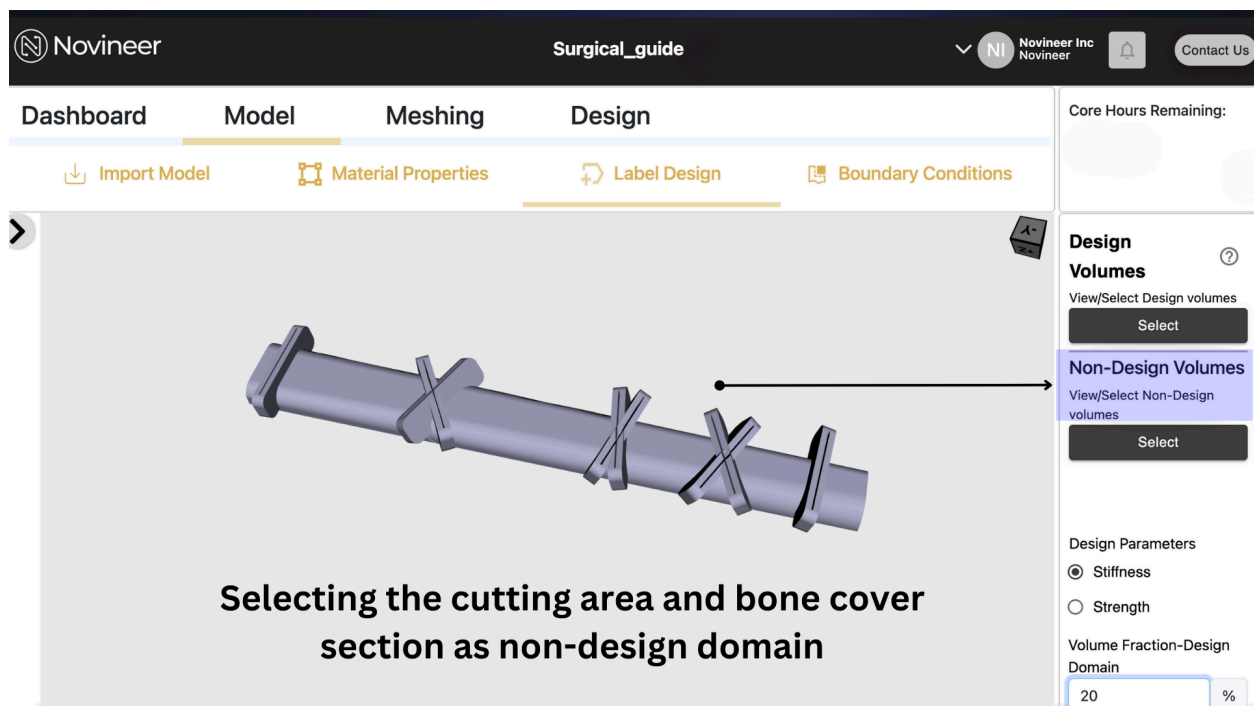
Despite the benefits of patient-specific cutting guides, their effectiveness can be compromised by misalignment of the guide on the bone. This can occur due to shifts in the guide's position during surgery caused by initial positioning errors or instability from applied forces during the surgery. Such discrepancies can lead to incorrect surgical actions which undermines the success of the surgery.

The necessity for design optimization in surgical cutting guides stems from the need to mitigate these risks. Optimized design aims to ensure that the guides not only fit perfectly but also remain

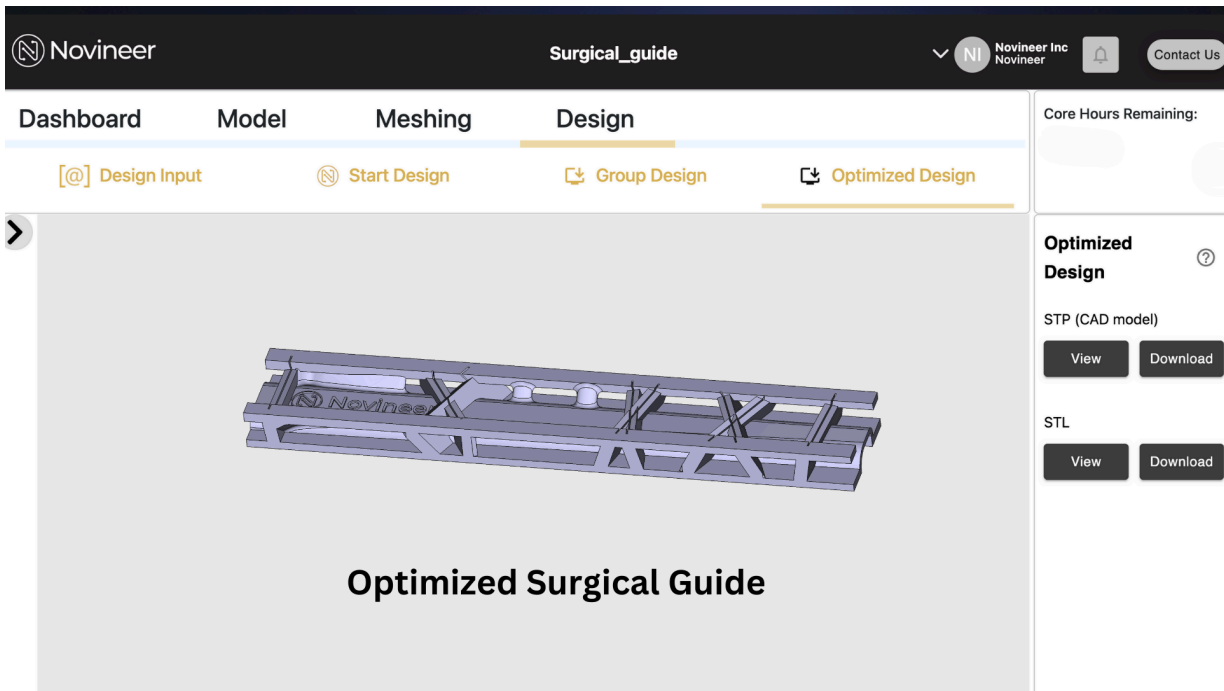
stable throughout the procedure, without adding bulkiness to the surgical area. Achieving a balance between guide stiffness and minimal obstruction is crucial to maintaining accuracy in surgical cuts and enhancing overall surgical efficacy. This underscores the importance of continual improvement in the design and utilization of these innovative surgical tools.

## How to Design and Print a Surgical Cutting Guide with Novineer in One Day!

**Novineer** collaborated with **TECHFIT Digital Surgery** to design and 3D print a surgical cutting guide. The process starts by preparing the CAD model based on the digital data. The location of the cuts, material properties, loads, and boundary conditions are identified. Within the Novineer software, the guide that covers the Bone and the location of cuts is chosen as the non-design domain. The non-design volumes will not be altered during the design process. Then, three load cases are established. Each load case is related to a set of load and boundary conditions to simulate the applied forces in the surgery process. The weight constraint is set to be equal to the baseline design to prevent adding bulkiness to the surgical area.



After the meshing, the design is obtained and converted to .stp. Novineer enables users to customize their design priorities, offering settings for either maximum performance or a balanced approach that highlights both optimal performance and editability. The maximum performance option leverages local geometries to produce structures that are performance-oriented and have an organic appearance. On the other hand, the setting that combines optimized performance with editability uses distinct geometries, making it suitable for projects that might need future alterations or a high degree of customization.



The design is then printed with Form 4, a Formlabs 3D printer. The baseline design and optimized designs were experimentally evaluated. As can be seen below, for the same weight, the Novineer optimized design is about 90% stiffer than the baseline design.

