

Article

An Open-Source Blender Add-On for Automated Design of Patient-Specific Splint Extensions for Condyle Positioning in Orthognathic Surgery: Workflow and Proof-of-Concept Validation

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Abstract

Background: Patient-specific splints have become an integral component of virtual surgical planning in orthognathic surgery. However, transferring the virtually planned condylar position into the intraoperative setting remains technically challenging and typically requires labor-intensive manual modification of splint geometries. The aim of this study was to develop and describe an open-source Blender add-on that automates the generation of patient-specific splint extensions for condyle positioning and to evaluate its technical feasibility in a proof-of-concept clinical setting. **Methods:** A Python-based add-on for the open-source 3D modelling software Blender was developed to automate the generation of condyle-positioning splint extensions from stereolithography (STL) models exported by a commercial virtual surgical planning system. The software architecture and processing pipeline comprise facilitated data import, coordinate normalization, extension generation, Boolean processing, optional manual refinement, and STL export for additive manufacturing. The workflow was applied in three patients undergoing bilateral sagittal split osteotomy. Postoperative correspondence between the planned and achieved mandibular positions was assessed using translational and rotational transformation parameters together with qualitative surface distance heatmaps provided by the planning software. **Results:** The proposed add-on successfully generated patient-specific splint extensions in all three proof-of-concept cases while automating manual modelling steps. All splints were successfully manufactured and applied intraoperatively without redesign. Postoperative evaluation demonstrated good agreement between the virtually planned and achieved mandibular positions, with only small translational and rotational deviations. Descriptive statistical analysis supported the technical feasibility and reproducibility of the proposed workflow. **Conclusions:** The presented open-source Blender add-on provides a reproducible and extensible workflow for automated generation of patient-specific condyle-positioning splint extensions. The proposed approach successfully integrates virtual surgical planning with additive manufacturing and demonstrates technical feasibility in a proof-of-concept clinical setting. The software establishes a foundation for future validation studies in larger patient cohorts and illustrates the potential of open-source tools to improve transparency, reproducibility, and accessibility in digital orthognathic surgery workflows.



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Keywords: orthognathic surgery; BSSO; condyle positioning; patient-specific splint; open-source software; computer-assisted surgery; additive manufacturing; virtual planning

1. Introduction

Orthognathic surgery is a well-established treatment for correcting dentofacial deformities and improving both function and facial aesthetics. Advances in computer-assisted three-dimensional (3D) planning have substantially improved the precision and reproducibility of orthognathic surgery and have become an integral component of contemporary treatment workflows. Commercial virtual surgical planning systems, such as IPS CaseDesigner® (KLS Martin, Tuttlingen, Germany), enable accurate planning of skeletal movements and facilitate the fabrication of patient-specific surgical splints, thereby improving the predictability and reproducibility of surgical treatment [1–5].

However, although virtual planning accurately defines the desired postoperative mandibular position, standard splint design workflows primarily transfer the planned occlusion and do not explicitly encode the planned condylar position within the splint geometry. Consequently, numerous techniques have been proposed to reproduce or maintain condylar positioning intraoperatively, each with specific advantages and limitations [6–8]. The necessity, benefits, and limitations of condylar positioning techniques have therefore been discussed extensively in the literature [8,9].

Within our institution, a modified occlusal splint (Figure 1) incorporating bilateral extensions for transferring the preoperatively planned condylar position to the intraoperative setting has previously been developed, demonstrating the feasibility of splint-based condylar positioning.



Figure 1. Occlusal splint with two extensions for condyle positioning.

Manual design of these splint extensions requires multiple geometric operations, repeated alignment procedures, and Boolean modelling steps, making the workflow time-consuming and operator-dependent when using general-purpose CAD software. To address this limitation, we developed an open-source Blender add-on that automates the generation of patient-specific splint extensions while preserving the possibility for optional user refinement. To the best of our knowledge, no open-source software tool has previously been described that automates the design of condyle-positioning splint extensions for orthognathic surgery.

Therefore, the aim of this study was to develop and describe the software architecture and automated workflow of the proposed Blender add-on and to evaluate its technical feasibility and clinical applicability in a proof-of-concept setting.

2. Materials and Methods

2.1. Study Design

All procedures involving human participants were conducted in accordance with the ethical standards of the Declaration of Helsinki and were approved by the Ethics Committee of the University of Würzburg (approval number: 223/20-am).

This study was designed as a software development and technical feasibility study with the primary objective of developing and implementing an open-source Blender add-on for the automated generation of patient-specific splint extensions for condyle positioning in orthognathic surgery. Clinical application was limited to a proof-of-concept demonstration in three patients undergoing bilateral sagittal split osteotomy (BSSO) and was not intended to establish clinical effectiveness or superiority over existing workflows. The postoperative correspondence between the virtually planned and achieved mandibular position was assessed using the built-in comparison and visualization tools of the planning software (IPS CaseDesigner® 2.4, KLS Martin, Tuttlingen, Germany). The software provides quantitative measurements of translational and rotational deviations together with qualitative surface distance heatmaps. Due to the exploratory nature of the study and the limited number of clinical cases, only descriptive analyses were performed, and no inferential statistical testing was conducted.

2.2. Software Environment

Preoperative virtual surgical planning was performed using IPS CaseDesigner® (KLS Martin, Tuttlingen, Germany), which served as the primary planning environment for orthognathic surgery and generated the stereolithography (STL) models required by the proposed workflow. The add-on was developed to extend this existing planning process (Table 1). The Condyle-Positioning Tool (CPT) was implemented as a Python add-on for the open-source 3D modelling software Blender (Blender Foundation, Amsterdam, The Netherlands). Development and testing were performed using Blender version 3.5.1 and the embedded Python 3.9 interpreter. Source code development was carried out using Visual Studio Code 1.8 (Microsoft Corp., Redmond, WA, USA). The workflow processes STL files exported from the virtual planning software. When necessary, exported meshes were preprocessed using Meshmixer 3.5.474 (Autodesk Inc., San Francisco, CA, USA) to repair non-manifold geometries and generate watertight meshes suitable for Boolean operations. The final splint models were exported as STL files and prepared for additive manufacturing using PreForm® 3.23.0 (Formlabs GmbH, Berlin, Germany).

Table 1. Applied Software and Purpose.

Software	Purpose
IPS Case Designer	Virtual surgical planning and STL export
Meshmixer	Mesh repair and solidification (if required)
Blender	Execution of the CPT add-on
Python	Add-on implementation
Visual Studio Code	Software development
PreForm	Print Preparation

The current implementation was developed and validated for Blender version 3.5.1 running under Microsoft Windows. Compatibility with other Blender versions, operating systems, or virtual surgical planning software has not yet been systematically evaluated and therefore represents a limitation of the present study.

2.3. Materials

- (a) Our add-on runs on a standard personal computer. We used a machine with the following hardware specifications:
- Intel® Core™ i7-670 CPU @ 3.40 GHz;
 - 16.0 GB RAM;

- Windows 10 (64-Bit-OS).
- (b) The occlusal splints are printed on an SLA-Printer Form3B+ (Formlabs GmbH, Berlin, Germany). We used the Resin “Surgical Guide” (Formlabs GmbH, Berlin, Germany) with a layer thickness of 50 μm . According to the manufacturer’s specifications, the splints were washed in 99% isopropyl alcohol (IPA) for 20 min. After a drying phase for at least 30 min, the occlusal splints were cured with the “form cure” at 70 degrees Celsius for 30 min. Finally, the support structures were removed manually. Before using the occlusal splints in the patients, they were disinfected with chlorhexidine 0.06%.

2.4. Software Architecture and Processing Pipeline

The Condyle-Positioning Tool (CPT) was implemented as a modular Blender add-on using Python. The software follows a sequential processing pipeline that automates the generation of patient-specific splint extensions while allowing optional user intervention where clinically desirable (Figure 2). Each processing step is implemented as an independent Blender operator, enabling reproducible execution of the complete workflow from data import to export of the final splint. The workflow requires stereolithography (STL) files exported from the virtual surgical planning software, including the planned mandible, the occlusal splint, and the anatomical structures defining the planned condylar position. After importing the models, the add-on automatically creates a dedicated Blender collection and assigns all imported objects to predefined object categories used throughout the subsequent processing steps. To establish a consistent reference frame, all imported objects are translated to a common coordinate system by centering the complete collection at the origin of the Blender scene.

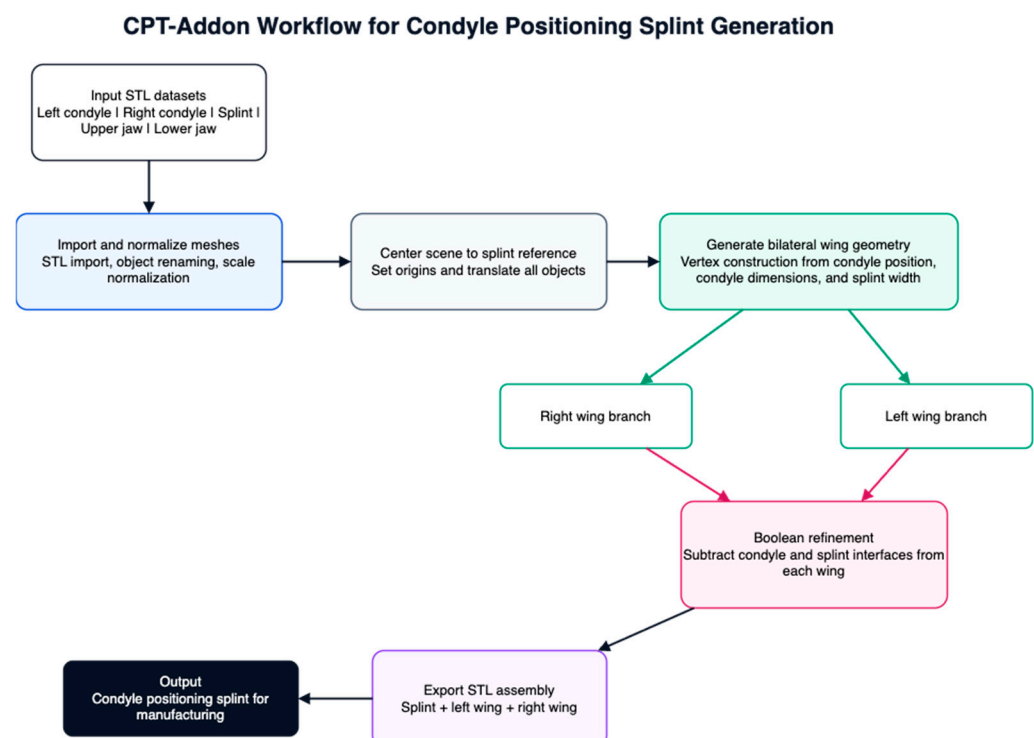


Figure 2. CPT-Addon Workflow for Condyle Positioning Splint Generation.

This normalization step ensures reproducible spatial relationships between the imported anatomical structures and minimizes user-dependent positioning errors during the subsequent geometric operations. Bilateral extension volumes were generated independently for the left and right sides using the positions and axis-aligned bounding dimensions

of the imported anatomical reference meshes together with the transverse dimension of the imported occlusal splint. For each side, predefined proportional offsets were applied to calculate medial and lateral vertex positions defining the extension geometry. A closed polyhedral mesh consisting of eight vertices and six faces was subsequently generated. Separate calculations were performed for the left and right sides to account for the mirrored anatomical configuration. During the finalization step, Boolean difference operations were applied sequentially to each extension. First, the corresponding anatomical reference mesh was subtracted to generate the patient-specific negative contact surface. Second, intersecting geometry of the occlusal splint was removed from the extension. These operations produced complementary geometries that accurately fit the planned anatomical configuration while preserving compatibility with the original splint. Finally, the occlusal splint and each processed extension mesh were exported together as an STL file for additive manufacturing (Algorithm 1).

Algorithm 1: CPT splint-extension generation

Input:

- Left and right anatomical reference STL files
- Occlusal splint STL file
- Optional upper- and lower-jaw STL files

Output:

- Printable STL containing the splint and bilateral extensions

1. Import STL models and assign standardized object names.
 2. Scale all imported models to the Blender working units.
 3. Set object origins to their geometric centers.
 4. Translate the complete dataset so that the splint location defines the working reference position.
 5. For each side:
 - a. Read the anatomical reference position and bounding dimensions.
 - b. Read the lateral extent of the splint.
 - c. Calculate extension coordinates from predefined proportional offsets.
 - d. Generate an eight-vertex, six-face extension volume.
 - e. Subtract the anatomical reference geometry from the extension.
 - f. Subtract the intersecting splint geometry from the extension.
 6. Allow optional manual inspection or refinement.
 7. Select the splint and both extensions.
 8. Export the selected geometry as an STL file.
-

3. Results

3.1. Software Implementation and Workflow

The Condyle-Positioning Tool (CPT) provides a graphical user interface (Figures 3 and 4) within Blender that guides the user through the required interaction steps for generation of splint extensions based on the automated processing pipeline described in Section 2.4 (Table 2). The Condyle-Positioning Tool (CPT) allows the import of stereolithography (STL) files representing the preoperative plan for orthognathic surgery, which was created using IPS CaseDesigner[®] (KLS Martin, Tuttlingen, Germany).

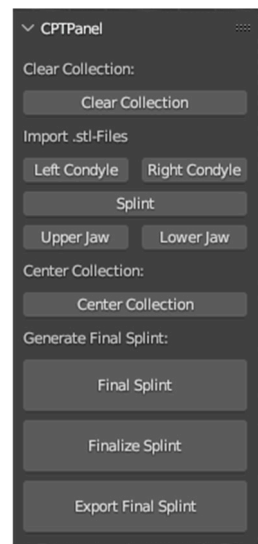


Figure 3. Illustration of the CPT Panel in detail.

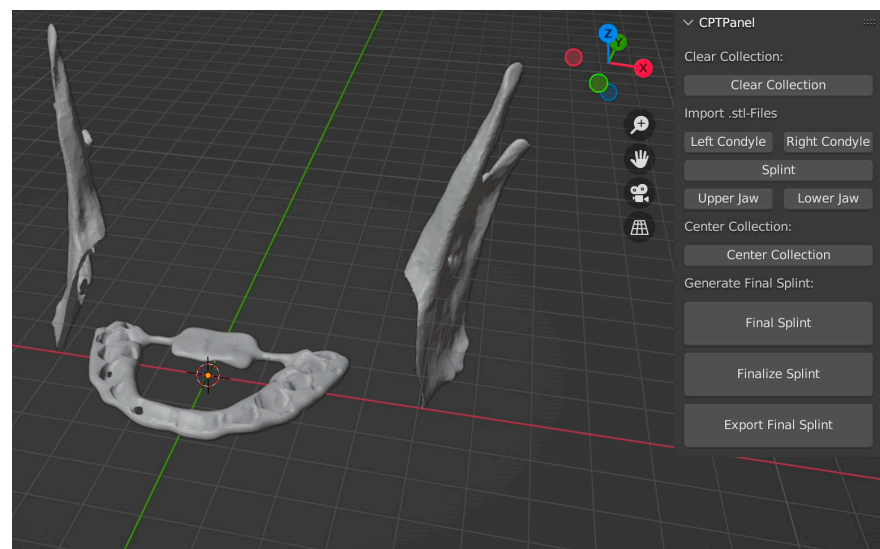


Figure 4. Illustration of the CPT Panel and the imported STL files.

Table 2. Overview of User Interaction.

Workflow Step	User Action	Automation
Import STL files	Manual	User Select files
Center Collection	One click	Automatic
Generate extensions	One click	Automatic
Manual refinement	Optional	User
Finalization	One click	Automatic
Export STL	One click	Automatic

After importing the files, it is necessary to “Centre the Collection” to locate all imported files correctly in the three-dimensional space. This is performed by one click.

Clicking the button “Final Splint” creates two extensions, one located on the left and the other on the right side of the splint, already correctly positioned relative to the condyles. The extensions encode the negative of the ascending ramus (Figure 5).

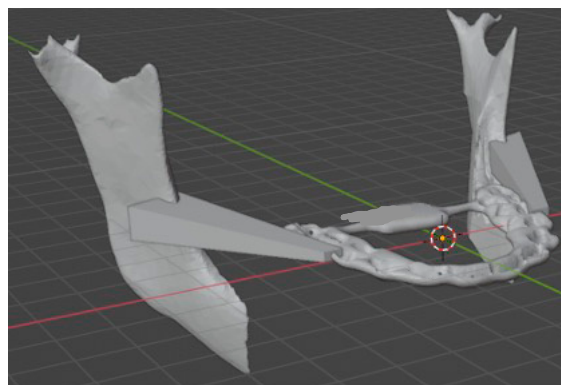


Figure 5. Illustration of the final splint positioned correctly to condyles.

The generation and positioning of the extensions are performed automatically by the add-on, whereas any subsequent shape adaptation is optional and performed manually by the user using standard Blender editing tools. It is possible to slightly modify the extensions of the splint manually in Blender 3.5.1 (Blender Foundation, Amsterdam, The Netherlands), allowing the surgeon to position the extensions as preferred. Being satisfied with the design, a click on “Finalize Splint” generates the result, ready for exporting (click on “Export Final Splint”) and printing.

Intraoperative Usage of Our Splint Design

The automatically generated splint modifications were used intraoperatively in three patients undergoing bilateral sagittal split osteotomy. The splints could be positioned without technical difficulties and integrated into the standard surgical workflow.

3.2. Quantitative Proof-of-Concept Validation

After the operation, the patients underwent a conventional cone beam CT (CBCT) scan. The DICOM data were imported into IPS CaseDesigner® (KLS Martin, Tuttlingen, Germany), allowing a comparison of the 3D-planning dataset and the actual realization on the patient. For our patients, we received the following quantification of the postoperative result (Table 3):

Table 3. Difference in translation [mm] and rotation [°] of the 3D planning and the actual postoperative outcome.

		Left Condyle			Right Condyle		
		Pat. 1	Pat. 2	Pat. 3	Pat. 1	Pat. 2	Pat. 3
Translation [mm]	Right/Left	−0.9	0.6	0.4	0.5	−0.5	−1.3
	Back/Forward	−0.3	0.3	0.1	−0.7	0.3	−0.6
	Up/Down	0.6	0.3	0.8	0.4	0.5	1.2
Rotation [°]	Roll	−0.4	−2.7	−2.8	0.9	2.8	−1.4
	Pitch	−0.4	−0.6	2	−1.5	−1.6	5.4
	Yaw	1.1	−4.5	−1.5	0.2	6.6	−0.9

The automatically generated splint extensions were successfully applied in all three proof-of-concept cases without requiring redesign or interruption of the intraoperative workflow. Postoperative comparison between the virtually planned and achieved mandibular position demonstrated generally small translational and rotational deviations across all evaluated anatomical structures. Owing to the exploratory nature of the study and the limited sample size, only descriptive statistics were calculated.

To facilitate interpretation of the transformation data, the mean absolute translational magnitude and the mean absolute rotational component error were calculated for each patient (Figure 6a,b). Patient 1 showed the smallest overall deviations, with a mean translational magnitude below 1 mm and the lowest rotational error. The patient-specific analyses demonstrated variability between cases. Patient 2 exhibited the largest overall translational deviations in the condylar transformation analysis, whereas the ramus analysis showed the largest left-sided translational deviation in Patient 3. Despite these inter-patient differences, all generated splints were manufactured successfully and could be used intraoperatively without requiring additional modifications.

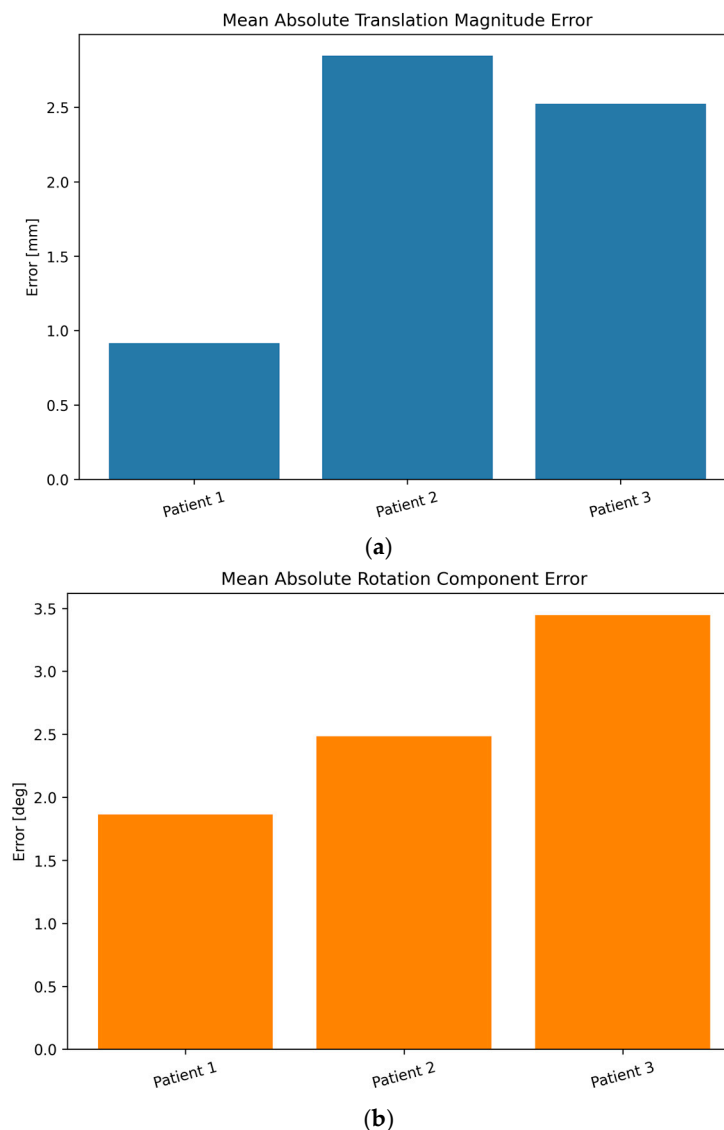


Figure 6. (a) Mean Absolute Translational Magnitude Error; (b) Mean Absolute Rotation Component Error.

Patient-specific analysis of the bilateral ramus segments demonstrated generally good agreement between the planned and postoperative positions (Figure 7), although deviations varied between patients. Euclidean translational deviations of the left ramus ranged from 0.74 to 6.31 mm, whereas those of the right ramus ranged from 1.06 to 1.76 mm. Mean absolute rotational deviations ranged from 2.22° to 6.48° for the left ramus and from 0.98° to 2.51° for the right ramus (Table 4). The largest deviations were observed for the left ramus in Patients 2 and 3, whereas Patient 1 demonstrated the smallest deviations overall.

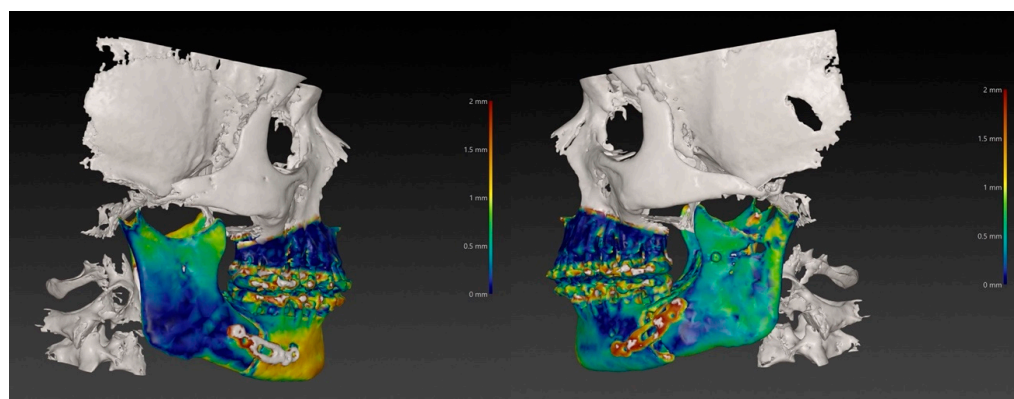


Figure 7. Illustration of the difference between 3D planning and post-operative result showing the right and left condyle. The difference is represented by a heatmap with the legend aside.

Table 4. Descriptive statistics for the left and right ramus (translation = Euclidean translation magnitude; rotation = Mean Absolute Rotation Error).

Patient	Left Ramus Translation (mm)	Right Ramus Translation (mm)	Left Ramus Rotation (°)	Right Ramus Rotation (°)
1	0.74	1.06	2.22	2.51
2	6.31	1.76	5.05	0.98
3	4.30	1.59	6.48	2.16

4. Discussion

This proof-of-concept study demonstrates the technical feasibility of an open-source Blender add-on for the automated generation of patient-specific splint extensions intended to transfer the virtually planned condylar position into the intraoperative setting. The proposed workflow automated the repetitive manual modelling steps required for splint design and enabled reproducible generation of printable splint extensions from standard stereolithography (STL) data exported by a commercial virtual surgical planning system. The software was successfully integrated into the clinical workflow in all three demonstration cases, and postoperative comparison between the planned and achieved mandibular positions demonstrated only small translational and rotational deviations. Although the present study was not designed to evaluate clinical superiority, these findings support the technical feasibility and successful clinical integration of the proposed workflow.

Accurate transfer of the virtually planned mandibular position to the operating room remains one of the major challenges in orthognathic surgery [10–12]. Numerous techniques have therefore been proposed to maintain or reproduce the planned condylar position, including mechanical condylar positioning devices, navigation-assisted procedures, and CAD/CAM-based transfer systems [13–16]. While these approaches have demonstrated satisfactory clinical performance, they frequently require dedicated hardware, additional intraoperative steps, or labour-intensive manual modification of patient-specific splints. Consequently, the design and fabrication of condyle-positioning splints remain operator-dependent and time-consuming, particularly when manual CAD modelling is required.

In contrast to these approaches, the present study focuses on automating the design process rather than introducing a new condylar positioning concept. The proposed Blender add-on generates patient-specific splint extensions directly from STL models exported by the virtual surgical planning software, thereby reducing repetitive manual modelling steps while preserving the flexibility to perform optional case-specific refinements. Because the implementation is based entirely on open-source software, the workflow is transparent,

reproducible, and can be further developed or adapted by other researchers without dependence on proprietary software development environments.

Blender was selected as the implementation platform because it combines a mature three-dimensional modelling environment with an integrated Python application programming interface, enabling rapid development of reproducible CAD workflows. In contrast to proprietary software, the complete implementation can be inspected, reproduced, modified, and extended by other researchers, thereby facilitating transparent methodological validation and collaborative development. Furthermore, the absence of licensing costs lowers the barrier for adoption in both research and clinical environments. Nevertheless, the current implementation has only been validated with Blender version 3.5.1 and STL data exported from IPS CaseDesigner®. Compatibility with other virtual surgical planning systems and future Blender releases should therefore be evaluated in subsequent studies.

The quantitative proof-of-concept evaluation demonstrated generally small translational and rotational deviations between the virtually planned and postoperative mandibular positions. Although inter-patient variability was observed, all generated splints were successfully manufactured and used intraoperatively without redesign or interruption of the surgical workflow. The observed deviations are likely to reflect the combined influence of multiple factors, including surgical execution, intraoperative condylar seating, image registration, postoperative imaging, and measurement uncertainty, rather than the automated splint-generation process alone. Although direct comparison with previously published studies is difficult because of differences in measurement protocols and condylar positioning techniques, the magnitude of the observed deviations appears to be consistent with values reported in the orthognathic surgery literature [8,9,17,18]. Because the present investigation was conceived as a technical feasibility study, these findings should be interpreted as evidence that the automated workflow can reliably generate clinically usable splint extensions rather than as proof of superior surgical accuracy.

The present study has several limitations that should be considered when interpreting the findings. First, the clinical evaluation was intentionally limited to three proof-of-concept cases. Consequently, the study was designed to demonstrate technical feasibility rather than to establish clinical effectiveness or superiority over existing workflows. Although the postoperative comparison demonstrated good agreement between the virtually planned and achieved mandibular positions, the limited sample size precludes inferential statistical analysis and does not allow conclusions regarding long-term skeletal stability or clinical outcome.

Second, the proposed workflow was evaluated using STL models generated by IPS CaseDesigner® and implemented with Blender version 3.5.1. The investigated cases were based on clinically accepted STL models that had undergone routine preprocessing when necessary to ensure mesh integrity before application of the add-on. Consequently, the robustness of the workflow against segmentation artifacts, non-manifold geometries, mesh defects, incomplete surfaces, and variations in STL export conventions was not systematically evaluated. Likewise, Boolean operation success rates under imperfect input conditions were not quantified. Although the underlying geometric operations are not inherently restricted to a specific planning platform, future studies should investigate compatibility with additional virtual surgical planning systems, define standardized preprocessing recommendations, and evaluate the tolerance of the workflow to clinically relevant mesh imperfections.

Third, the quantitative evaluation was based on translational and rotational transformation parameters provided by the planning software. Although these measurements allow objective comparison between the planned and postoperative mandibular position, additional mesh-based surface metrics, such as mean surface distance or Hausdorff distance, were not available within the current workflow. Future studies combining post-

operative surface meshes with independent mesh analysis software could provide a more comprehensive geometric validation.

An additional consideration is the mechanical performance of the manufactured splints. The present investigation focused on software development and therefore did not evaluate the influence of the added splint extensions on fracture resistance, dimensional stability after additive manufacturing, or long-term intraoperative reliability. Although all splints were successfully manufactured, disinfected, and used clinically without redesign or intraoperative complications in the three demonstration cases, systematic mechanical characterization was beyond the scope of this proof-of-concept study. Future investigations should evaluate manufacturing tolerances, dimensional deviations after printing, the influence of wall thickness and local stress concentrations at the extension–splint interface, and the effects of sterilization or disinfection procedures on the mechanical behaviour of the printed devices.

Furthermore, the present study focused exclusively on evaluating the automated software workflow. It did not include a direct comparison with manually designed splint extensions, assessment of inter-operator variability, or prospective measurement of workflow efficiency under standardized conditions. Objective workflow metrics, including total design time, number of user interactions, frequency of manual refinement, learning curves among users with different levels of experience, and standardized usability assessments, were not prospectively recorded during software development or the initial proof-of-concept application. A direct comparison between manually designed and automatically generated splint extensions within the same patient is not feasible because only one surgical splint can be used to transfer the virtual treatment plan during orthognathic surgery. Consequently, meaningful comparative evaluation requires independent patient cohorts treated using standardized protocols to account for inter-patient variability and other confounding factors. Such investigations would provide valuable information regarding workflow reproducibility, usability, inter-operator variability, and clinical performance and should therefore be incorporated into future prospective validation studies [19].

Future work should focus on validating the workflow in larger prospective cohort, evaluating compatibility with additional virtual surgical planning systems, and extending the software with further automation features. Comparative studies between automated and manually designed splint extensions, combined with standardized surface-distance analyses and workflow efficiency measurements, will further clarify the clinical value of the proposed approach.

Despite these limitations, the present study demonstrates that open-source software can successfully automate a previously manual step in the digital orthognathic surgery workflow while maintaining compatibility with established virtual surgical planning systems. Beyond the specific application presented here, the CPT add-on illustrates how open-source environments can be used to develop transparent, reproducible, and extensible tools for computer-assisted maxillofacial surgery. Similar trends toward transparent computational frameworks and reproducible algorithm development are increasingly observed across diverse scientific and engineering disciplines [20]. As digital workflows continue to evolve, such approaches may facilitate collaborative software development, improve accessibility, and accelerate the translation of new computational methods into clinical practice.

5. Conclusions

The presented open-source Blender add-on enables automated and reproducible generation of patient-specific splint extensions for condyle positioning based on virtual surgical planning data. By integrating commercial planning software with an open-source

computer-aided design environment, the proposed workflow reduces manual modelling effort while maintaining flexibility for optional case-specific refinements.

The proof-of-concept evaluation demonstrated successful integration of the software into the clinical workflow and showed good correspondence between the virtually planned and postoperative mandibular positions in three demonstration cases. These findings support the technical feasibility of the proposed approach but should not be interpreted as evidence of clinical superiority or long-term effectiveness.

As an open-source and extensible platform, the Condyle-Positioning Tool provides a reproducible foundation for further development of computer-assisted workflows in orthognathic surgery. Future studies involving larger patient cohorts, comparative evaluation against manually designed splints, standardized workflow efficiency analyses, and independent surface-based validation will further establish the clinical value and generalizability of the proposed method.

Author Contributions: S.G. and R.C.B. were the primary investigators and were involved in all aspects of the design of the CPT add-on. S.G. is the primary contributor to manuscript preparation. R.C.B. created the splint design. S.G., A.S., A.V., C.B. and N.B. were involved in manuscript preparation and splint production. V.C.S., J.M.V., S.H., U.M.-R. and A.K. were involved in manuscript preparation and correction. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: Ethics approval and consent to participate: The study was conducted in accordance with the Declaration of Helsinki for studies involving humans and approved by the Ethics Committee of the University of Würzburg (protocol code 223/20-am, 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The Blender add-on described in this manuscript is publicly available in a versioned repository (release v1.0.0) at [<https://github.com/smdg88/4paper-CPT-Addon.git> (accessed on 22 July 2026)]. Clinical imaging data (DICOM/CBCT) cannot be shared due to ethical and institutional restrictions. De-identified example STL input files and a step-by-step installation and usage guide are provided in the repository to enable reproducibility.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

API	Application Programming Interface
BSSO	Bilateral Sagittal Split Osteotomy
CBCT	Cone Beam Computed Tomography
CPT	Condyle-Positioning Tool
DICOM	Digital Imaging and Communications in Medicine
TMJ	Temporomandibular Joint

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