CHAPTER 14

SUMMARY AND CLOSING REMARK
The aim of this work was to explore the potential of innovative 3D printing applications in dentoalveolar surgery. The emphasis was principally on custom 3D printed surgical tools and implants for (guided) surgical tooth replacement. Thru the various studies the posed research aims were investigated.

In chapters 2, 3, and 4 the feasibility and accuracy of 3D printing a custom root analogous implant or tooth replica based on 3D surface models obtained from volumetric CBCT data was assessed. The results showed it to be well feasible to reconstruct 3D surface models from CBCT data as relatively accurate 3D models for custom RAIs or tooth replicas. The question subsequently arose what the biomechanical effects of custom implant designs would be on alveolar bone stress. In chapter 5 this research question was analyzed and within the limitations of the applied methodology, it was concluded that adding targeted press-fit geometry to the standard root analogue implant design, will most probably have a positive effect on stress distribution, lower concentration of bone stress and will provide a better primary stability. After gaining principal knowledge on the root analogue implant technique it was decided to perform a pilot study to evaluate the clinical implications of this approach. Chapter 6 describes and evaluates the technical and clinical implications of the custom RAI technique with a commercially available system in the first pilot cases. The RAI approach allowed for uncomplicated immediate implant placement with potential esthetical and patient comfort benefits.

On the basis of the 3D technologies for custom RAI fabrication 3D replication of teeth for autotransplantation was established. Chapters 8, 9 and 10 aimed to evaluate the use of this individual pre-operatively 3D-printed donor tooth replica during autotransplantation procedures and assess the advantages of this technique. It was concluded that the use of 3D printed analogues of the to be transplanted teeth reduces the risk of iatrogenic damage and the extra-alveolar time of the donor tooth is minimized facilitating a successful outcome.

With advancing 3D technologies and founded on the previously mentioned approaches, a method for computer-assisted template-guided custom (root) shaped osteotomy/neo-alveolotomy with custom 3D designed/printed surgical tooling was developed. In chapters 7 this method was investigated for its feasibility and accuracy for custom 3D printed implants with good results. For autotransplantation the feasibility, accuracy and clinical application was studied in chapters 11, 12 and 13. The results show that translating the full-digital planning with 3D printing to the clinical setting to be an accurate method with easy surgical handling.
CLOSING REMARK

The applied 3D technologies in this manuscript through which a pre-operatively fully digitally planned tooth replacement can be realized with 3D printing show disruptive potential to transform current day practice towards a fulsomely patient-custom approach.