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先進數據技術於顱顏面手術之發展

Advanced Image Technology in Craniomaxillofacial Surgery

時　　間：113 年 6 月 22 日(星期六) 09:00~12:00
地　　點：臺北榮民總醫院 致德樓第五會議室

09:00-09:15	***長官致詞*** ***Opening Remarks***	馬旭院長 Hsu Ma
	座長：王天祥 主任 (Tien-Hsiang Wang)	
09:15-09:45	顱顏重建的創新：透過影像引導手術模擬、客製化植入物、3D 列印和手術中成像及導航系統引領未來 Innovations in Craniofacial Reconstruction: Leading the Future Through Image-Guided Surgical Simulation, Customized Implants, 3D Printing, Intraoperative Imaging, and Navigation Systems	廖漢聰主任 Han-Tsung Liao
09:45-09:50	Q&A	
09:50-10:20	電腦輔助顱顏手術 Computer: Assisted Craniofacial Surgery	謝孟祥主任 Thomas Mon-Hsian Hsieh
10:20-10:25	Q&A	
10:25-10:40	***Coffee Break***	
	座長：石育仲 醫師 (Yu-Chung Shih)	
10:40-11:10	擴增實境於皮瓣穿通枝辨識的應用 The Use of Augmented Reality for Flap Perforator Identification	石育仲副主任 Yu-Chung Shih
11:10-11:15	Q&A	
11:15-11:45	描繪人體藍圖：擬真手術計畫的經驗 Drawing a Body Blueprint: Experience in Virtual Surgical Planning	王天祥主任 Tien-Hsiang Wang
11:45-11:50	Q&A	
11:50-12:00	***Closing Remarks***	王天祥主任 Tien-Hsiang Wang

Innovations in craniofacial reconstruction: Leading the future through image-guided surgical simulation, customized implants, 3D printing, intraoperative imaging, and navigation systems

顱顏重建的創新：透過影像引導手術模擬、客製化植入物、3D 列印和手術中成像及導航系統引領未來

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The field of craniofacial reconstruction has witnessed remarkable advancements with the integration of intraoperative imaging and navigation technologies. This talk explores the transformative impact of intraoperative 3D C-arm CT imaging and navigation systems in conjunction with other cutting-edge methodologies, including surgical simulation, customized implants, and 3D printing guidance, in the context of craniofacial reconstruction procedures.

Intraoperative 3D C-arm CT imaging offers surgeons real-time, high-resolution visualization of the surgical field, providing invaluable insights into anatomical structures and surgical progress. When combined with surgical simulation software, this imaging modality facilitates seamless integration of preoperative plans with intraoperative reality, enabling surgeons to execute complex procedures with enhanced precision and efficiency.

Intraoperative navigation systems complement the capabilities of 3D C-arm CT imaging by providing surgeons with real-time guidance and feedback during surgical procedures. By overlaying preoperative plans onto intraoperative images, navigation systems enable surgeons to navigate complex craniofacial anatomy with unparalleled accuracy, facilitating precise implant placement, bone reshaping, and soft tissue manipulation.

A pivotal component of modern craniofacial reconstruction is the utilization of customized implants. Traditional off-the-shelf implants often fail to adequately address the unique anatomical variations present in craniofacial defects, leading to suboptimal outcomes and increased risk of complications. However, with recent advancements in additive manufacturing technologies, such as 3D printing, surgeons can now fabricate patient-specific implants that precisely conform to the individual patient's anatomy. These customized implants offer superior fit, biomechanical stability, and aesthetic outcomes compared to their generic counterparts, thereby enhancing the overall success of craniofacial reconstruction procedures.

The integration of 3D printing technology into craniofacial reconstruction workflows has been transformative, offering unparalleled levels of customization and versatility. By leveraging patient-specific anatomical data, surgeons can design and fabricate intricate surgical guides and models that facilitate precise intraoperative navigation and streamline complex surgical procedures. Furthermore, the ability to rapidly iterate and customize implant designs based on patient feedback allows for iterative refinement

and optimization of surgical outcomes, ensuring the highest levels of patient satisfaction and functional restoration.

In summary, the integration of intraoperative imaging and navigation technologies with surgical simulation, customized implants, and 3D printing guidance represents a paradigm shift in craniofacial reconstruction. These synergistic approaches empower surgeons with enhanced visualization, precision, and control, leading to improved patient outcomes and satisfaction. As we continue to push the boundaries of technological innovation, the future of craniofacial reconstruction holds promise for even greater levels of surgical success and patient care.

Computer - assisted craniofacial surgery

電腦輔助顱顏手術

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Surgeries over the craniofacial region are challenging, as they pose the characters of small and well-hidden incisions - therefore limited operation field, and the exist of nearby vital structures like vessel, nerve, eyeballs and brain. Even more difficult on the occasion of congenital anomalies treatment. With the advance of the computer technology, now we can use modern medical imaging techniques to assist these challenging procedures. They include: Surgical Navigation System and CAD/CAM technology. We can use them on pre-op design and simulation, intra-op guides and assisted in implant and cutting guide fabrication. With the help of these techniques, we can perform the craniofacial procedure more precisely, efficient and safe, and the results could be more predictable and satisfactory.

The use of augmented reality for flap perforator identification

擴增實境於皮瓣穿通枝辨識的應用

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The identification of flap perforators is important for flap design and harvest. Using medical imaging to assist in precise intraoperative localization of these perforators can reduce surgical time and complications. Though computed tomography angiography (CTA) can provide perforator images and even reconstruct three-dimensional (3D) virtual models of bones and perforating vascular anatomy. However, these images are still confined to screens and cannot be directly displayed in the surgical field, relying solely on the surgeon's mental alignment. Augmented reality (AR) technology, employing computer vision alignment to overlay virtual images onto the surgical field, aids surgeons in a more intuitive interpretation of medical images.

3D virtual anatomical images are reconstructed with 3D Slicer, and the relative position between targeting and virtual images is established by Vuforia. Intraoperative flap perforators identification is done through auto-registration either by image target or model target. The flap perforators are then confirmed during flap dissection. With the reconstructed 3D virtual perforator images, augmented reality is able to locate the flap perforators on the body surface intraoperatively.

Drawing a body blueprint: Experience in virtual surgical planning

描繪人體藍圖：擬真手術計畫的經驗

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With the advancement of 3D printing and virtual surgical planning, including computer-aided design and manufacturing, plastic surgeons now have access to highly precise methods for performing surgeries. Here, we share our experiences with utilizing this technology in nasal augmentation rhinoplasty, genioplasty, and the resection of bony tumors in the zygoma. This approach provides surgeons with well-planned, customized surgical guides tailored to the specific needs and conditions of each patient. These surgical guides are highly reliable, resulting in consistently successful outcomes and reproducible procedures.