

# Short Communication: Transforming Oral & Maxillo-Facial Reconstruction: Insights into the “Jaw-in-a-Day” Procedure Ziyad S. Haidar<sup>1-6\*</sup>

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**Resumen:** Aunque el colgajo libre de peroné y la transferencia de tejido libre microvascular permiten la reconstrucción maxilofacial, la rehabilitación oral y dental puede ser muy larga. En los últimos años, los avances tecnológicos en cirugía oral y maxilofacial han revolucionado este campo, sobre todo con procedimientos como la cirugía «Jaw-in-a-Day», una evolución del colgajo vascularizado de peroné que ha sido el pilar de la reconstrucción mandibular durante décadas. De hecho, la cirugía «Jaw-in-a-Day» es cada vez más popular y supone un cambio radical en la cirugía reconstructiva cráneo-maxilo-facial. En pocas palabras, «Jaw-in-a-Day» se refiere a un procedimiento quirúrgico y protésico integral destinado a reconstruir y restaurar la mandíbula funcional de un paciente, realizado en una sola fase en el mismo día. Este enfoque innovador implica una planificación meticulosa, técnicas de imagen avanzadas y una ejecución quirúrgica precisa para restaurar tanto la forma como la función de la mandíbula en un plazo de tiempo condensado. El procedimiento suele incluir pasos como la planificación quirúrgica virtual, la prefabricación de implantes, la reconstrucción quirúrgica del hueso maxilar y la colocación inmediata de dientes o prótesis. Al agilizar el proceso quirúrgico y minimizar el periodo de recuperación, «Jaw-in-a-Day» ofrece a nuestros pacientes una vía más rápida y eficaz para la restauración mandibular contemporánea en comparación con las cirugías reconstructivas tradicionales, mejorando así la experiencia y los resultados de los pacientes

## **Palabras claves:**

Jaw-in-a-Day, cirugía oral y maxilofacial, cirugía reconstructiva, odontología, implantes dentales, implantes prefabricados, impresión 3D, CAD/CAM, medicina personalizada, calidad de vida, QoL.

**Abstract:** Although fibula free flap and microvascular free tissue transfer allow for maxillofacial reconstruction, oral and dental rehabilitation can be very lengthy. In recent years, technological advancements in oral and maxillofacial surgery have revolutionized the field, particularly with procedures such as the “Jaw-in-a-Day” surgery, an evolution from the vascularized fibular flap which has been the mainstay for mandibular reconstruction for decades. Indeed, "Jaw-in-a-Day", is becoming increasingly popular; a game-changer in cranio-maxillo-facial reconstructive surgery. Briefly, "Jaw-in-a-Day" refers to a comprehensive surgical and prosthetic procedure aimed at reconstructing and restoring the functional jaw of a patient, performed in a single stage within the same day. This innovative approach involves meticulous planning, advanced imaging techniques, and precise surgical execution to restore both the form and function of the jaw in a condensed timeframe. The procedure typically includes steps such as virtual surgical planning, pre-fabrication of implants, surgical reconstruction of the jawbone, and immediate placement of teeth or prosthetics. By streamlining the surgical process and minimizing the recovery period, “Jaw-in-a-Day” offers our patients a quicker and more efficient path to contemporary jaw restoration when compared to the traditional reconstructive surgeries, thereby enhancing patient experience and outcomes.

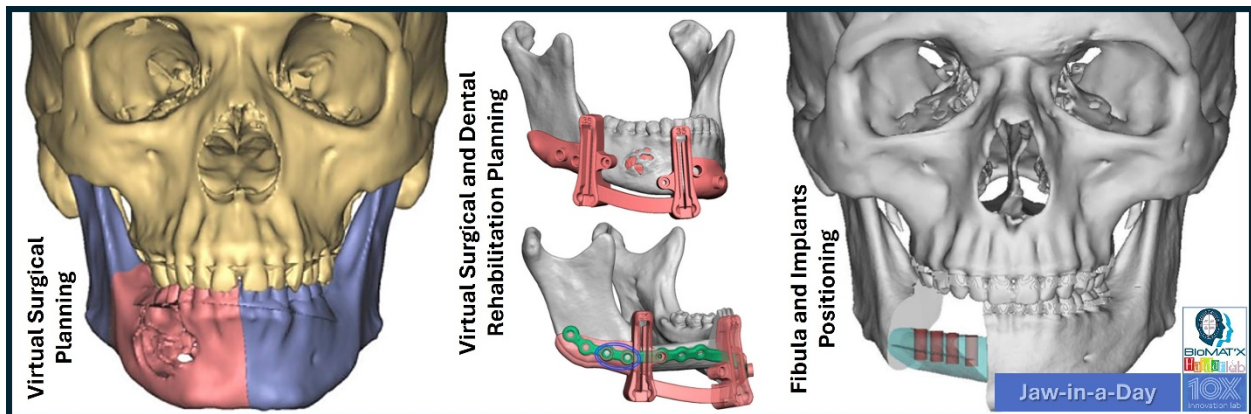
**Keywords:** Jaw-in-a-Day, oral and maxillofacial surgery, reconstructive surgery, dentistry, dental implants, pre-fabricated implants, 3D printing, CAD/CAM, personalized medicine, quality of life, QoL.

### **Pre-Fabricated Flaps to Immediately-Loaded Ti Implants to Jaw-in-a-Day for better QoL.**

The ultimate goal of jaw reconstruction is to restore facial harmony and oral function, thereby enhancing the well-being, self-confidence and Quality of Life or QoL of the patient (1, 2). Indeed, it is a complex surgical procedure aimed at restoring the form and function of the jaw following trauma, disease, or congenital abnormalities. It involves re-building bone, soft tissue, and dentition to improve aesthetics, chewing ability, and overall quality of life for patients. Various techniques, including the use of bone grafts, titanium (Ti) dental implants, and tissue flaps, are employed to achieve optimal outcomes (1). For example, microvascular free tissue transfer has been one of the greatest milestones and popular advances in maxillofacial reconstruction (of both, the mandible and maxilla) following tumor ablative surgery. Henceforth, jaw reconstruction requires careful planning, advanced surgical skills, and often collaboration between multiple medical specialties, such as oral and maxillofacial surgery, plastic surgery, and dentistry (2-4). While vascularized bone grafts (the traditional jaw replacement procedure is called “fibula free flap

surgery” where the damaged jawbone is replaced with a section of bone cut from the fibula - the outer bone in the lower leg - which can be removed without compromising the ability of the patient to walk) have been used successfully for decades, achieving predictable dental rehabilitation has been elusive (5).

Indeed, although fibula free flap reconstruction allows for immediate bony jaw reconstruction, dental rehabilitation usually requires 6 to 12 months before it is completed. And, despite many patients receiving dental implants, few achieve full restoration with teeth. Immediate loading of dental implants was uncommon, especially in non-oncologic dental practices. As dental implant surgeons became more comfortable with immediate loading in the 1990s, interest in this approach grew in jaw reconstruction. Herein, immediate loading offers advantages such as shorter rehabilitation times, fewer surgical procedures, improved soft tissue healing, and reduced negative psycho-social impact. Nonetheless, immediate Ti implant loading also faced challenges in cases involving segmental mandible defects, often due to malignancy requiring additional soft tissue reconstruction. To address this, researchers, clinicians and surgeons explored solutions using pre-fabricated fibula, scapula, and iliac crest flaps (2-4). For example, Rohner et al. (5) placed Ti dental implants in the fibula six weeks before harvesting and transferring the flap to the jaws. While pre-fabricated flaps require a two-stage operation and are limited to benign disease or secondary reconstruction due to the delay after pre-fabrication, they do offer potential solutions to soft tissue problems in select patients. Further advancements have improved the success and predictability of dental rehabilitation, enabling the complete reconstruction in a single surgery. By decreasing the number of surgeries, stages and procedures, suffering and costs are reduced. For many patients, jaw-in-a-day offers an alternate to flap surgery.



**Basics of the Jaw-in-a-Day Procedure: from tumor extirpation to full jaw reconstruction.**

The Jaw-in-a-Day procedure, as the name suggests, involves a comprehensive surgery that restores the jaw of a patient in just one day. In other words, it allows for tumor ablative removal and full jaw reconstruction (a new jaw) and dental rehabilitation (new teeth: occlusion-driven approach) in 1 surgery (6, 7). This is a significant departure from traditional procedures that could take weeks or months to achieve similar results. The complex procedure is customized to each patient's unique needs and typically involves careful planning, advanced imaging techniques, and precise surgical techniques. Hence, similar to any other new technique or approach, it is accompanied with a learning curve. Also, it is noteworthy herein that the most possible drawback of Jaw-in-a-Day is should a flap failure occur, thereby, leading to the loss of the investment in the dental implants and the custom-fabricated prosthesis. This can be prevented via careful and appropriate collaboration between the oral and maxilla-facial surgeon, the micro-vascular surgeon, the prosthodontist, and the dental laboratory technician. Step-wise, the multi-disciplinary procedure, combining concepts from ablative tumor surgery and conformist orthognathic surgery, to remove a tumor, graft new bone into the jaw, reconstruct the jaw and perform dental restoration, typically comprises of the following:

**Patient Assessment:** Before the surgery, the patient undergoes a detailed assessment, including imaging studies (CT scans, MRIs, CAT scans, 3D intra-oral scans, etc.) and dental impressions to map out the specific anatomy of their jaw. Such helps the surgical team plan the procedure accurately.

**Virtual Surgical Planning:** Using advanced imaging software, the surgical team simulates the procedure digitally, creating a 3D model of the patient's jaw. This allows them to precisely plan the surgery, including the placement of dental implants and the reconstruction of the jawbone. Models of the jaw can and are often created for reference during the procedure.

**Pre-Fabrication of Implants and Pre-assembled Prosthesis:** In some cases, the surgical guides, implants and prosthetics (that replicate the original dentition of the patient) needed for the surgery are pre-fabricated (in advance) based on the digital workflows and point-of-care 3D printing. This ensures a perfect fit and reduces the time required during the surgery. It also eliminates the previous need to postpone the surgery until the prosthesis is fabricated.

**Surgery:** On the day of the procedure, the patient undergoes the surgical reconstruction of his/her jaw. This involves removing any diseased or damaged bone, placing dental implants, and reconstructing the jawbone using the pre-fabricated implants and bone grafts. Herein, modifications of traditional fibula reconstructive techniques can be helpful to minimize traditional soft tissue and prosthetic (aesthetic and functional) challenges.

**Immediate Placement of Teeth:** In some cases, temporary teeth or prosthetics can be placed immediately after the surgery, allowing the patient to leave and return home with a fully functional jaw and smile on the same day. Today, the immediate placement of dental prostheses on immediate implants during the fibula reconstruction of the jaws can be performed with a high(er) rate of predictability.

**Recovery and Follow-Up:** After the surgery, the patient undergoes a period of recovery, typically involving pain management and follow-up appointments with the surgical team to monitor healing and ensure the success of the procedure.

It is noteworthy here in that with advances in computer-assisted surgery and patient-specific dental implants, the individual functional reconstruction of the jaw has been evolving rapidly and the prompt rehabilitation of the masticatory function and aesthetics post-jaw resection is now possible.

### **Clinical Applications of Jaw-in-a-Day Surgery: Versatility for the Maxillofacial Complex.**

The Jaw-in-a-Day procedure has a wide range of applications and benefits, making it a versatile and attractive option for patients with various oral and maxillofacial conditions (8-10). When compared to traditional approaches, patients are often less anxious with the Jaw-in-a-Day procedure. Some of the key applications and benefits include:

**Treatment of Trauma and Disease:** The procedure is often used to treat traumatic injuries to the jaw, such as fractures (trauma, accidents, etc.) or gunshot wounds. It is also effective in addressing jaw deformities caused by diseases such as osteomyelitis or osteonecrosis.

**Reconstruction after Tumor Removal:** For patients who have undergone tumor removal surgery in the jaw, the Jaw-in-a-Day procedure offers a way to reconstruct the jaw and restore function and aesthetics.

**Dental Implant Placement:** The procedure is ideal for patients who need dental implants but have insufficient bone in the jaw. By reconstructing the jawbone, the procedure provides a stable foundation for dental implants.

**Immediate Restoration of Function and Aesthetics:** One of the most significant benefits of the Jaw-in-a-Day procedure is that it allows patients to leave the surgery with a fully functional jaw and a natural-looking smile. This immediate restoration of function and aesthetics is a game-changer for many patients.

**Reduced Recovery Time:** Compared to traditional reconstructive surgeries, the Jaw-in-a-Day procedure typically involves a shorter recovery time, as it eliminates the need for multiple surgeries and prolonged healing periods.

**Improved Patient Experience:** The combination of advanced planning, pre-fabrication of implants, and immediate restoration of function and aesthetics makes the Jaw-in-a-Day procedure a more precise, comfortable, convenient, and less-costly option for patients, where they can leave the hospital with fully functional jaw and dentition, rather than waiting 6-12 months to receive implants.

### **Current Challenges and Critical Considerations with/for Contemporary “Jaw-in-a-Day”.**

Although the Jaw-in-a-Day procedure presents numerous advantages, it is also accompanied by several certain challenges and factors to take into account (11, 12). Noteworthy among these are:

**Surgical Expertise:** The procedure requires a highly skilled and experienced surgical team, including oral and maxillofacial surgeons, prosthodontists, and dental laboratory technicians.

**Patient Selection:** Not all patients are suitable candidates for the Jaw-in-a-Day procedure. Factors such as the extent of jaw damage, overall health, and bone quality need to be carefully considered.

**Cost:** The Jaw-in-a-Day procedure can be more expensive than traditional reconstructive surgeries due to the advanced technology and expertise involved and required for its execution and success.

**Long-Term Outcomes:** While the immediate results of the procedure are impressive, long-term outcomes, such as the durability of implants and bone grafts, need to be monitored and evaluated over time.

**Patient Expectations:** It is essential for patients to have realistic expectations about the procedure, including the recovery process and potential complications. Henceforth, patient education is vital.

Whilst Jaw-in-a-Day is employed to treat large benign and cancerous tumors of the upper and/or lower jaw, it is noteworthy to emphasize that, today, soft tissue management biomaterials and strategies (to restore the distorted facial and jaw features), implant survival rates (with immediate loading in fibulas), and outcomes in malignant cancer (ossifying fibromas, for example) and irradiated patients are topics of ongoing investigation in institutions and hospitals around the World.

### **Closing Remarks**

The principal difficulties in jaw reconstruction stem from the need to replace and reconstruct multiple tissues and elements, including bone, surrounding soft tissues, and functional dentition. The Jaw-in-a-Day procedure is a groundbreaking innovation that is transforming the field of oral and maxillo-facial reconstruction. Indeed, it represents the cutting edge of oral and maxillo-facial surgery, and its future is promising. Its immediate restoration of function and aesthetics, reduced recovery time, and improved patient experience make it a game-changer for patients with various oral and maxillo-facial conditions. Advances in imaging technology, virtual surgical planning for soft tissue reconstruction, surgical techniques, materials science, the in-house design and 3D printing of dental and facial prostheses, augmented/mixed reality, artificial intelligence, bio-engineering, and regeneration/rehabilitation of the stomatognathic system will continue to improve the efficacy and accessibility of the practise to further improve and positively-impact the quality of life of our patients. Indeed, advances in biomaterials and pharmaceutical science(s), achieved at our BioMAT'X I+D+I (HAiDAR R&D&I) laboratory and research group at the CiiB of the Universidad de los Andes, have led to the design, development, characterization, fine-tuning and evaluation of biocompatible and biodegradable materials that can be used in simple and complex oro-dental and cranio-maxillo-facial reconstruction procedures, and beyond. These materials have been demonstrated to promote tissue integration and regeneration, reduce the risk of infection, and eliminate the need for implant removal surgeries, thereby, and upon successful translation from the laboratory benchtop to the clinic bed-/chair-side, would potentially further improve patient outcomes, predictability and QoL.

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