

Maxillo-mandibular Reconstruction with Vascularized Bone Flaps Using Insourced Virtual Surgical Planning And Home-Made CAD-CAM: A 5-year Single-Center Evolution In 75 Patients.

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Introduction

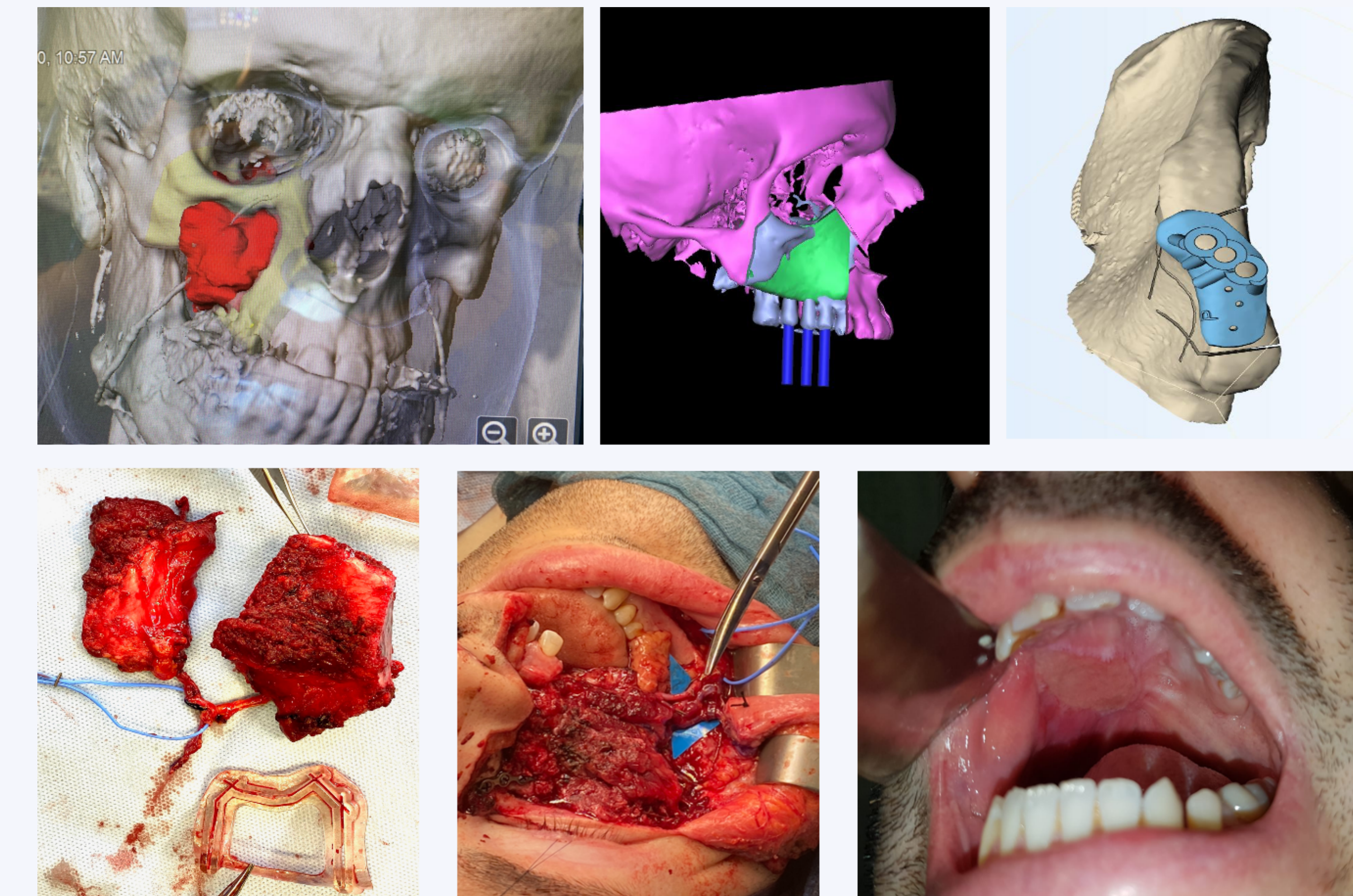
Virtual surgical planning (VSP) and computer aided design (CAD) and manufacturing (CAM) of surgical guides and jigs turned craftsmanship into precision and enables the surgeon to complement the donor bone osteotomies with the bony resection of the jaw. In recent years, immediate dental rehabilitation became an integral part of VSP. However, outsourced CAD-CAM is expensive and may be no option to many institutions worldwide. We have developed an insourced facility for 'in-house' VSP and accelerated 'home-made' 3D printing of models, jigs and guides.

Results

- The 3-year survival rates were 65.9% (non CAD-CAM) & 68.1% (CAD-CAM) ($p > 0.05$).
- Total operative time for osteocutaneous fibula reconstructions between both groups averaged 641 minutes in non CAD-CAM (n=53) vs. 554 minutes in CAD-CAM cases (n=44) ($p=0.004$).
- The maxillofacial reconstructive surgical procedures offered optimal compliance to the initially planned CAD-CAM (*Ma H et al. 2021 Front. Oncol.*)

Variable	Statistic	Non CAD-CAM	CAD-CAM
Age (years)	N	82	75
	Mean	56.47	57.30
Indication			
SPINOCELLULAR CARCINOMA	n/N (%)	41/82 (50.00%)	33/75 (44.00%)
OTHER MALIGNANT NEOPLASM	n/N (%)	14/82 (17.07%)	10/75 (13.33%)
BENIGN NEOPLASM	n/N (%)	2/82 (2.44%)	5/75 (6.67%)
OSTEORADIONECROSIS	n/N (%)	18/82 (21.95%)	17/75 (22.67%)
OTHER	n/N (%)	7/82 (8.54%)	10/75 (13.33%)
Receptor bone			
MANDIBLE	n/N (%)	71/82 (86.59%)	63/75 (84.00%)
MAXILLA	n/N (%)	11/82 (13.41%)	12/75 (16.00%)
Flap type			
FREE OSTEO-CUTANEOUS FIBULA	n/N (%)	77/82 (93.90%)	58/75 (77.33%)
ILIAC CREST BONE FREE FLAP	n/N (%)	3/82 (3.65%)	13/75 (17.33%)
SCAPULAR ANGLE FREE FLAP	n/N (%)	2/82 (2.44%)	4/75 (5.33%)

		Unweighted		Weighted	
		non CAD-CAM	CAD-CAM	non CAD-CAM	CAD-CAM
TOTAL FLAP FAILURE	No	76 (92.7%)	70 (93.3%)	77.5 (94.5%)	71.3 (95.0%)
	Yes	6 (7.3%)	5 (6.7%)	4.5 (5.5%)	3.7 (5.0%)
	P-value	0.87		0.88	
SKIN ISLAND FAILURE	No	72 (87.8%)	66 (88.0%)	71.6 (87.4%)	63.0 (84.0%)
	Yes	10 (12.2%)	9 (12.0%)	10.4 (12.6%)	12.0 (16.0%)
	P-value	0.97		0.70	



Iliac crest bone flap for maxillary reconstruction with intra-oral anastomosis. The blue rods indicate the position of osteo-integrated implants (row 1-2).

Scapular angle flap for maxillary reconstruction with placement of osteo-integrated implants (row 3).

Mandibular reconstruction with an osteo-cutaneous fibula flap using insourced 3D printed models, jigs and guides (row 4).

Methods

We present a consecutive series of 157 cases (2007-2020). In 75 cases (2015-2020) we have used insourced VSP and CAD-CAM for the reconstruction of maxillo-mandibular defects with fibula, iliac crest and scapular angle flaps. Relevant parameters influencing the reconstructive outcome were determined. We have compared these data with 82 previous reconstructions without CAD-CAM (2007-2014). Mann-Whitney U tests and Fisher's exact tests were used to compare continuous and binary variables between both groups.

Conclusions

- In-house VSP and CAD-CAM have evolved into valuable strategies in maxillo-mandibular reconstruction that shorten total operative time, promote precision and allow for occlusion-based planning with quality of life, aesthetic outcome and minimizing donor site morbidity as essential parts of the reconstruction even in high level oral cancers.
- This occlusion-driven bony reconstruction has evolved in a 'jaw-in-a-day' approach with a further focus on esthetic outcome with minimal scars and intra-oral anastomosis.
- The establishment of a 3D core facility in our Institution with a multidisciplinary 'shared' 3D printer and equipped with VSP Software allows to self-print the required models and guides in-house to decrease the cost and accelerate implementation.
- Patient-specific reconstruction plates are the missing link in our insourced CAD-CAM strategies.

