BACK TO BASICS:
The Reconstructive Ladder

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Complex bone and soft tissue defects present the surgeon with myriad potential reconstructive approaches. The reconstructive ladder, a classic plastic surgery teaching, assists the surgeon in selecting an option, by suggesting the easiest approach that will satisfy the demands of the patient. The reconstructive ladder has been heavily critiqued over the years because it does not take into account the following two important considerations:

1) Sometimes the best method to reconstruct a defect may be the most complex method on the ladder. For example, in breast reconstruction, the easiest method would be simple closure of the mastectomy flaps, yet many surgeons do complex implant-based fat grafting or construct perforator flaps, which are really not part of the ladder.
2) Use of new technologies, such as negative pressure wound therapy, cell-based therapies, and soft tissue scaffolds can very often allow the surgeon to use a simpler rung of the reconstructive ladder.

A hypothetical reconstructive case can illustrate use of the reconstructive ladder: a 47-year-old female has sustained a scalp injury, which leaves a 2.0 cm x 2.0 cm defect with exposed bone. How should the surgeon attempt to close this defect? The surgeon would review the various options on each rung of the ladder, listing the pros and cons of each approach (Table 1), and, in consultation with the patient, determine and implement the decision that made the most sense.

The surgeon could also consider new technologies and options outside the reconstructive ladder (Table 2). Although these

Closure Method	Pros	Cons
Secondary Intention	Simple, easy to do	May take long time to close May not heal over bone Possibility of bone infection
Skin Graft	Reasonably simple	Graft may not take over exposed bone Creates scar at donor site
Local Flap	Reasonably simple	Creates additional scars on scalp May require skin graft to cover transposition site
Regional Flap	Would not sacrifice additional scalp	Complex operation Will leave a substantial donor site scar
Free Flap	Would not sacrifice additional scalp	Very complex operation Will likely end up thicker than desired Likely donor site morbidity

Table 1. Potential Options for 2 cm x 2 cm Scalp Defect with Exposed Bone.

Technological Advance	Pros	Cons
Tissue Expansion	Minimize areas of alopecia	Risk of infection or extrusion
Negative Pressure Wound Therapy	May allow simpler surgical solution, such as skin graft	Likely requires burring outer table down to diploic space (may extend healing time) Requires protection of intact bone with single nonadherent layer
Bilayer Dermal Regeneration Template	Reasonably simple approach Minimize donor site morbidity	Requires burring down to diploic space Takes longer for closure May require skin graft Risk of infection

Table 2. Technologies That Could Alter Reconstructive Ladder Choices

technologies lengthen the time to definitive closure of the wound, they have the potential to improve the donor site, simplify the reconstructive approach, or achieve a better functional result.

The expertise of the surgeon and the setting of care delivery also influence selection of the reconstructive method. Advanced technologies may not be available in all hospitals. In this situation, the reconstructive ladder provides an outstanding paradigm. In addition, a skilled surgeon with expertise in microsurgery or complex procedures, such as tissue expansion, may not be readily available in all settings. Even when these providers are available, wide variation in their experience guides selection of a surgeon for a specific patient. For example, some centers in the United States have considerable experience with either implant- or perforator flap-based breast reconstruction. Therefore, a woman's selection of a surgery center strongly influences the type of reconstruction she is likely to receive.

Clearly, more data are needed to help medical practitioners and surgeons determine the optimal procedure or technology for a given patient. Prospective randomized clinical trials have been considered the gold standard to assist in making these difficult decisions, but they are difficult to perform to assess complex surgical procedures, due to the variation in surgical technique. Often, trials do not accurately reflect clinical practice as they exclude many patients who require treatment. Registry-based data collection systems may offer better real-life information to help guide selection of surgical procedures and technologies and may facilitate generation of data on the cost and value of different procedures.

In summary, the reconstructive ladder is a useful paradigm to help surgeons work through a variety of options for patients requiring reconstruction. Modifications to this ladder to include new technologies and the capacity of specific care settings could also be quite useful.

Reference:
Erba P, Ogawa R, Vyas R, Orgill DP. The reconstructive matrix: a new paradigm in reconstructive plastic surgery. Plast Reconstr Surg. 2010;126(2):492-8.