

# T-Stat Monitoring in Head & Neck Free Flap Reconstruction

## Overview of Head & Neck Free Flap Reconstruction

Head and neck surgeons, especially those specializing in otolaryngology, frequently perform free flap reconstructions to repair defects that result from tumor resections. These procedures are notably long and complex, carry a high risk, and are often performed in areas previously exposed to radiation. This prior radiation exposure increases the challenge and risk of successful reconstruction.

## Common Types of Free Flaps Used in Head & Neck Reconstruction

- Radial Forearm Free Flap (RFFF): Primarily used for repairing defects of the tongue, floor of the mouth, and pharynx.
- Fibula Free Flap: Commonly selected for mandibular reconstruction.
- Anterolateral Thigh (ALT) Flap: Suitable for larger soft-tissue defects, including those affecting the face, neck, and pharynx.
- Scapular/Parascapular Flap: Preferred for three-dimensional reconstruction in the facial or oropharyngeal region.
- Jejunal Free Flap (less common): Historically used for circumferential pharyngeal reconstruction.

## Clinical Outcomes and Failure Rates

Flap survival rates in head and neck free flap reconstruction typically range from 90% to 95%. Failures, which occur in 5% to 10% of cases, most often result from venous thrombosis. Venous issues account for approximately 60% to 70% of flap failures and usually arise within the first 48 hours after surgery. The time window for successful flap salvage is quite narrow; early detection - ideally within four to six hours of compromised blood flow - is critical. The likelihood of successful intervention drops significantly if this window is missed.

## Common Points of Failure in Head & Neck Flaps

- Venous congestion at the anastomosis site or caused by kinking of neck vessels.
- Arterial inflow issues are less common but can be catastrophic if not promptly identified.
- Radiated beds increase complexity and pose a higher risk for microvascular compromise.
- Thin flaps (such as radial forearm and ALT flaps) are particularly prone to ischemia, which may not be clinically apparent until late in the process.

## Limitations of Doppler Monitoring in ENT Free Flap Cases

***“An arterial Doppler signal will persist for several hours after venous thrombosis.”***

- High False Positive Rate (20–25%): Doppler may indicate a loss of signal even when the flap remains viable.
- False Negatives (10–15%): A Doppler signal might still be detected even if the flap is already compromised.
- Probe Displacement: This is particularly common in intraoral flaps due to swelling or patient movement.
- Intermittent Checks: Monitoring is generally performed every one to two hours, which allows time for problems to develop between assessments.
- Subjective Interpretation: Doppler results depend heavily on the training and experience of the clinical staff.
- Poor Visualization: Intraoral flaps are difficult to assess.

## The Value of T-Stat Monitoring

- Continuous Monitoring: T-Stat delivers real-time data, eliminating the gaps between traditional nurse checks.
- Capillary-Level StO<sub>2</sub>% Measurement (1–2 mm): Provides accurate information about tissue oxygenation, rather than relying solely on the sound of blood flow.
- Arterial vs. Venous Distinction.
- Intraoral Application: The sensor can be sutured directly onto the surface of the flap, allowing for more reliable monitoring.
- Objective, Reproducible Data: This reduces false alarms and variability, making the monitoring process more consistent and actionable.

## Sales Positioning Points

- Free flaps in ENT most commonly fail due to venous congestion. T-Stat provides the most reliable method for early detection of venous compromise.
- Unlike breast flaps, ENT flaps are dynamically complex and often situated in radiated tissue beds, making Doppler monitoring unreliable. T-Stat excels in these challenging environments.
- Surgeons desire fewer false alarms, (especially after long and complicated cases) while nurses prefer less subjective assessments. T-Stat addresses both needs by offering continuous, objective monitoring.

- Continuous and objective monitoring with T-Stat reduces ICU workload and improves flap salvage rates.

## Breast vs. Head & Neck Free Flaps: Key Differences

Breast free flaps, such as DIEP, TRAM, MS-TRAM, or SIEA, are typically harvested from healthy donor sites and transplanted into generally healthy recipient beds. These flaps are thicker and easier to visualize.

In contrast, head and neck free flaps - often involving the radial forearm, fibula, anterolateral thigh, scapular/parascapular, or jejunal tissue - are placed into radiated, scarred, or vessel-depleted fields. Many of these flaps are thin, intraoral, or buried, making visual assessment difficult. Venous thrombosis is the leading cause of failure, and complications can develop and progress rapidly.

Doppler monitoring is especially problematic in head and neck cases. Intraoral flaps are susceptible to probe displacement due to swelling or patient movement. Even when the probe is correctly positioned, Doppler signals can offer false reassurance or trigger unnecessary alarms. Nurses might only check flaps intermittently, and interpretation remains subjective.

T-Stat provides significant advantages in these challenging scenarios. By suturing the sensor directly to the flap, both surgeons and nursing staff receive continuous, objective StO<sub>2</sub>% readings at the capillary level. This approach removes gaps in monitoring, reduces false positives and negatives, and allows for reliable assessment of intraoral and complex flaps.

