Journal of Plastic, Reconstructive & Aesthetic Surgery (2015) 68, 1025—1035

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

REVIEW

A systematic review on the sensory reinnervation of free flaps for tongue reconstruction: Does improved sensibility imply functional benefits?

Martijn Baas [a], Liron S. Duraku [a], Eveline M.L. Corten, Marc A.M. Mureau*

Department of Plastic and Reconstructive Surgery, Erasmus MC Cancer Institute, University Medical Centre Rotterdam, Rotterdam, The Netherlands

Received 29 December 2014; accepted 27 April 2015

KEYWORDS
Tongue reconstruction;
Free flaps;
Nerve reinnervation;
Sensory recovery

Summary *Background:* Tongue reconstruction after (hemi)glossectomy including sensory recovery is challenging. Although sensory recovery could improve functional outcome, no consensus on the need for reinnervation of the neo-tongue exists. Therefore, a systematic review was performed to determine if sensory reinnervation of free flaps in tongue reconstruction is better than no sensory reinnervation. The secondary study aim was to assess the effect of sensory reinnervation on overall functional outcome, such as speech and deglutition.
Methods: Seven databases (Embase, Medline, Web of Science, Scopus, PubMed publisher, Cochrane, and Google Scholar) were searched. Studies that reported the effect of sensory reinnervation on overall functional outcome were identified.
Results: Fourteen articles were included in the systematic review, concerning a total of 271 tongue reconstructions. Free flaps that were used were the radial forearm (RF) flap (n = 137), the anterolateral thigh (ALT) flap (n = 65), the rectus abdominis (RA) flap (n = 20), and the tensor fascia latae (TFL) flap (n = 5). Seven out of seven articles directly comparing sensory reinnervation with no sensory reinnervation revealed superior sensibility in the reinnervated group. Moreover, the innervated RF and ALT flaps showed superior recovery of sensibility compared to other flaps used for the reconstruction of hemiglossectomy as well as total glossectomy defects. There are indications that sensory reinnervation may have a beneficial effect on overall tongue function. Age, smoking, and sex did not affect sensory recovery. Four out of five articles showed that postoperative radiotherapy does not have a long-term adverse effect on sensory recovery.

* Corresponding author. Department of Plastic and Reconstructive Surgery, Erasmus MC Cancer Institute, University Medical Centre Rotterdam, PO Box 2040, 3000 CA Rotterdam, The Netherlands.
E-mail address: m.mureau@erasmusmc.nl (M.A.M. Mureau).
[a] Both authors contributed equally to this article.

http://dx.doi.org/10.1016/j.bjps.2015.04.020

Conclusions: Sensory reinnervation of free flaps in the reconstruction of (hemi)glossectomy defects improves sensory recovery; however, evidence for beneficial effects on function is poor.

Introduction

The tongue is an important muscle, with numerous functions, such as articulation, deglutition, and taste. Impairment of tongue function can severely affect quality of life.[1] Therefore, it is paramount to restore the tongue's main function after oncologic (hemi)glossectomy. Because of its complex anatomy, it is challenging to restore bulk, mobility, and sensibility in order for the reconstructed tongue to be functional.

Because of advances in microvascular tissue transfer, various free flaps for tongue reconstruction are available.[2] Small defects can usually be closed primarily with good function.[3,4] After hemiglossectomy, the appropriate reconstruction of choice includes a thin fasciocutaneous flap such as the radial forearm (RF) flap or a thin anterolateral thigh (ALT) flap. However, larger defects need more bulk to restore deglutition and articulation. In these situations, thicker fasciocutaneous or musculocutaneous flaps such as the ALT and rectus abdominis (RA) flap may be indicated.[3,4]

Interestingly, sensory recovery is a factor that is often neglected in the reconstructive algorithm,[5–7] whereas it is supposed to be an essential factor for the proper function of the tongue. Previous articles showed that sensory reinnervation of free flaps in tongue reconstruction may have an advantage in the recovery of articulation, deglutition, sensibility, and even quality of life.[8–10] However, still no consensus exists on the need for reinnervation of the neotongue. Therefore, a systematic review was performed to determine the advantages and reasons for sensory reinnervation of free flaps in tongue reconstruction.

The primary research question of this review was whether sensory reinnervation of free flaps in tongue reconstruction leads to better sensibility of the neo-tongue compared with no sensory reinnervation. In addition, the effect of recipient nerves and factors such as age, tobacco use, sex, and radiation history on the return of sensibility was investigated.

The secondary study question was whether the improved sensibility of free flaps also implies improved functional outcome of the reconstruction, such as speech and deglutition.

Methods

The search strings that were used to search in seven different databases (Embase, Medline (OvidSP), Web of Science, Scopus, PubMed publisher, Cochrane, and Google Scholar) are listed in Appendix 3. A combination of search criteria was used to identify all articles concerning oncological tongue as well as intraoral reconstructions with either innervated or non-innervated free flap. The initial search was performed on April 2014, and it was monitored during the review progress. Subsequently, two reviewers (M.B. and L.S.D.) performed a manual secondary selection based on the following inclusion criteria for our primary and secondary outcome measures. Eligibility criteria were formulated to select articles with comparable, preferably standardized, measures of reinnervation. The criteria for eligibility were as follows:

- Only original articles studying patients (no reviews) and written in English were included
- At least one of the study groups consisted of tongue reconstructions
- Tongue reconstructions were performed with free flaps only
- Articles had to contain objective sensory testing modalities
- Only articles with a design classification of levels I–V were included, as classified by Jovell and Navarro-Rubio (Table 1).

Bias was assessed using the Cochrane tool for assessing the risk of bias, addressing sequence generation, allocation, blinding, incomplete outcome data, selective outcome reporting as well as other sources of bias.[11]

Table 1 Classification of strength of evidence by Jovell and Narvarro-Rubio.

Level	Strength of evidence	Type of study design
I	Good	Meta-analysis of randomized controlled trials
II		Large-sample randomized controlled trials ($N > 25$ for each group)
III	Good to fair	Small-sample randomized controlled trials ($N < 25$ for each group)
IV		Non-randomized controlled prospective trials
V		Non-randomized controlled retrospective trials
VI	Fair	Cohort studies
VII		Case–control studies
VIII	Poor	Noncontrolled clinical series; descriptive studies
IX		Anecdotes or case reports