Short Communication

Transoral reconstruction of oropharyngeal tumors. The Hospital Clínic algorithm ☆

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A R T I C L E   I N F O

A B S T R A C T

Transoral approaches to the oropharynx have evolved rapidly in the past years. The development of technical instruments such as specific oropharyngeal retractors, 2D and 3D endoscopic systems, robotic platforms, and a combination of energies, has facilitated transoral resection and bleeding control. This new scenario has raised the need for new reconstructive alternatives after resection to achieve adequate oncologic and functional outcomes.

The purpose of this work is to provide a guiding algorithm to plan the transoral resection and reconstruction of oropharyngeal tumors, based on the known anatomical landmarks that determine functionality after surgery.

The Hospital Clínic transoral resection and reconstruction classification of the oropharynx (HC-TRR oropharynx) is based on the size and location of the defect after the surgery and considers the scenario of salvage surgery after radiotherapy failure. The reconstructive algorithm is adapted to the concept of a reconstructive ladder

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☆ Clinical question/level of evidence: Therapeutic, V.
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and represents a non-dogmatic and flexible vision that may facilitate clinical decision making.

Introduction

Primary chemoradiation therapy (CRT) and surgery with or without adjuvant CRT are competing therapeutic approaches for oropharyngeal tumors with similar oncologic outcomes. Both treatments may also result in significant functional impairments such as severe dysphagia and feeding-tube dependence.

In the past, transoral resection of oropharyngeal tumors was mainly limited by the difficulties of exposure and by the bleeding risk of the area. More recently, the development of technical instruments such as specific oropharyngeal retractors, 2D and 3D endoscopic systems coupled with different robotic platforms and a combination of energies, have allowed us to improve the exposure, facilitate the resection, and control more easily the intraoperative bleeding. Because of that, the transoral approach to the oropharynx is considered a standard treatment for selected cases and has been included in the international guidelines of head neck cancer treatment.[1]

The transoral approach implies a paradigm shift in surgical anatomic landmarks and in reconstructive needs, but has, in theory, many advantages for the patient. Different publications have highlighted the reduced number of complications, reduced hospital stay and better postoperative function when transoral surgery is compared with the classical approaches.[2] It is true, however, that for extended resections that go beyond a radical tonsillectomy, the patient still faces a risk in terms of oncological safety and swallowing and phonation recovery. For this reason, there is a need to systematize the oropharyngeal elements that can be resected without relevant postoperative functional limitations and, when this is not the case, propose the type of reconstruction needed to make an oncologic and functional sound resection.

Smith et al.[3] reported that the main reasons for reconstruction after oropharyngeal resection were: (1) to avoid nasopharyngeal stenosis, (2) to avoid palatal insufficiency, (3) to avoid the presence of a pharyngocutaneous fistula, (4) to prevent neck infection, (5) to reduce the risk of haemorrhage, (6) to prevent aspiration pneumonia and (7) to achieve a correct swallow without difficulties in speech articulation. Thus, the principles of oropharynx reconstruction should consider 4 main aspects:

- To maintain a velopharyngeal sphincter to prevent velopharyngeal insufficiency.
- To restore bulk in the tongue base to facilitate deglutition, speech articulation and prevent aspiration.
- To maintain separation between the cervical and pharyngeal components.
- To cover exposed vessels in the pharynx.

From these principles and applying the classic concept of the reconstructive ladder,[4,5] which includes five levels from the least to more invasive (secondary healing, use of biomaterials, local flaps, regional flaps and free flaps), we have elaborated our Hospital Clínic treatment algorithm. Recommendations are made according to the extent and the depth of the defect along with the antecedent of previous radiotherapy.

The first step in the algorithm would be secondary healing with or without the use of biomaterials. The main advantage would be the simplicity of the procedure and the possibility to maintain the sensitivity of the area. In case of greater reconstructive requirements, a high number of procedures and variants could be considered (from local to free flaps).
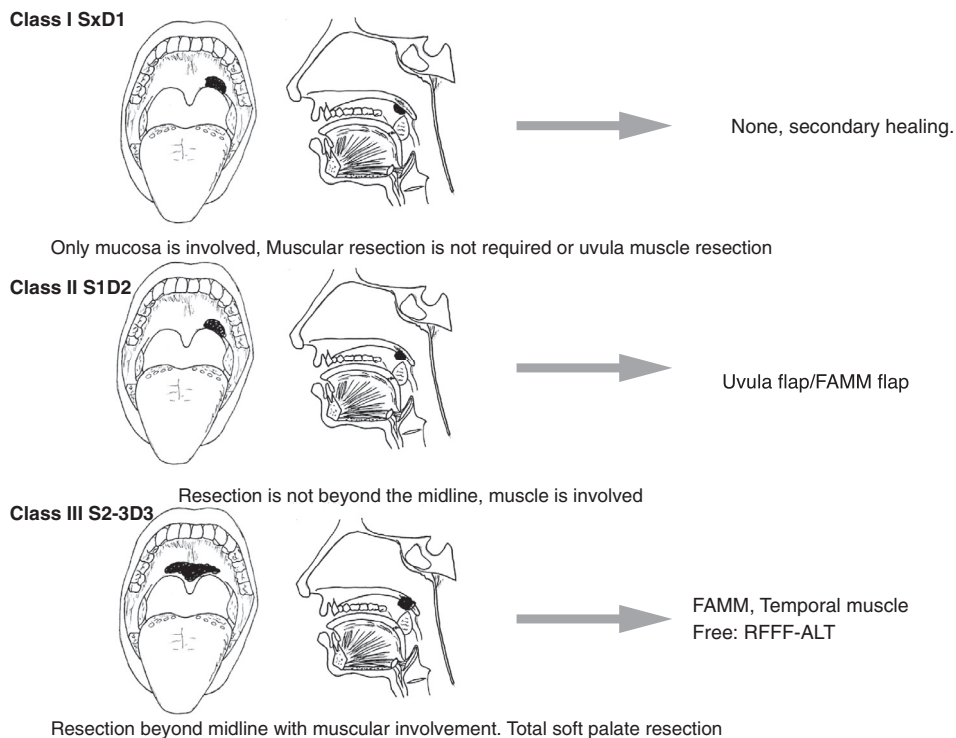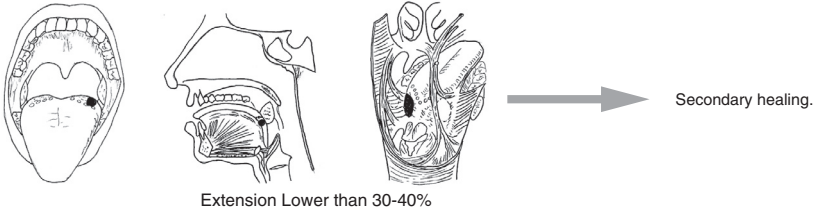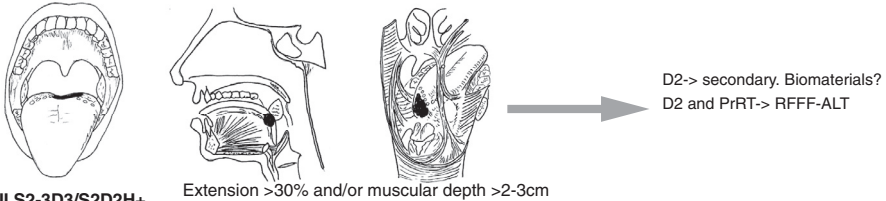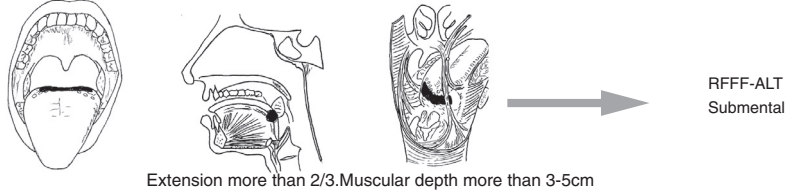
Figure 1. Overview of palatal defects approach.
Sx: Any superficial extension
S1: Superficial extension less than one third
S2: Superficial extension between one to two thirds
D1: no muscular resection
D2: muscular resection < 2cm
D3: muscular resection < 2cm
RFFF: Radial forearm free flap
ALT: Anterolateral thigh free flap

So far, there is not enough evidence in the literature[2,3,6,7] to reliably support one over the other. The main limitations are: 1) lack of well-designed studies on the need for reconstruction, 2) transorality mixed with open surgery, 3) lack of function assessment in the majority of the studies, 4) lack of objective functional measures, 5) non comparable groups. Moreover, from the functional point of view, the impact of resection and/or reconstruction on the functional outcomes is crucial. The majority of publications describe the most used flaps by each surgeon with a lack of functionality assessment in those treated transorally (with or without robotic assistance). However, De Almeida et al.[8] published an outstanding study with its experience and systematized reconstruction in transoral approaches.

Different works have been published systematizing the anatomic inside-outside hallmarks of the oropharynx,[9,10] and we have taken them into account for our classification. This has been of paramount importance to avoid complications and achieve oncologic sound resections.

In the present publication we propose the Transoral Resection and Reconstruction classification with the therapeutic algorithm that we use in the Hospital Clínic of Barcelona (HC-TORR). Our classification considers three different subsites in the oropharynx (the base of the tongue, the lateral wall and the soft palate), together with the superficial extension in every subsite, the depth of resection, the antecedent of previous radiotherapy and the different reconstructive options. It does not pretend

Class I S1D1

Extension Lower than 30-40%

Secondary healing.

Class II S2D2

Extension >30% and/or muscular depth >2-3cm

D2-> secondary. Biomaterials?
D2 and PrRT-> RFFF-ALT

Class III S2-3D3/S2D2H+

Extension more than 2/3.Muscular depth more than 3-5cm

RFFF-ALT
Submental

Figure 2. Overview of the base of the tongue defects approach.
S1: Superficial extension less than one third
S2: Superficial extension between one to two thirds
S3: Superficial extension more than two thirds
D1: no muscular resection
D2: Extension >30% and/or muscular depth >3cm
D3: Extension more than 2/3. Muscular depth more than 2–3 cm
PrRT: Previous radiotherapy
H+: Hypoglossal nerve affection
RFFF: Radial forearm free flap
ALT: Anterolateral thigh free flap

to be a rigid protocol, but quite the opposite, it is open to all modifications that each group may adopt according to individual needs and availability of technical resources.

Defect and reconstructive algorithms
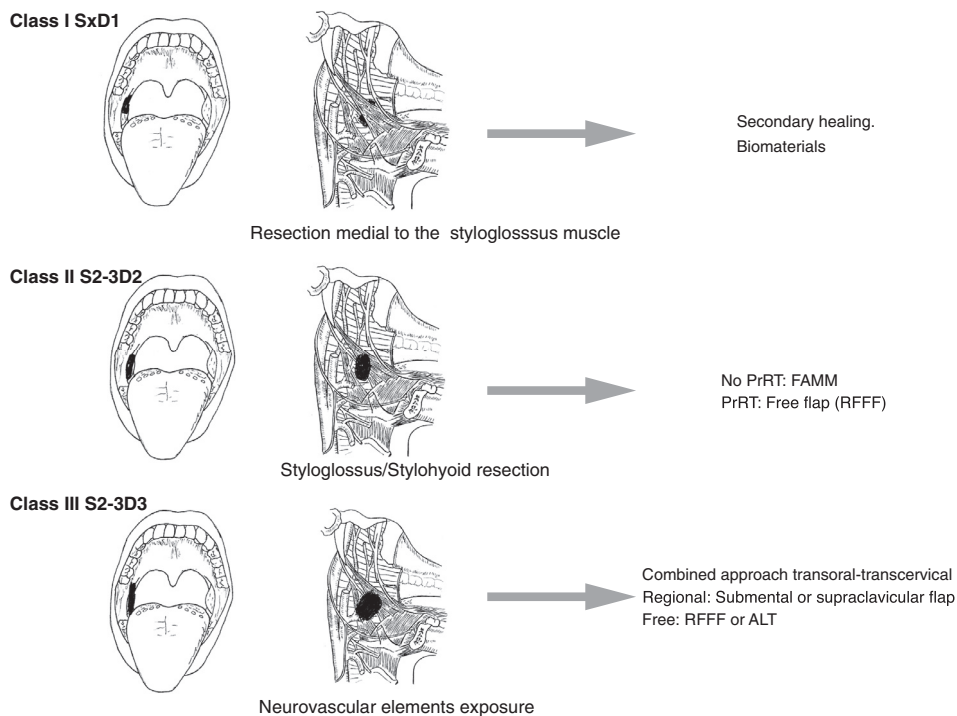
We must consider three aspects:

(1) Extension on the surface of the lesion (S)
(2) Depth of resection (D)
(3) Previous Radiotherapy (PrR)

Soft palate (Figure 1)

Class I: superficial lesions irrespective to the extension. Secondary healing is the recommended option.
Class II: lesions with muscular resection that do not go beyond the midline. In these cases, a local flap is recommended.

Class I SxD1

Resection medial to the styloglosssus muscle

Secondary healing.
Biomaterials

Class II S2-3D2

Styloglossus/Stylohyoid resection

No PrRT: FAMM
PrRT: Free flap (RFFF)

Class III S2-3D3

Neurovascular elements exposure

Combined approach transoral-transcervical
Regional: Submental or supraclavicular flap
Free: RFFF or ALT

Figure 3. Overview of lateral oropharyngeal wall defects approach.
Sx: Any superficial extension
S1: Superficial extension less than one third
S2: Superficial extension between one to two thirds
D1: Medial to styloglossus muscle
D2: Between styloid muscles and parapharyngeal fat. Styloglossus/Stylohyoid resection
D3: Neurovascular elements exposure
PrRT: Previous radiotherapy
RFFF: Radial forearm free flap
ALT: Anterolateral thigh free flap

Class III: cases with muscular resection, which exceed the midline. Reconstruction is necessary to avoid velopharyngeal insufficiency (from a palatal island to a radial flap or anterolateral tight flap (ALT), depending on the surgeon's experience and patient characteristics).

Base of tongue (Figure 2)

In this location, the volume of the resection will determine the deglutition problem, therefore we must consider this aspect when planning the reconstruction.

Class I: the extension of the defect is less than a 30–40% and affects lingual tonsil or invades less than a 2 cm deep. Secondary healing is recommended.

Class II: Extension over 40% or beyond midline with involvement of musculature over 2 cm deep. Type of reconstruction will depend on the depth of the defect and prior treatment. Without previous treatment: secondary healing or biomaterials. With previous radiotherapy: consider free flaps.

Class III: in wide lesions with high invasion in depth (4–5 cm), the reconstruction follows the same principles as in open surgery. We recommend a combined approach with submental flap or free flaps.

Lateral wall. (Figure 3)

In this location, depth (D) is determined by the involved structures rather than the size of the tumor. The lateral wall is defined according the layers shaped by the styloid muscles.

Class I: defects in which the resection is medial to the styloglossus. Secondary healing or bioma-
terials are the preferred options.

Class II: defects requiring Styloglossus/Stylohyoid resection, with extension greater than one third
of the lateral wall. If we need to excise these muscles, the carotid artery could be at risk. Facial
artery musculomucosal flap (FAMM) may be an option if the patient has not received previous
radiotherapy. If the patient has received previous radiotherapy a free flap should be considered.

Class III: defects with exposure of neurovascular structures. Regional or free flaps are recom-
mended.

Composite defects

In case of composite defects, each surgeon must decide the main anatomical component for the reconstruction and act accordingly.

Conclusions

• Thoughtful reconstruction of oropharyngeal defects can help to optimize functional outcomes and preserve the physiological function of the pharynx.
• The surgeon must carefully consider all the options in the reconstructive armamentarium, ranging from secondary healing or new biomaterial options to microvascular free tissue transfer.
• Each center must adapt its approaches according to their respective and reconstructive capacities.
• It is necessary to validate the reconstructive proposals with long-term results, including oncologi-
cal and functional aspects.
• It would be desirable to unify classifications and functional measures, in order to facilitate the comparison between different proposals and studies.

Declaration of Competing Interest

None.

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