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# Algorithms for eyelid repair

Algoritmos para reparo das pálpebras

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## ABSTRACT

Eyelid defects resulting from skin cancer excision are common in the daily practice of dermatologic surgeons.

The aim of this review is to summarize the most relevant methods for eyelid repair, proposing reconstructive algorithms for both lower and upper eyelids. Both algorithms were designed according with dichotomic decisions based on the thickness (partial- versus full-thickness) and the size of the eyelid defect (less than 1/3, less than 2/3 or larger than 2/3 of the eyelid length).

**Keywords:** Eyelids; Reconstruction; Eyelid Neoplasms; Eyelid Neoplasms/surgery; Cornea

## RESUMO

Os defeitos nas pálpebras resultantes da excisão do câncer de pele são comuns na prática diária dos cirurgiões dermatológicos.

O objetivo desta revisão é resumir os métodos mais relevantes para o reparo da pálpebra, propondo algoritmos reconstrutivos para as pálpebras inferiores e superiores. Ambos os algoritmos foram projetados de acordo com decisões dicotômicas baseadas na espessura (espessura parcial versus total) e no tamanho do defeito da pálpebra (menor que 1/3, menor que 2/3 ou maior que 2/3 do comprimento da pálpebra).

**Palavras-Chave:** Pálpebras; Reconstrução; Cornea; Neoplasias Palpebrais; Neoplasias Palpebrais/cirurgia

## Review Articles

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## INTRODUCTION

Skin cancer excision is the main cause of eyelid defects to be treated by dermatologic surgeons. As occurs in other facial regions, basal cell carcinoma (BCC) is the most frequent neoplasm in the eyelids. Squamous cell carcinoma (SCC), melanoma and sebaceous carcinoma account for most of the remaining cases.<sup>1</sup> The dermatologic surgeon has to be prepared to face this kind of defects, for which is essential to develop advanced surgical skills based on solid knowledge about eyelid anatomy and physiology.

Eyelid reconstruction is usually challenging and the decision about the optimal method to repair a specific defect is mainly based on two factors: the thickness and the extent of the defect.

The chosen closure method should result in tension vectors with a predominant horizontal orientation. Furthermore, the alignment of the free margin and the canthal fixation should be preserved or restored. Each layer of the eyelid should be repaired, from the internal tarsoconjunctival layer to the external cutaneous layer. These basic principles are essential to achieve optimal cosmetic and functional results, preventing complications, such as ectropium, lagophthalmos, epiphora, chronic conjunctivitis and corneal dryness, and ulceration.

Reconstructive algorithms are generally considered useful tools in the clinical setting, helping the surgeon to decide which management strategy should be chosen. The aim of this work is to design decisional algorithms both for upper and lower eyelids repair.

## MATERIAL AND METHODS

The algorithms were based on a literature review about eyelid repair and also on the author personal experience. Therefore, despite the literature review supporting the proposed options, the algorithms' decisions were also influenced by some personal preferences. The algorithms have no intention to include an extensive review of all the possible reconstructive options reported in the literature. Under the same combination of criteria (personal experience and literature review), the most relevant techniques were considered as the most reliable and consistent.

## RESULTS

### Conditionals of the algorithms

The size and the thickness of the defect were identified as the two factors with more impact in the decision about the reconstructive method to be used for both lower and upper eyelid defects.<sup>2,3,4</sup>

The management of partial-thickness defects differs significantly from the management of full-thickness defects since the latter require restoration of the posterior lamella (tarsoconjunctival layer) in addition to the anterior lamella (myocutaneous layer)<sup>2,3,4</sup>. Therefore, the thickness was considered the first condition to be included in the algorithm.

The extent of the eyelid length affected by the defect is more relevant than the absolute diameter itself. Therefore, the size, expressed as a fraction of the eyelid length, was pointed out as the second condition of the algorithm.

The ability to close primarily a defect is mainly related to the size of the defect. However, it may be also influenced by individual factors (tissue elasticity, age, etc.). Therefore, in those situations in which individual variations were considered to have influence in the reconstructive strategy, the ability to primarily close a defect was included as a specific condition instead of the size itself.

**Partial-thickness defects.** The repair of skin-only defects on the eyelid should be performed avoiding vertical tension to prevent ectropion, scleral exposure or lagophthalmos, causing cosmetic impairment and functional abnormalities such as epiphora, chronic conjunctivitis, and dry eye. Upper eyelids admit some grade of vertical tension, but lower eyelids are unable to support any kind of vertical tension. Therefore, a horizontal approach should be always considered.<sup>5</sup> If the primary closure leads to distortion or vertical tension over the eyelid margin, the need for special techniques is obvious. Patients with impaired snap-back test are more prone to the occurrence of ectropium.<sup>6</sup>

In large defects occurring in the lower eyelid, direct closure can be sometimes possible after stabilization of the eyelid through a lateral canthopexy and a lifting of the suborbicular oculi fascial tissue (SOOF) (figure 1), anchoring this tissue to the periosteum of the orbital rim.<sup>7</sup> Otherwise, a flap or a graft will be needed. Full-thickness skin grafts are efficient for repairing the anterior lamella on both eyelids.<sup>3,4</sup> The most used donor area is the opposite upper eyelid.

The redundant skin of the upper eyelid can be recruited as advancement or rotation flaps for upper eyelid partial-thickness defects. Transposition flaps from the periocular region or from the supraciliary region can also be harvested for repairing bigger defects.



**FIGURE 1:** Direct closure of a large partial thickness defect of the lower eyelid after lateral canthopexy and elevation of suborbicular ocular fat



Several flaps were described for repairing lower eyelid partial-thickness defects. The Tripier flap<sup>8</sup>, which consists of a myocutaneous transposition flap from the homolateral upper eyelid is one of the most reliable techniques for this purpose (Figure 2). Other alternative transposition flaps are Fricke flap, Kreibitz flap, and superiorly-based nasolabial flap. Advancement flaps (McGregor flap and Imre flap)<sup>8,9</sup> from the periocular region are also a possibility. Mustardé rotation flap<sup>10</sup> is a very good option to repair extensive defects of the lower eyelid anterior lamella (Figure 3).

**Full-thickness defects.** Small full-thickness defects can be repaired by direct closure. If the defect involves the eyelid margin, usually the closure is performed after planning the excision under a pentagonal shape (Figure 4, left column). This method results in a hipereversion of the lesion borders, leading to a correct alignment of the eyelid margin, crucial to achieve an optimal cosmetic and functional outcome.<sup>11</sup> If there is too

much tension and it is hard to join the lesion borders, the closure can be easily performed after the lateral canthal ligament have been cut (lateral cantholysis).<sup>4</sup> This will allow an additional advancement of up to 5 mm (Figure 4, right column). After the suture, the lateral canthal ligament should be reattached to the periosteum of the orbital rim.

The Tenzel flap (semicircular advancement-rotation flap from the zygomatic region)<sup>4</sup> is an excellent option for defects up to 1/3 of the eyelid length, despite this flap may be sufficient to repair defects up to 40-50% of the eyelid length in some older patients. The Tenzel flap has the advantage to repair both lamellas within a single procedure. The semicircular design of this flap is highly important to prevent ectropion. The convexity of the semicircle is superior for the lower eyelid; however, it is considered inferior for the upper eyelid (Figure 5).

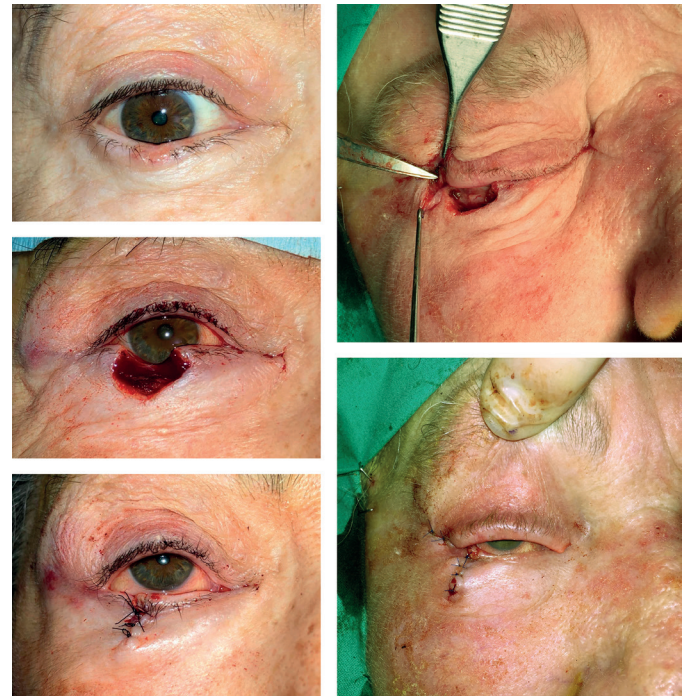
Defects bigger than 1/3 of the lower eyelid length commonly require multi-step procedures with sequential repair of posterior and anterior lamellas. Tarsconjunctival grafts harvested in the upper eyelid (Figure 6, upper line) or flaps (Hughes flap)<sup>12</sup> can repair defects up to 2/3 of the lower eyelid extent (Figure 7). From 2/3 to the totality of the eyelid, the nasal septum (alternatively, the oral mucosa and auricular cartilage can be used) is a good donor site to harvest chondromucosal grafts (Figure 6, bottom line), big enough for the entire posterior lamella restoration.<sup>13</sup> When the posterior lamella is repaired with a graft, a flap should be performed to repair the anterior lamella,<sup>4</sup> since a graft sutured over a graft will result in poor nutrition of both grafts, leading to necrosis. However, a full-thickness skin graft is



**FIGURE 2:** Myocutaneous transposition flap (Tripier) transposed from the upper eyelid for lower eyelid repair

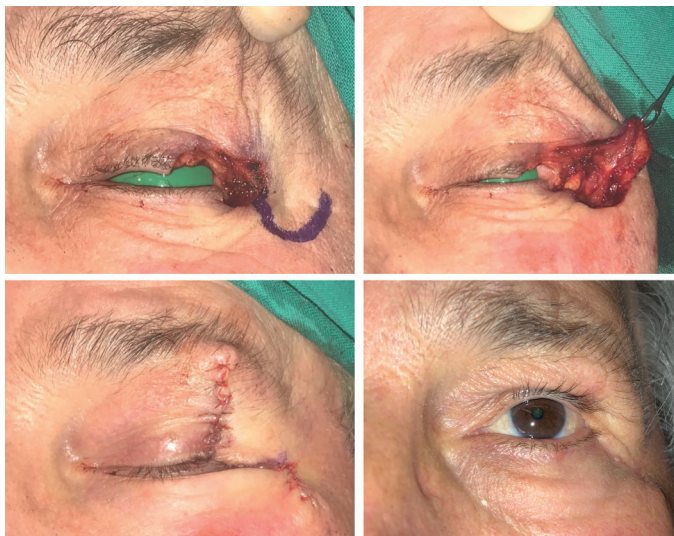


**FIGURE 3:** Mustardé rotation flap for lower eyelid repair



**FIGURE 4:** Pentagonal excision of the lower and upper eyelids (left column). Lateral cantholysis, allowing an additional movement of the eyelid that allows direct closure (right column)



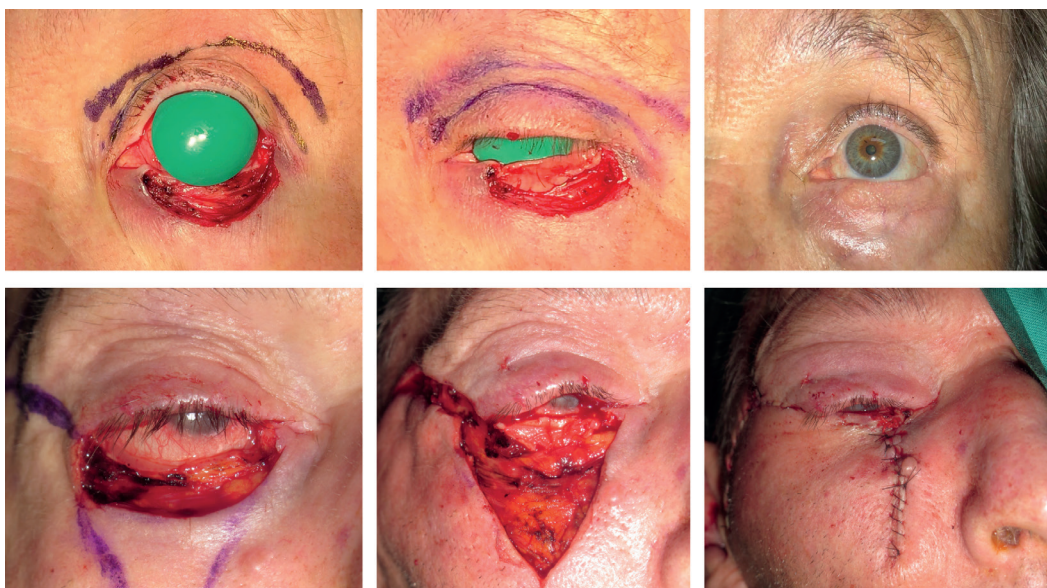


**FIGURE 5:** Inverted Tenzel flap for upper eyelid repair

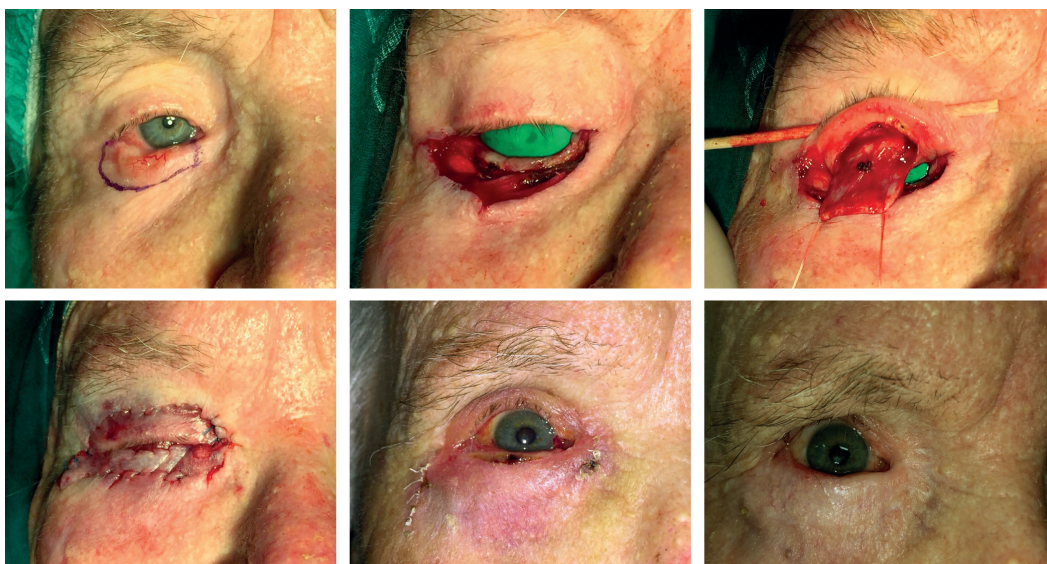
a safe procedure to perform in addition to a Hughes tarsoconjunctival flap.

Defects larger than one half of the upper eyelid length are very difficult to repair and the options are very limited. The most reliable and safe procedure is the Cuttler-Beard flap,<sup>14</sup> which consists of an advancement full-thickness flap harvested in the lower eyelid. Like the Hughes flap, it is an interpolated flap with a 4-6 weeks period before pedicle division. Since the Cuttler-Beard flap should not affect the lower eyelid margin, it is tunneled to achieve its final position over the upper eyelid defect.

**Algorithms.** The final algorithms can be analyzed in the Figures 9 and 10.



**FIGURE 6:** Posterior lamella repair. Tarsoconjunctival graft (top) combined with a Tripier flap for anterior lamella. Chondromucosal graft (bottom) combined with a Mustardé flap

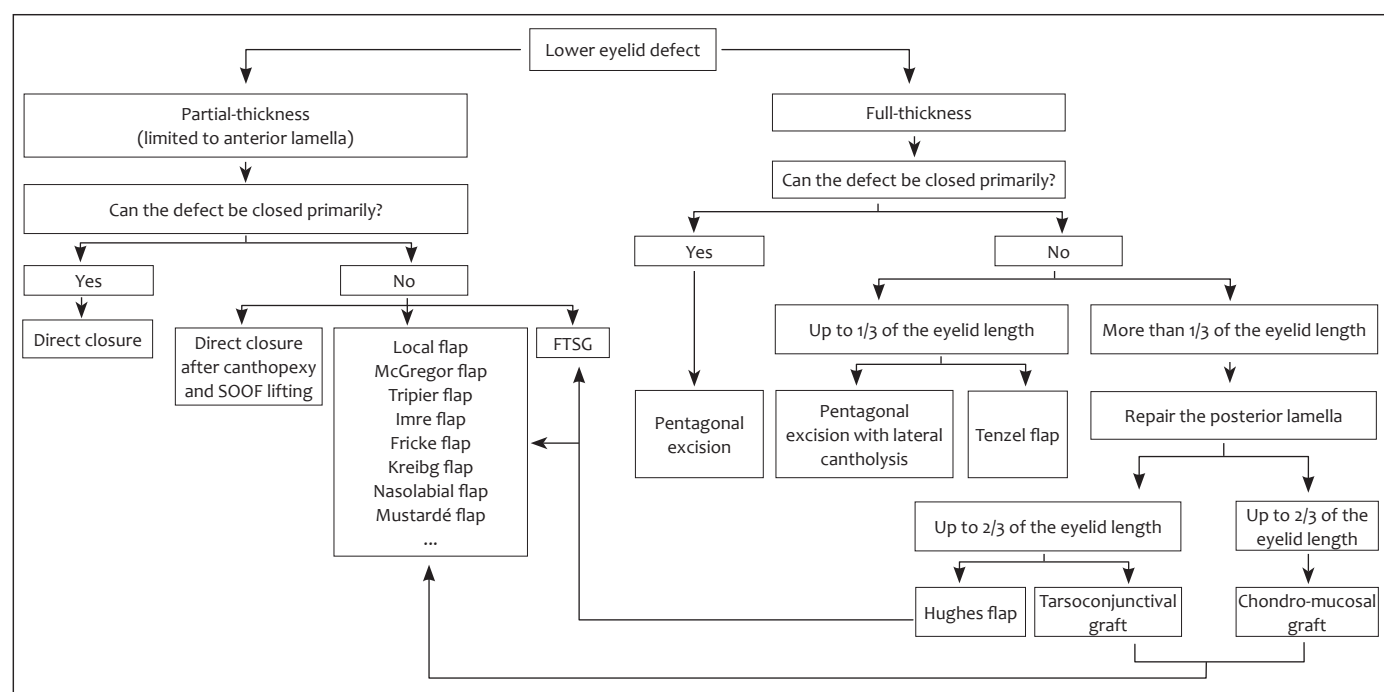


**FIGURE 7:** Hughes flap combined with a Tripier flap for repair a full-thickness defect of lower eyelid





**FIGURE 8:**  
Cuttler-Beard flap for a large upper  
eyelid full-thickness defect



**FIGURE 9:** Reconstructive algorithm for lower eyelids

## CONCLUSIONS

Eyelid reconstruction is challenging due to the anatomic and physiologic particularities of the eyelids. The multiplicity of surgical techniques available, differences in defects thickness

and size, and individual variations in skin mobility and elasticity make the reconstructive strategy difficult to establish.

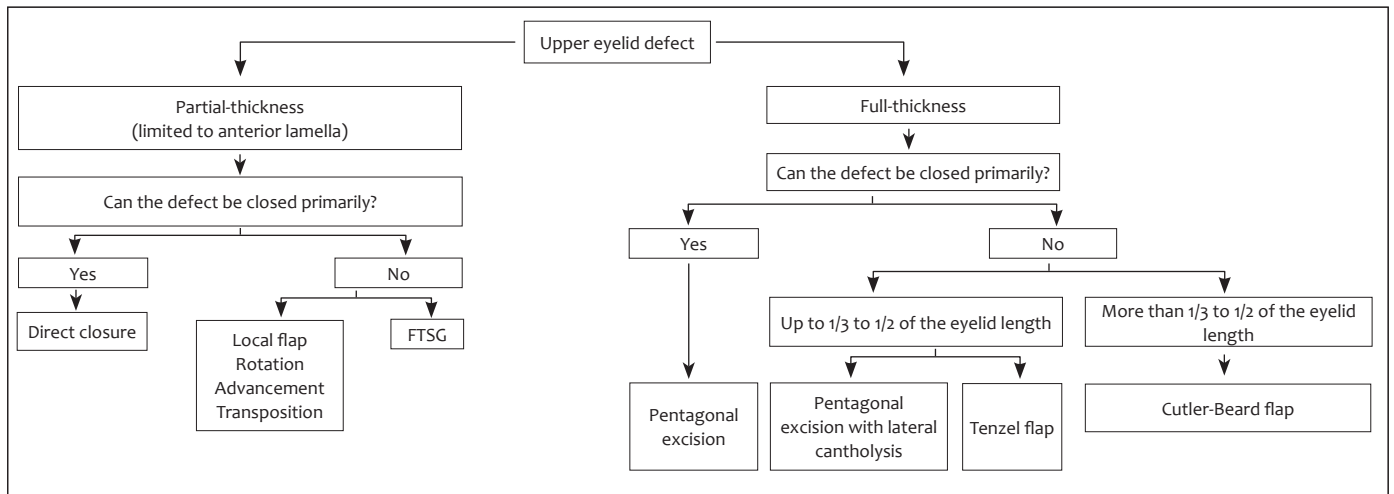


FIGURE 10: Reconstructive algorithm for upper eyelids

The proposed algorithms summarize the most common reconstructive procedures for upper and lower eyelids defects, sequentially categorized under a dichotomic decision tree aim-

ing to assist the dermatologic surgeon during the reconstructive decision-making process. ●

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