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БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ЧЕЛЮСТНО-ЛИЦЕВОЙ ХИРУРГИИ

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ПЛАСТИЧЕСКОЕ ВОЗМЕЩЕНИЕ ДЕФЕКТОВ И ДЕФОРМАЦИЙ ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ МЕСТНЫМИ ТКАНЯМИ

LOCAL FLAPS IN MAXILLOFACIAL RECONSTRUCTION

Учебно-методическое пособие

Минск БГМУ 2019

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Н63 Пластическое возмещение дефектов и деформаций челюстно-лицевой области местными тканями = Local flaps In maxillofacial reconstruction : учеб.-метод. пособие / А. И. Николаева-Киселевич, И. А. Боярина. – Минск : БГМУ, 2019. – 16 с.

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Содержит информацию о преимуществах и недостатках, оперативно-технических принципах и особенностях пластических оперативных вмешательств по устранению дефектов и деформаций челюстно-лицевой области с использованием местных тканей.

Предназначено для студентов 5-го курса, обучающиеся на английском языке по специальности «Стоматология» и «Лечебное дело», врачей-интернов, клинических ординаторов.

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MOTIVATION CHRACTERISTICS

Total time of class: 315 min.

Open wounds, particularly around the face, often require complicated techniques for optimal closure. The approach to the closure of the complicated wound depends largely on the nature of the wound, including the location and size of the defect, the functional outcome after closure, the medical comorbidities of the patient, neighboring structures, and whether the defect is secondary to a malignancy or trauma. The goals of wound management are optimal aesthetic outcome, preservation of function, and patient satisfaction. The authors briefly review basic skin closure options and discuss use of skin flaps, particularly of the head and neck region.

Aim of the study: to study the main aspects of local flaps reconstructing in the maxilla-facial surgery.

Objectives of the study:

1. Learning how to collect complaints and the medical history, and to identify clinical symptoms as an indication for plastic surgery.
2. Learning how to plan examination of patients;
3. Learning how to make a treatment plan of patients;
4. Learning how to choose a treatment method depending on clinical features.

Initial knowledge requirements. In order to master the subject,

the student is to revise:

– human morphology: topografo-anatomic and histologic structure of soft tissues of maxillofacial area and neck, feature of blood supply and innervations of maxillofacial area and neck;

– maxillofacial surgery: examination of patients with pathology of the maxillofacial region.

Test questions on related disciplines:

1. Call features of the histologic structure of integuments person and mucous membrane of an oral cavity.
2. List the main anatomical structures of blood supply and innervations of maxillofacial area and neck.
3. Give methods of objective inspection which are used for diagnostics of defects and deformations of the face and a neck.
4. Call the main additional methods of inspection for diagnostics of defects and deformations of the face and neck.
5. Specify the main special methods of inspection for diagnostics defects and deformations of the face and neck.
6. List physiological features which influence on reparative and regenerative potential of fabrics of maxillofacial area and necks.

Over the past 50 years the development and application of several different flaps has led to reliable reconstruction of facial defects. Most defects can be reconstructed immediately, leading to better restoration of form and function with early rehabilitation. Reconstructing facial defects can be both challenging and rewarding. Missing tissue most often results from either trauma or oncologic surgery. Commonly there is a wide range of options for repairing a given defect, including healing by secondary intention, primary closure, or mobilization of local tissue.

PREOPERATIVE PLANNING AND CONSIDERATION

For each patient, a medical history encompassing smoking, peripheral vascular disease, atherosclerosis, diabetes mellitus, steroids, and previous surgeries should be elicited, because of the effects of these factors on wound healing and skin perfusion.

In managing the excisional defect, the surgeon must first assess the **size** and **depth** of the wound, as well as the nature of any exposed underlying internal anatomy. A defect containing exposed bone, nerves, or blood vessels usually necessitates a more advanced closure than would a less complicated wound.

The quality of the surrounding skin is also of great importance. Skin quality may vary from young, tight, and elastic to aged, dry, and lax. The wrinkled skin of an older patient produces less obvious scarring and offers the opportunity to conceal scars within skin tension lines. Skin that is more oily or heavily pigmented generally yields a less favorable scar. Color match is also of importance in deciding on the flap donor site. The presence of actinic damage, skin diseases, and premalignant satellite lesions should be considered. Finally, location is of major concern. Defects adjacent to critical anatomic structures, such as the eyelids, the nares, the oral commissure, and the external auditory meatus, must be reconstructed so as to avoid distorting the anatomy unique to those areas. Any alteration of these surrounding landmarks may compromise functional and aesthetic results. Previous surgical incisions and traumatic scars should also be assessed before the closure of the defect is designed.

Well-planned and -executed reconstruction of facial defects is particularly important because of the visibility of the result and the potential for functional deficits. However, the principles presented here may be applied to the management of all complicated wounds.

Many defects can be treated with primary closure, secondary healing, or skin grafts. However, if, after careful assessment of the lesion, defect, and patient, the surgeon determines that the patient needs a flap for closure, he or she can apply techniques that produce the optimal aesthetic outcome.

MOBILISATION OF WOUND EDGES AND ADDITIONAL INCISIONS FOR FACIAL SKIN RECONSTRUCTION

The final outcome in any closure depends on the proper assessment of the defect and the selection of an appropriate closure technique. Primary closure involving direct approximation of the wound edges is a first option. An intermediate closure consists of approximation and closure of deeper tissue levels before final skin closure. Complex closure entails approximation and adjustment of the wound edges by means of undermining, the excision of any dog ears, or trimming of wound edges before closure. Finally, the options of skin grafting, allografting, and flap repair must be considered.

When a wound cannot be closed primarily, the options are as follows: secondary wound healing, skin grafting or local tissue transposition. Healing by secondary intention consists of two phenomena. The major means of size reduction of the defect is wound contracture, accompanied by re-epithelization to a lesser extent. Wound contracture may result in distortion of nearby mobile anatomic features, such as the oral commissure or the epicanthi. The contraction of scar tissue alters the orientation of the surrounding normal anatomy, which may result in an unacceptable cosmetic outcome and, more importantly, in poor function.

Healing by secondary intention is a viable option in fixed areas away from important anatomy, such as the middle of the forehead, the cheek, or the neck. In areas adjacent to important, easily deformable anatomic structures, transposition flaps are often a better wound closure approach.

Skin is a heterogeneous material with unique mechanical properties. As skin is stretched, the randomly oriented collagen and elastic fibers are stretched in the direction of the applied force. This continues until all of the available collagen and elastic fibers are recruited and no further lengthening occurs. After the maximum amount of stretch is reached, the skin may rupture.

An advancement flap is advanced linearly over a defect. It consists of a classic elliptic closure with adjacent undermining; there are no rotational or pivotal movements. Tissue elasticity provides adequate horizontal motion with a flat closure effected as Burow's triangles are removed from the ends. The length of the ellipse is three to four times the width of the defect. Advancement flaps can be constructed with multiple modifications: simple, square, bilateral, Burow's triangle repositioning, and A- or O- to T-shaped designs, double opposing rectangular advancement flaps (H-plastic by Shimanousky). The experienced surgeon realizes that the tethering forces of advancing skin also constrict the size of the leading edge. Modifications are useful in specific instances. All flaps, including simple advancement flaps, presuppose that the surgeon can disguise, adjust, transpose, or eliminate «**dog-ears**» or excess tissue that gathers as tissue is transposed.

There are seven ways to deal with «**dog-ears**»:

1. Do nothing; this approach works well on the scalp as bunched up tissue lies down with time.

2. Close opposite lines of uneven lengths by spreading out the problem halving.

3. Remove the excess to a hidden area—an end or middle triangle.

4. Lengthen the incision. This eliminates bunching.

5. Perform an M-plasty (sometimes called a T-plasty), which shortens the problem.

6. Reverse the S loop and hide the excess elsewhere

7. Advance the dog-ear as a flap (subcutaneous «island») or use it as a free graft.

ROTATION FLAPS

Rotation flaps (fig. 1) are semicircular flaps raised in a subdermal plane and rotated from the donor bed around a pivot point adjacent to the defect. The defect site is visualized as a triangle with its base as the shortest side. After the flap is rotated into the defect, the donor site is closed primarily, yielding an arcuate scar. Considerable tension may be present in this flap and needs to be recognized.

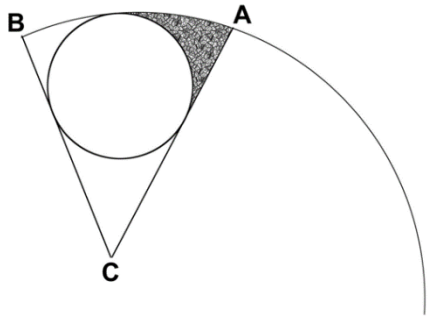

Fig. 1. Developing a rotation flap. A circular defect can be imagined as lying within a triangular defect, without the actual creation of a triangular defect. Point A of the triangle will be sutured to point B. Thus, the leading edge of the flap (shaded area) is started above the midpoint of the circular defect, then rotated beyond the defect, and ultimately sacrificed

The line of maximal tension is directly opposite the pivot point and adjacent to the defect. Excessive tension along this line may result in ischemia and subsequent necrosis of the flap. Rotation flaps require considerable planning, and little gain is realized relative to the size of the flap. In some cases, the donor site cannot be closed primarily and may require a skin graft. However, depending on the location of the defect, rotation flaps may be preferable to transposition or advancement flaps. A problem with rotational flaps is the unequal length between the edge of the flap and the entire edge of the primary and secondary defects. To correct this mismatch in length, one can use the Burow's triangle technique, a cutback incision, advancement of the flap while rotating it, or suture on the bias to stretch the flap forward. The rule of thumb is that the length of the flap should be four times the width of the base of the defect. In addition, the ideal defect for repair has a height to width ratio of two to one. The blood supply is usually random, but if the surgeon designs the position of the base of the flap, it can be axial.

ADVANCEMENT FLAPS

Advancement flaps have a linear configuration and are advanced into the defect along a single vector. These flaps can be single or double. Advancement flaps are often chosen when the surrounding skin exhibits good tissue laxity and the resulting incision lines can be hidden in natural creases. Advancement flaps limit wound tension to a single vector with minimal perpendicular tension. They are often helpful in reconstructing defects involving the forehead, helical rim, lips, and cheek. In these areas advancement flaps capitalize on the natural forehead furrows without causing vertical distortion of the hairline superiorly or the eyebrow inferiorly Advancement flaps are created by parallel incisions approximately the width of the defect. Standing cutaneous deformities («dog ears») are usually created and are managed with excision. A Z-plasty incision or Burow's triangle may be performed at the base of the flap, reducing the standing cutaneous deformities.

A variation of the advancement flap is the **V-Y flap** (fig. 2). A triangular island of tissue adjacent to the defect is isolated and attached only to the subcutaneous tissue. It relies on a subcutaneous pedicle for blood supply. As it is advanced into the defect, the secondary defect is closed primarily in a simple V-Y manner. These flaps are especially amenable for cheek defects along the alar facial groove and are generally avoided where there are superficial nerves because of the depth of the incisions.

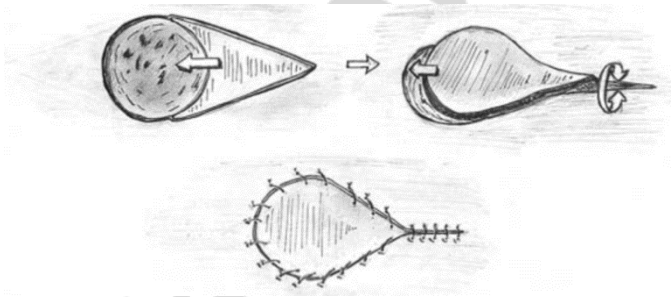

Fig. 2. V-Y advancement flap

Intraoral uses of advancement flaps include covering oroantral fistulas and alveolar clefts. A disadvantage of buccal advancement flaps is the decrease in vestibular sulcus depth.

TRANSPOSITION FLAPS

Local **transposition flaps** involve the movement of adjacent skin from an area of excess to the area of deficiency. These flaps involve the transfer of the flap through an arc of rotation on a pivot point in a linear axis. Regional tissue laxity and mobility are of greater importance than the precise angular/geometric measurements. In addition, the flap should be designed to fit the defect with minimal tension at the closure line, to avoid distorting the neighboring structures, and to

have an adequate base to perfuse the undermined, elevated flap. The rule of thumb is that the random pattern transposition flaps should not have a linear axis longer than three times the width of the flap. Rhomboid flaps, Z-plasties, and W-plasties are variations on the transposition flap. They involve the transposition of a random skin and subcutaneous tissue flap into an adjoining defect. These flaps are designed so that the donor scar is well camouflaged. They must be meticulously designed according to the specific requirements of the reconstruction. However, transposition flaps are quick and easy for the experienced surgeon and are versatile solutions to many coverage problems.

BANNER FLAP

The **banner flap** is a transposition flap designed as a pendant of skin tangential to the edge of a round defect. The flap is elevated, and the donor site closed. The flap edges are then trimmed to fit the defect better, and the flap is inset. The bilobed flap (fig. 3) is a variant of the banner flap in which two adjacent segments are raised, one smaller than the other. The two flaps are oriented perpendicularly to each other. The smaller. flap (usually half the diameter of the larger flap) is used to fill the larger donor site, and the small donor site is closed primarily. The original defect is then closed by means of the larger of the two lobes. The final result is the 180° rotation of excess tissue to fill the skin deficit. Bilobed flaps are most commonly used in the closure of nasal defects, particularly in the lower third, and they are a means to transfer excess adjacent skin into the area of deficiency. Defects that cannot be covered using a single transposition flap because of tension can be closed by this method. One must be aware that these curvilinear incisions will not necessarily fall into pre-existing skin folds or wrinkles.

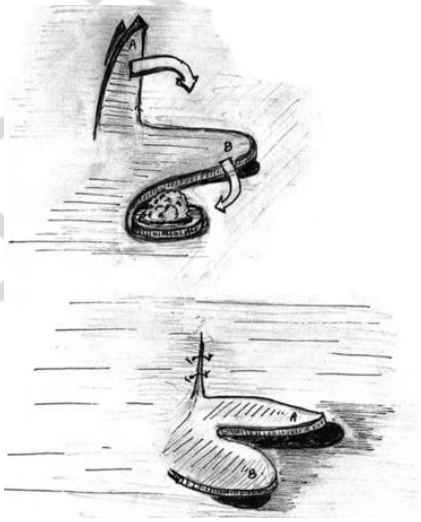

Fig. 3. The bilobed transposition flap. The primary donor flap is designed tangential to the defect, and the secondary flap is designed to be smaller and more elliptic to allow for primary closure of the secondary donor site

Z-PLASTY

The basic Z-plasty is composed of a central limb incision and two lateral limb incisions that form a «Z». The lengths of the three limbs and the angles formed between the central and lateral limbs are equal. The incisional pattern creates two triangular tissue flaps that are transposed, changing both the length and orientation of a wound or scar. This topic will review the indications and technique for Z-plasty. Simple wound closure with sutures and staples is discussed elsewhere.

The primary reasons to perform a Z-plasty are to improve contour, release scar contracture, relieve skin tension, and mobilize tissue for reconstructive surgery. This technique is rarely needed for the acute management of open wounds.

Z-plasty has four main tissue effects:

1. Redirection of scar — The new scar reorients from the axis of the central limb to a line connecting the tips of the lateral limbs. Z-plasty is used to redirect scar into «relaxed skin tension lines» — Langer's lines (fig. 4) natural skin folds, or along the border of an aesthetic unit (ie, nasolabial fold) to improve cosmetic or functional outcome.

Fig. 4. Linger’s lines head

2. Lengthening of scar — Z-plasty lengthens the initial wound or scar. It is used to release flexion contractures (usually due to burns) occurring in the axilla, neck, antecubital fossa, or popliteal fossa.

3. Tissue mobilization — Z-plasty mobilizes adjacent tissue to close skin defects that might otherwise have required a skin graft (eg, deepen finger digital web spaces, or correction of syndactyly), lobular transposition in congenital microtia (ie, small ears), vaginal reconstruction, or management of pilonidal cysts.

4. Tissue realignment — Z-plasty realigns tissue (eg, male cervicoplasty) and can be used to shift topographical structures.

There are no absolute contraindications to Z-plasty. Factors adversely affecting skin vascularity, wound healing, and skin mechanics are relative contraindications. These include severe peripheral vascular disease, smoking, poorly controlled diabetes mellitus, collagen vascular disease, and prior skin irradiation.

TYPES OF Z-plasty. Multiple Z-plasty configurations are available. The choice depends on the nature of the wound/scar being repaired and laxity of the surrounding skin.

The classic Z-plasty consists of three limbs of equal length (fig. 5). The angles between the central limb and each lateral limb are also equal and measure 60º. When used for lengthening a scar, the central limb is oriented along the long axis of the scar/wound to be repaired. Transposition of the skin flaps results in a new central limb that is perpendicular to the original; the orientation of the Z-plasty limbs does not change. The classic Z-plasty theoretically lengthens a scar by 75 %, but the actual gain in central limb length will be 55–84 % of predicted values, depending on tissue elasticity.

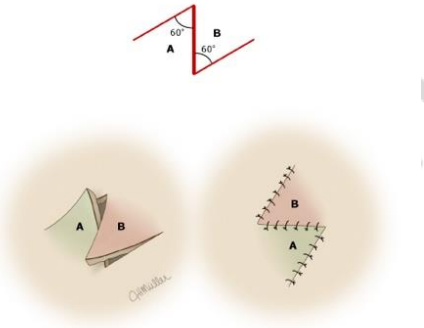

Fig. 5. The classic Z-plasty consists of three limbs of equal length. The angles between the central limb and each lateral limb are equal and measure 60°. Additional lengthening can be achieved by using larger angles and/or longer limbs. As discussed above, large angles (> 75º) cause greater skin tension, which increases the risk of flap breakdown. Large-angle Z-plasties work with only extremely lax tissue

Longer Z-plasty limbs produce greater degrees of lengthening; however, these larger flaps also produce greater skin tension during closure and require greater tissue mobility.

Z-plasty produces elongation not only longitudinally in the plane of the skin but also projecting away from the skin's surface ("stereometric elongation"), which may result in a poor cosmetic result when the skin surface is flat rather than curved . The use of large angles increases the amount of skin projection and can lead to the formation of dog ears.

Double-opposing Z-plasty consists of two Z-plasty incisions placed next to each other as mirror images (fig. 6). This technique is useful in scar contracture because skin lengthening is achieved in areas of limited adjacent skin laxity. Also, this technique may be more useful in areas of decreased vascularity (eg, burns) because the larger central flap is less prone to necrosis.

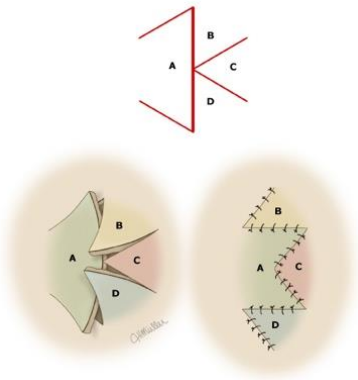

Fig. 6. Double opposing Z-plasty

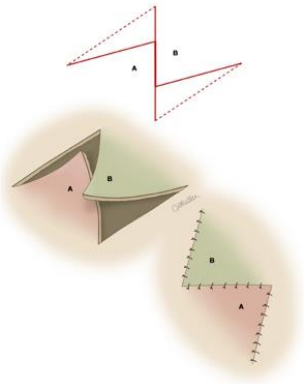

Fig. 7. Planimetric Z-plasty

The planimetric Z-plasty uses a 75º angle and limb incisions that are twice as long as the central incision (fig. 7). The central incision is then elongated in both directions to twice the length of the limb incisions. The two triangular areas that are created are excised prior to flap transposition. Planimetric Z-plasties can also be linked as in the compound Z-plasty described above. This technique was developed to address issues of stereometric elongation, which predisposed to «dog ears» when performing Z-plasty on flat surfaces.

FOLLOW-UP CARE

Follow-up care is an important aspect of the treatment of any surgical wound. Suture removal is timed to prevent suture cross marks and epithelial cysts. Patients need to be advised as to the proper management of new scars and monitored to ensure that the healing process is progressing normally. As in the treatment of any condition, follow-up and continuity of care are vital aspects of good medical practice. Skin flaps take 3 to 6 months to mature. They tend to look puffy and distorted at first but will settle down and improve over time. Patients need to be reassured.

EARLY COPLICATIONS OF FLAP RECONSTRUCTION

The possible complications after flap reconstruction vary in severity and require distinct approaches depending on their type. Fortunately, most of the complications are preventable as well as amenable to treatment. The most common early complications after skin flap reconstruction surgery are infection, hematoma, seroma, and wound dehiscence.

The complication of flap necrosis is more serious and is usually due to a design flaw or an error in execution of the reconstruction. These errors include the use of too small a flap for a given defect, damage to the flap's blood supply, extension of the flap beyond its blood supply, or closure of the defect in such a way that it is subject to too much tension. Flap necrosis may usually be avoided by

means of more precise flap design and avoidance of undue tension on wound closure. Treatment of distal necrosis is conservative and may include allowing certain areas to heal by secondary intention or subsequent surgical revision of the area. However, in areas where the flap was placed to prevent a deforming scar contracture, such as the eyelid, a new reconstruction should be performed as soon as the wound condition permits.

LATE COMPLICATIONS OF FLAP RECONSTRUCTION

These complications are avoided for the most part by means of experience and careful planning of the flap reconstruction. Unfavorable scarring is a complication that occurs when scars are placed outside of the direction of the skin tension lines. Scars that lie in the wrong direction may be revised with a Z-plasty or a W-plasty. Pincushioning (trap door deformity) of the flap is another complication that arises from a curvilinear scar. Correction of the pin-cushion deformity should not be performed until the scar matures. Options for correction include excision of the old scar, defatting of the flap, and closure with Z-plasties or a W-plasty.

Hypertrophic scars are uncommon on the face. However, keloids can be a major concern. Any patient with a personal or family history of keloids or a personal history of hypertrophic scars must be warned about the risk of developing additional keloids or hypertrophic scars. Once a keloid forms, many treatment options are available, most of which are only partially effective in minimizing the scar. Pressure, topical silicone, steroid injections, and massage are the standard treatments, although re- excision in conjunction with intralesional steroids and postoperative radiation may also be considered for unresponsive lesions.

SELF-CONTROL TESTS

1. Primary wound closure means:

a) direct approximation of the wound edges.
b) using an allograft. c) skin grafting.
d) local tissue transposition.

2. What dose «dogs-ears» mean in plastic surgery?

a) A one-sided mound of redundant tissue, which is seen after the repair of certain skin lesions and defects. Puckering at the end of a scar.

b) It is an abnormal proliferation of scar tissue that forms at the site of cutaneous injury

c) An abnormal scar that grows beyond the boundaries of the original site of skin injury.

3. Advancement flaps include:

a) Z-plasty; c) rotation flaps;
b) V-Y-plasty; d) transposition flaps.

4. Transposition flaps include:

a) Z-plasty;
b) V-Y-plasty;
c) rotation flaps;
d) W-plasty.

5. Lander's line is:

a) mobilized wound edges;
b) additional incisions in Z-plasty;
c) relaxed skin tension lines.

6. The angles between the central limb and each lateral limb are also equal and measure:

a) 30 degree;
b) 40 degree;
c) 50 degree;
d) 60 degree.

7. How many times limbs incision should be longer that central incision in planimetric Z-plasty?

a) incisions should be the same;
b) twice;
c) 3 times.

8. Maturity of skin flaps take:

a) 1–2 month;
b) 3–4 weeks;
c) 3–6 month;
d) 1 year.

9. Early complications after skin flap reconstruction surgery are:

a) hematoma;
b) wound dehiscence;
c) keloid scar;
d) hypertrophic scar.

10. Late complications after skin flap reconstruction surgery are:

a) hematoma;
b) keloid scar;
c) wound infection;
d) scar malignization.

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LOCAL FLAPS IN MAXILLOFACIAL RECONSTRUCTION

Учебно-методическое пособие

На английском языке

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