

Split Thickness Skin Graft

Richard Davis, Vallery Logedi

Introduction:

Split thickness skin graft is a useful way to cover wounds that have no living epidermal cells, such as deep abrasions, burns, venous stasis ulcers, and sites of tumor excision. It is a good option for covering even large wounds, as split thickness skin can be expanded to cover more space than the area it came from, through the process of “meshing” which is described further below. Skin grafts, either split or full thickness, are not useful for pressure ulcers; an option that is more tolerant of pressure must be used in this situation.

Split thickness grafts can be harvested in various thicknesses, as discussed further below. Every split thickness graft will contract after being placed; the thinner a graft is, the more it will contract. Conversely, the thicker a graft is, the less it will contract, and the stronger and more resistant it is to trauma. The strength of increased thickness comes at the price of a slightly higher chance that the graft will not “take,” or successfully implant at the graft site.

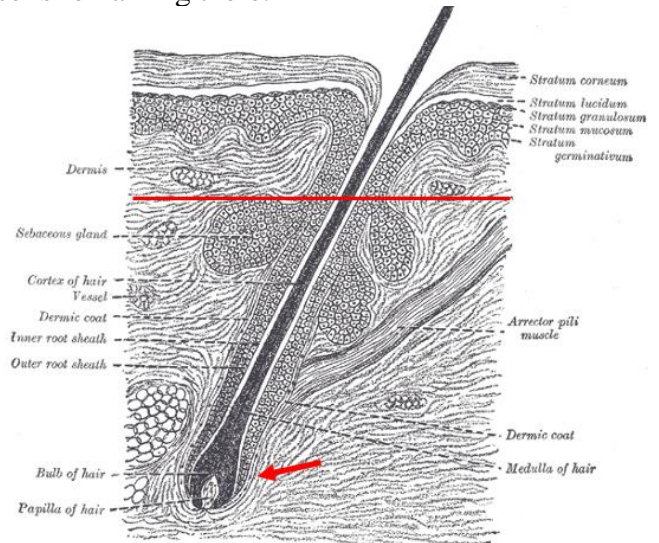
It is acceptable to use split thickness grafts on the face in certain situations, although in general they should be avoided because of their tendency to contract. When used on the face, they should be thick and not “meshed” because of the cosmetic effects of doing so.



Typical appearance of a meshed skin graft after healing. Peter M Nthumba, CC BY-SA 2.0 <<https://creativecommons.org/licenses/by-sa/2.0/>>, via Wikimedia Commons

A skin graft can be thought of as transplantation of living epidermal cells from one location to another. Therefore, the surgeon must assure that there are sufficient epidermal cells remaining at the donor site after harvest, and that the recipient site will support these newly arrived cells after their transplantation.

To assure that living cells remain at the donor site after harvest, the graft must be taken at a depth that is less than the hair follicles. The donor site will re-epithelialize by migration of these cells, from the hair follicles, into the rest of the wound. Hair follicles' depth is variable depending on the part of the body, but in general they are located at about 2-3mm of depth. So the dermatome, whether manual or mechanical, must be set to a depth to leave a good deal of the hair follicle behind. Most skin grafts harvest skin around 0.3-0.5mm deep. It is the surgeon's responsibility to make sure that the dermatome is set properly and remains so, harvesting neither too little nor too much skin. A dermatome that cuts too deep will result in a non-healing wound at the donor site, as there will be no viable epidermal cells remaining there.



Anatomy of the epidermis and hair follicle. The dermis is represented here by wavy lines. The epidermal cells, near the surface, are also located all along the hair follicle (Red arrow) which extends to a depth of 2-4mm. A skin graft harvested through a depth of 0.5mm, represented by the Red line, takes viable epidermal cells above the red line, and leaves behind viable epidermal cells around the hair follicle.

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A healing donor site. Epidermal cells are migrating from the hair follicles to fill the wound and cover the dermis. Melanocytes have migrated with them, giving a dark color. When the migration is complete, the wound will be a uniform color and the previously exposed dermis will be completely covered.

To assure that the transplanted epidermal cells survive where they are grafted, the graft site must be clean and well perfused. Generally the presence of healthy granulation tissue indicates good perfusion and absence of infection.

For venous stasis ulcers, the edema must be controlled and the patient must be properly counseled on prevention of edema in the future through compression stockings. It is possible for skin grafts to fail years later when the patient stops taking measures to prevent edema, so proper counseling on the nature and chronicity of venous stasis disease is very important.

In general, skin grafts will not take on exposed bone unless periosteum is present (which is almost never the case.) They will be very unlikely to take on exposed tendon unless granulation tissue has covered the tendon. The common situation is an ankle or lower leg wound with exposed bone and tendon after trauma, infection, or venous stasis disease. Small tendons can be resected if they are not functional (the ankle is frozen) though the Achilles tendon should not be completely resected. Careful consideration of an alternate method of wound closure (flap coverage of tendon or exposed bone, or amputation) should be considered. Sometimes a vacuum-assisted dressing can encourage granulation

tissue to cover exposed tendons or even small segments of exposed bone.

In general, split thickness skin grafts proceed in the following general steps:

- Debridement of the recipient site
- Setup and adjustment of the dermatome
- Harvest of the skin
- Preparation of the skin by expansion through “meshing” if indicated
- Placement of the graft on the recipient site and securing the graft in place
- Application of a dressing that will protect and secure the skin graft
- Application of a dressing that will protect the donor site

Steps:

1. While counselling the patient on the planned operation, it is important to emphasize the cosmetic implications of a meshed graft, and to counsel the patient on the risk of graft failure.
2. The wound is cleaned before the grafting is done. Change gloves after debridement and prior to harvesting the graft.



A wound that is ready for debridement and grafting. There is no foul smell, no discharge of pus, and the eschar is thin and easily debrided. Care should be taken when debriding over bone or tendon, to preserve some clean granulation tissue to support the graft.

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Healthy granulation tissue of uniform thickness after debridement shows that the wound is ready to accept a graft.. It is acceptable to have a small amount of slough on the wound, as in the picture above, but if there is excessive purulent or necrotic tissue, it should be debrided and followed with serial dressing changes until clean.

3. Mineral oil, also known as liquid paraffin, is applied to the donor site to make it easier for the blade to move over the skin. Tension is applied to the skin.



Tension is held on the skin at the donor site using sponges, with help from an assistant. The skin has been lubricated with Mineral Oil.

4. The manual dermatome is held at a 45-degree angle on the skin. The dermatome is then moved back and forth in a sawing motion while slowly advancing down the limb. For a mechanical dermatome, the machine is held at a 45-degree angle above the skin, turned on, and then lowered to contact the skin and gently advanced. In both cases, the main driver of dermatome advancement is the knife cutting the skin; the operator gives gentle

pressure to allow the dermatome to continue in a smooth forward motion.



The back and forth motion of the knife harvests the skin at the appropriate depth. The surgeon should avoid "forcing" the blade to advance, but rather apply gentle pressure allowing the blade to advance as it cuts the layer of skin.

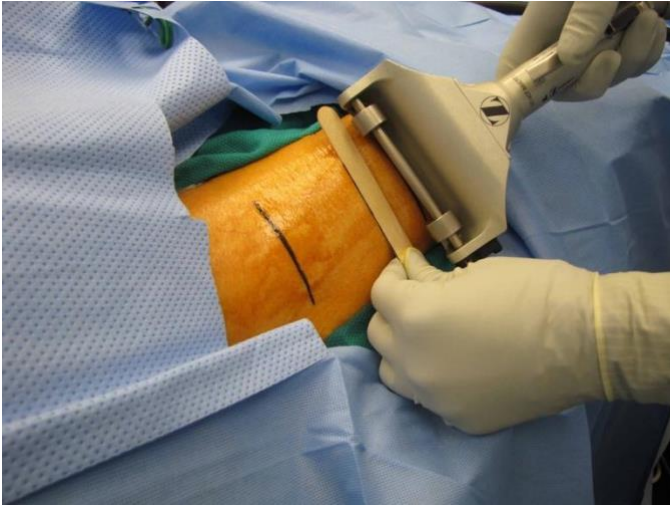


As the blade advances it the harvested skin will collect within the dermatome. An assistant can gently pull the skin upwards but this is usually not necessary.

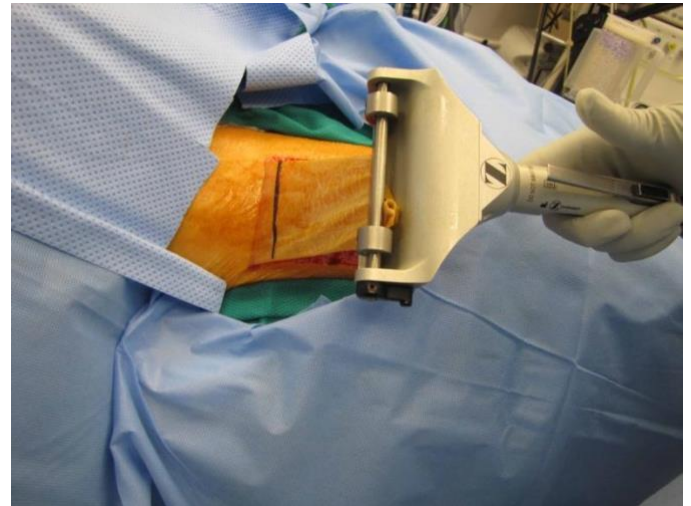
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dermatome away from the skin and cut the graft flush with the unharvested skin.



For the mechanical dermatome, hold the machine above the skin at a 45 degree angle, engage the throttle, and lower your hand until the blade touches the skin. Tension and lubrication are applied as described above. In this case, the surgeon is applying tension with a sterile tongue depressor. Source: Hoffman HT (ed) Iowa Head and Neck Protocols "Case Example Split Thickness Skin Graft STSG Zimmer Dermatome settings" <https://medicine.uiowa.edu/iowaprotocols/case-example-split-thickness-skin-graft-stsg-zimmer-dermatome-settings> Accessed 5 May 2022



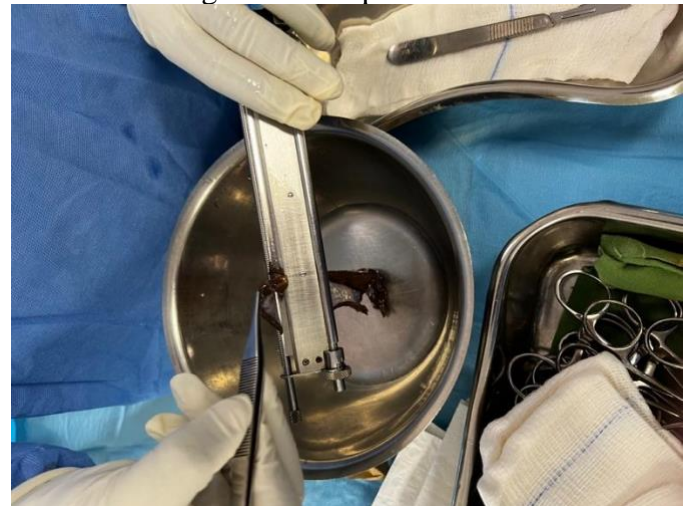
Once harvesting is completed, raise the dermatome away from the skin and then turn off the throttle. Cut the graft flush with the skin exactly as in the example above. Source: Hoffman HT (ed) Iowa Head and Neck Protocols "Case Example Split Thickness Skin Graft STSG Zimmer Dermatome settings" <https://medicine.uiowa.edu/iowaprotocols/case-example-split-thickness-skin-graft-stsg-zimmer-dermatome-settings> Accessed 5 May 2022

5. One the desired amount of skin is harvested, raise the dermatome away from the skin. For a mechanical dermatome, keep the machine running while you raise it away from the skin, then turn it off. Use scissors to divide the remaining skin where it is still attached.



Once the desired amount of skin is harvested, raise the

6. Harvested skin is immediately placed in a bowl with wet gauze to keep it moist.



The skin is removed carefully from the dermatome with gentle traction and placed in saline.

7. If the graft needs to be meshed to cover a large defect, then it can be passed through a mesher as shown below.

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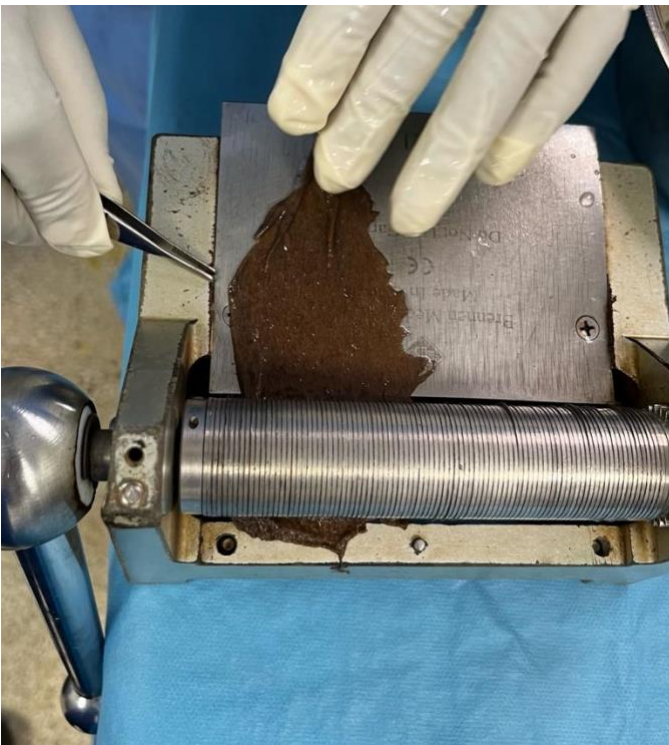
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The mesher places even cuts on the graft to allow it to expand. Some types of meshers require the graft to be placed on a plastic insert (called a "Carrier") that controls the number of cuts made. This one does not.



As the graft exits from the mesher, make sure that it does not become entrapped in the blades.



The skin must lie flat as it enters the mesher.

8. The graft is then applied on the wound and secured with either staples or absorbable monofilament suture such as chromic gut. It is crucial to orient the dermis side of the graft downwards. In light skin it can be difficult to tell which way the skin should be oriented. Close examination of the graft shows that the dermis (inward-facing) side is smooth, while the epidermis (outward-facing) side retains the tiny wrinkles of the skin.

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The pieces of graft are placed on the wound bed and positioned. A non-tooth forceps, or sometimes the blunt side of an instrument, can be used to slide the graft into position. It is then secured with staples or interrupted chromic gut.



Following application of silver sulfadiazine or petroleum jelly, a petroleum jelly-soaked gauze is applied to the graft.

9. We apply silver sulfadiazine cream directly to both sites before applying petroleum jelly gauze: other antibiotic ointment or petroleum jelly alone is also acceptable. Both graft and donor site are dressed with Petroleum jelly-soaked gauze followed by wet, then dry dressing. The graft must be kept moist under the dressing for the duration of the 4-5 days that the dressing is in place. For large wounds, avoid topical antibiotic ointment (such as neomycin) because there is a theoretical risk of systemic absorption of the antibiotic.



A wet sponge is wrapped over the petroleum jelly gauze. This is covered by dry gauze and then wrapped gently but firmly with an elastic bandage.

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Continuous gentle pressure over a newly placed skin graft is crucial. On the extremities or the torso, this can be accomplished with an elastic bandage. In other areas such as the scalp or perineum, this is better accomplished by a “Tie over Bolster” dressing. Monofilament nylon is sutured to the skin circumferentially around the graft, the dressing is applied in the same way as described above, and then the sutures are tied to each other over the dressing.

Pitfalls

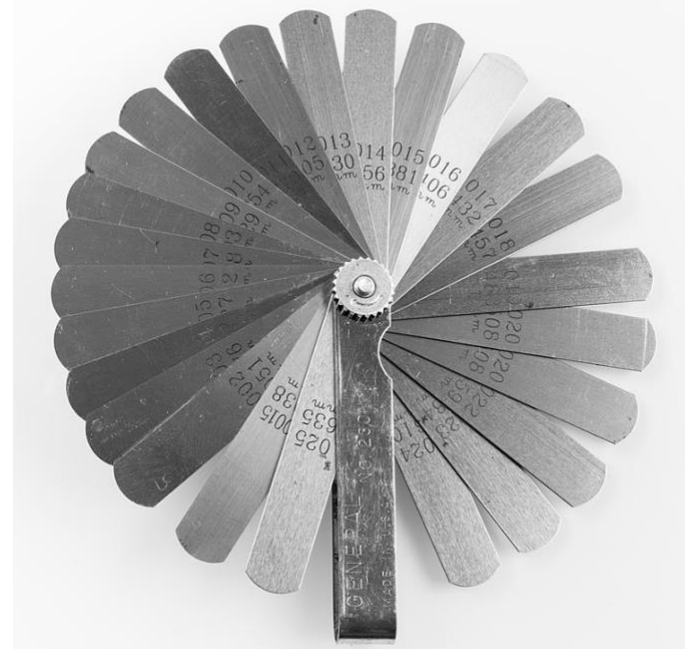
- An incorrectly set dermatome may cause the surgeon to harvest a graft that is either too thick or too thin. As mentioned earlier, harvesting too much skin at the donor site might result in a non-healing wound that will also need grafting!
- It is important that adequate tension is applied at the donor site during harvesting as this is key to how the dermatome works. Failure to do this will cause the dermatome to “bog down” and not advance.
- Keep in mind the size of the defect to be covered while preparing and draping the patient. If the skin from one thigh might not be enough, it may be prudent to prepare both lower limbs and the abdomen just in case, rather than to run out of space to harvest skin.
- Failure to correct the factors that led to the wound will lead to graft failure. Examples include poor glycemic control, lower extremity edema, infection, or even undiagnosed malignancy. Infections that may not be suspected include osteomyelitis deep to the ulcer, eumycetoma,

mycobacteria, or atypical infections in the presence of immunosuppression.

Guide- Setup and adjustment of the dermatome

All dermatomes, whether mechanical or manual, have in common the blade, the guard, and the ability to adjust the distance between the two. The blade moves side to side to cut the skin, while the guard keeps the blade at the proper depth. The blade is removable from the device and intended for single patient use. If many grafts are being taken with the same blade, it may become dull as the operation proceeds.

It is the surgeon’s responsibility to assure that the dermatome, whether mechanical or manual, is in perfect functioning order. If a graft is too thin, it may give a poor cosmetic or functional result, or may not take at all. If a graft is too thick, it may leave a full-thickness defect at the donor site. The margin for error is between 0.25 and 0.5mm. The thickness of a standard #10 or #15 scalpel blade is 0.4mm. The thickness of your hospital's blades may vary, attempt to contact the supplier if you are starting to perform skin grafts for the first time in a new setting. Alternatively, for more precise measurements, a Feeler gauge can be used. This machine is used to measure the gap space in automotive spark plugs and may be available from a mechanic or auto supply store.



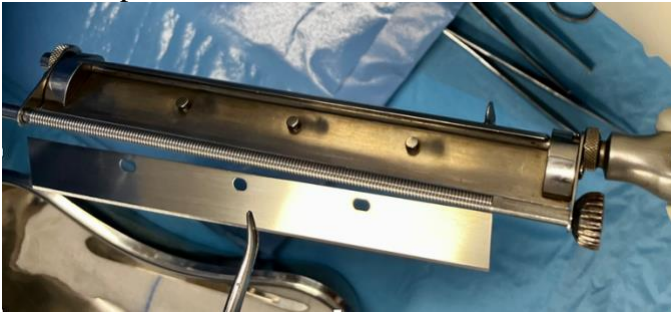
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A feeler gauge, with measurements in inches and mm. This can be used as is or disassembled and only the sizes used for skin grafts kept and used. By © Raimond Spekking / CC BY-SA 4.0 (via Wikimedia Commons) <https://commons.wikimedia.org/w/index.php?curid=71791974>

Manual dermatomes

1. Place the blade in the space provided and secure it in place.



The blade is slid into place between the guard and the base of the knife.

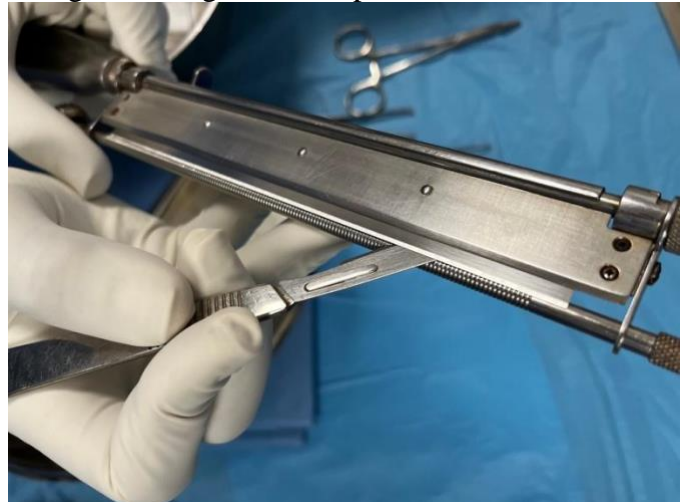


Once in place, the blade is gently slid until its grooves are engaged by the tabs on the base of the knife.



The cover is slid over the blade and secured by sliding it in the direction shown by the Red arrow.

2. Measure the gap between the blade and the guard using a #10 scalpel blade.



The space between the guard and the blade is measured with a #10 scalpel blade, which should just barely fit in the space all along the length of the blade.

3. Adjust the thickness of the gap. Verify with the scalpel blade, as it should fit with no room to spare all along the gap. In some knives, there is a separate thickness adjustment on each side of the knife.



Adjustments to the thickness of the blade are made by turning the dial. On some models of the Humby knife, there is another dial that secures the thickness once the adjustment has been made.

Mechanical Dermatomes

1. Put the throttle on "Safe" mode. Alternatively, assure that the dermatome is not connected to power during setup.

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On this air-powered dermatome, the throttle (Green arrow) is squeezed to activate the machine. Currently it is in safety mode. When the throttle is raised away from the handle and the black switch on the throttle is moved downward, the button (shown by the Red arrow) can be depressed when the throttle is squeezed. Note also that the dermatome is not connected to its air hose, an extra measure of safety for installation and setup.

- Place the blade in the space provided, assuring that the hole in the blade is aligned with the drive pin.
- Place a plate of the desired thickness in place and tighten the screws. Do not tighten excessively.



Plates of different sizes can be fixed over the blade to assure harvest of a perfectly uniform width of split thickness skin.



The disposable blade (Green dot) is made of metal and white plastic fused together. It is placed with the correct side facing up so that the drive pin (Blue arrow) passes through the hole in the plastic. The plate (Red dot) is then placed above the blade and the screws tightened. The blade must lie freely in the space, as it will vibrate when the machine is engaged



The dermatome completely assembled and ready to be calibrated and used. Source: Hoffman HT (ed) Iowa Head and Neck Protocols "Case Example Split Thickness Skin Graft STSG Zimmer Dermatome settings" <https://medicine.uiowa.edu/iowaprotocols/case-example-split-thickness-skin-graft-stsg-zimmer-dermatome-settings> Accessed 5 May 2022

- Set the desired skin graft thickness by turning the control lever adjustment knob.

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of the gauge will chip or dull the blade. Source: Hoffman HT (ed) Iowa Head and Neck Protocols "Case Example Split Thickness Skin Graft STSG Zimmer Dermatome settings" <https://medicine.uiowa.edu/iowaprotocols/case-example-split-thickness-skin-graft-stsg-zimmer-dermatome-settings> Accessed 5 May 2022

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The control lever adjustment knob can be set to the desired thickness of the graft, in mm or inches.

5. Measure the thickness with a feeler gauge or #10 scalpel blade. (Note that the Owner's Manual of some dermatomes say to omit this step, but our practice is to never assume that the machine is properly calibrated.)



The space between the blade and the guard (Blue arrow) should be gently probed with a #10 scalpel blade or feeler gauge along the entire length of the space. Careless or aggressive insertion

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