An Argument Against Tissue Removal During Hair Transplantation Incisions vs. Punches

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Hair transplants can be placed into recipient sites created by punches or into small linear incisions created by scalpels. With punches, tissue is placed into the void caused by tissue removal. When using scalpels and small incisions, there is no tissue removal. The option that recreates nature is preferable. The method causing the least amount of scar tissue causes less alteration is scalp morphology. It is of utmost importance to maintain the integrity, appearance, and feel of the scalp. Prevention of scarring will create the best aesthetic and most natural results.

It has been noted by some that grafts inserted into holes where tissue is removed does not look as natural as follicular units placed into incisions. On the other hand, experienced surgeons who employ punches report high patient satisfaction. A satisfied patient in which punches are used or an unhappy patient on whom incisions are used should not obscure the facts. The method that is most effective must be determined without regard to expense (to the patient or surgeon), number of technicians needed, length of surgery, or ease of performance. Only truth will combat error. Patients considering hair transplantation look to us as physicians who can provide results of the highest quality. The skills needed to create these results must be recognized and learned. The factors below explain, on a mathematical, anatomical, and theoretical basis, the disadvantages of tissue removal and advantages of small incisions.

1. Net removal of scalp tissue

With permanent scalp removal there will be disruption of scalp anatomy and morphology. Using punches there is a "net loss" of scalp tissue.

Let me explain the concept of "net loss". Using incisions (other than the small amount of tissue that is discarded during dissection) the scalp that is removed from the donor is inserted into the recipient area, hence no net loss of scalp tissue. Using punches, tissue in the recipient area is intentionally removed and discarded. The holes are filled with tissue from the donor area. There is no loss of tissue in the recipient area as the holes are filled. (There is probably more tissue when scar tissue is added.) The "net loss" is actually in the donor area. Therefore, when using punches one actually does do a scalp reduction but what is not said and seems to be not understood is that the scalp reduction commonly referred to in this situation is in the donor area, the area of the scalp that has the greatest remaining density. What is the need for, or advantage of effectively doing a scalp reduction in the donor area? This net loss, especially experienced over and over, theoretically causes alteration of the stratification of and disruption of the scalp anatomy. Incisions cause no net loss and therefore are less disruptive.

The skull is a fixed object and must be covered by the same tissue surface area. To truly "reduce" scalp, a craniotomy should be performed, bone removed, lessening the amount of fixed bony surface area to be covered. Then the amount of scalp needed can actually be reduced. I hope we don't get to that point.

From a farmer's perspective, the less land I have, the less hay I can grow. The Blasket Islands in Ireland lie off the most westerly point of Dingle Peninsula. Great Blasket Island was once the home of a thriving community. Its population recovered fully from the Great Famine and actually grew. After World War I a rapid decline set in but the final blow was when the supply of turf (to burn to heat the houses) ran out in the 1930's. (1) The final blow to our patients is the exhaustion of their turf.

2. Incision Damage and Healing Surfaces

Linear incision damage and linear healing surface are greater with scalp tissue removal by punches. This causes a greater amount of scar tissue to be formed.

Incision length with 1mm diameter punch is equal to Pi x dia. or 3.14mm. (**Fig.1**) Incision length with 45° microsurgical scalpel is approximately 2mm. On average, both accept a graft containing 3-4 hairs. The increased linear incision damage, 3.14mm vs. 2.0mm (1.14mm per site) is 36%. Performing 500 punches of 1mm diameter will create 57cm (22.4 inches) more incision damage than 500 incisions 2mm in length. (To actually calculate these surface areas, three dimensional space (volume) should be calculated. For the sake of simplicity I am limiting this discussion to linear calculations. Please use your 3-D imagination and extrapolate.)

Both sides of this 2mm incision must heal therefore linear healing surface must be calculated. With an incision, 2 mm of linear incision damage is expanded to 4 mm of linear healing surface. When calculating linear healing surface created by a punch the additional horizontal surface at the base of the cylinder must be included. (**Fig.2**) Let's say this horizontal healing surface at the base is 1mm in linear terms. This hole now has 4.14mm of linear healing surface. Linear vertical healing surface of 3.14mm and linear horizontal healing surface of 1mm. (Incisions-4mm, holes-4.14mm, giving the advantage to incisions by 10%) This horizontal surface is not smooth but irregular as the condemned tissue is ripped from its base, not incised. Intuition tells us the scar tissue will be thicker here. Add to that, these healing surfaces are at right angles when using punches, horizontal and vertical. Intuition tells us the scar tissue will be thicker here. When using incisions the angular healing surfaces meet without an interposed perpendicular horizontal surface created, no tissue is ripped, and the healing surfaces are smooth. Punches therefore create 36% more linear incision damage and add 10% more linear healing surface by adding a horizontal plane of disruption. (When performing the math with incision length less than 2mm, which is often the case, the results will be significantly more favorable for incisions.)

3. Scarring

Scar tissue creates color changes, hypo and hyperpigmentation, and altered light reflection causing an unnatural appearance of the scalp.

With the small size of today's grafts, scarring is not the problem it was with larger grafts of the past. But even small punches create more scar tissue in my argument above and will alter light reflection more than follicular units placed into incisions. The damage is cumulative. In my experience when punches are used over and over, more hypo and hyperpigmention is seen compared to incisions used over and over. One only needs to look at the patients.

4. Langer's Lines

Langer's lines (Fig. 3) are violated to a much greater degree when circular sections of scalp are removed leading to more scarring when compared to incisions made parallel to Langer's Lines.

A circle will be tangent to Langer's lines in 2 degrees out of 360 (0.006%) hence a 1mm diameter hole which has a 3.14 mm perimeter will incise and violate these lines 3.12mm (3.14x0.994) to some degree. I spoke with Patrick Frechet at a meeting 2 years ago and at that time he stopped using coronal incisions for his linear grafts. At that time he thought the amount of scarring was unacceptable and began using sagittal incisions. Other surgeons do use coronal incisions which violate Langer's lines. I attempt to make my incisions parallel to these lines as much a possible.

5. Alteration of anatomy

Devascularizton, denervation, and removal of other vital components from the scalp by punches can lessen the growth of transplanted hair.

See "Net loss" of scalp tissue. This is more a global (entire scalp) phenomenon (repeated scalp reductions in the donor area creating the "net loss" of vessels, nerves, etc.) and absolutist philosophy. The increased scar tissue created with punches is an additional factor retarding blood flow, healing, and growth.

6. Removal of non-hair bearing tissue

The myth that punches remove "bald" skin is mathematically incorrect.

Tissue removal is often cited as an advantage of circular punches. The surface area of skin of 1mm diameter circle is 0.785mm2 (Pi r2). The surface area covered by one hair of average diameter (0.07mm) is 0.0038mm2 (Pi r2). (**Fig. 4**) Four hairs present on a circular section of skin 1mm in diameter will occupy 0.015mm2. (**Fig. 5**) This is 1.9% of the surface area of that piece of tissue (0.015/0.785). When this amount of non-hair bearing skin is removed it is replaced with skin that is 98.1% non-hair bearing. (**Fig.6**) In fact very little skin not bearing hair is actually removed.

A 4 mm punch removes 12.5 mm2 of surface area instead of 0.78. Intuitively one would think that removing larger pieces of scalp would be more favorable in terms of "bald" skin removal, when in fact the opposite is true. Using the same calculations, a 4mm diameter circle of scalp that contains 20 hairs will be 99.4% non-hair bearing. The amount of tissue that actually is covered by the hair is 0.6%. When 12.5 mm2 of tissue is removed, replaced by a graft that is 99.4% bald, a greater percentage of bald replacing bald occurs than with the 1mm diameter graft. Again, the greatest net removal of tissue is in the donor area where effective permanent tissue removal occurs.

- 1mm dia. surface area w/ 4 hair = 1.9%-covered with hair
- 2mm dia. surface area w/ 10 hair = 1.1%-covered with hair
- 3mm dia. surface area w/ 15 hair = 0.8%-covered with hair
- 4mm dia. surface area w/ 20 hair = 0.6%-covered with hair

Contemporary dermatologic and hair restoration literature continues to cite the myth that punches remove bald skin. “Elliptografts remove balding scalp tissue.” (2). Unless one is convinced that removing if effect, at most, less than 2% of the surface of the discarded tissue is significant, belief in this supposed dogma is no more than the blind acceptance of a myth.

7. Fit

Incongruent fit occurs when tissue that is not round is inserted into a round hole created with a punch. (Fig.7)

I carefully inspect the size of the grafts in every patient, every graft size, and make the incisions to fit the grafts. My assistants cut grafts that fit into the incisions. Unless grafts that are put into holes are round, as standard (4.0mm) grafts were, there is incongruent fit. Does anybody put small round grafts into small round holes of 0.75, 1.0, 1.3, or 1.5mm diameter? Usually micro and minigrafts put into holes are cut from a linear donor strip and are any shape but round.

8. Fit

Rotation of a graft is necessary to cause perfect fit. The 360-degree configuration of a circle makes correct placement more difficult (360 choices) than placing into an incision that has 180-degree configuration (two choices).

The secret to placing in incisions is to pick the graft up in the proper 180-degree orientation. If not, all it takes is a quick 180-degree rotation for proper orientation. The rotational fit can be equally perfect with incisions or punches. It depends on the experience of the placers. With experienced skilled placers this is not a significant factor.

9. Space

Grafts larger than one follicular unit become compressed causing a micro-migration of partially liberated follicular units (compression) and an unnatural reinterpretation of space.

Large grafts put into incisions that are too small create some of the most unsightly results ever seen due to compression. Any graft larger than a follicular unit, even when put into a proper sized incision, has the potential to become compressed as they, the follicular units, are now free to roam about.

10. Economy

When space is correctly (naturally) interpreted fewer hairs are needed to create adequate density.

This is the point of the entire discussion. Using punches there is a “net loss” of scalp tissue that alters three-dimensional space. There is also compression and increased scarring making it impossible, when compared to incisions, to correctly interpret space.

That is, the natural spacing of follicular units. With a limited number of available donor follicles their economical use is imperative.

One may argue that when using punches, grafts larger than the diameter of the recipient hole are used whether the hole is 1mm or 4mm diameter. I totally agree. The same size hole and graft are used in the examples above for ease of calculation. The reality of graft larger than hole actually strengthens the argument as follows:

1. Net loss- The discarded tissue in the recipient area and hence net loss doesn't change. Using a graft that has a larger diameter than the hole in the recipient scalp increases the amount of tissue removed from the donor area resulting in an even larger scalp reduction in the donor area.

6. Removal of non-hair bearing tissue- By adding these pieces of skin larger than the hole created, not only is there not a "scalp reduction in the recipient area", one is actually performing a scalp addition in the recipient area, just the opposite of that which is commonly stated.

9. Space- This size differential, graft larger than hole, causes even more compression of follicular units making an unnatural distribution more unnatural and unsightly due to increased compression.

The comments and theories above are not proven by scientific studies but represent and support a philosophy that minimizes wounding of the scalp and recreates the natural distribution of hair for the benefit of the patient. I have made suppositions, used my imagination, and taken mathematical license to explain these ideas. The observation of these minute details comes from personally placing approximately 100,000 grafts per year and having the time, while placing, to contemplate these details. The points of this argument, to some, may be construed as trivial or as "splitting hairs". To quote Mies Van der Rohe, architect and father of the modern skyscraper, "God lives in the details."

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1. **"The Blasket Islands"**, Ireland of the Welcomes, Vol. 50, No. 4, pg. 24, July-August 2001
2. **Sadick N; "Elliptografting: The Right Fit"**, Dermatologic Surgery, Vol. 27, #8, Aug 2001, pg. 742