How to improve graft survival in hair transplantation?

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Abstract
Despite the improvements in the methods of hair transplantation, results are not always satisfying. The viability of grafts is one of the most challenging problems in the hair transplantation. This is especially important in case of mega sessions, when the time of ex vivo maintenance of the follicles increases significantly.

The purpose of our study was to evaluate the morphological changes of grafts and to define time frames of follicles’ viability at the various stages of hair transplantation.

On the base of presented results, the timing of various stages of hair transplantation may be optimized to increase the survival rate of grafts and improve the effect of hair transplantation.

Introduction
Hair transplantation is the only effective method to restore hair in case of androgenic and cicatricial alopecia. Its popularity has significantly increased in recent years; consequently the number of the specialists of hair transplantation has risen. Over the past 15 years, hair transplantation has transformed from a simple 1-2 hour procedure, in a very difficult, 5-10-hours microsurgical operation, when it is possible to transplant hundreds and sometimes thousands of grafts. It requires the coordinated work of numerous highly qualified staff. Despite the improvements in the methods of hair transplantation, results are not always satisfying.

The viability of grafts is one of the most challenging problems in the hair transplantation. This is especially important in case of mega sessions, when more than 3,000 grafts are transplanted during one surgical intervention, while the time of ex vivo maintenance of the follicles increases significantly.

One of the key factors, affecting the grafts survival is warming and dehydration of grafts. Generally recognized method of graft preservation is cooling them to + 4-5°C in saline or Ringer solution.

What happens in follicles during the time of ex vivo maintenance? This is the question to which we would like to answer. For this reason we have carried out an original research.

The purpose of our study was to evaluate the morphological changes of grafts and to define time frames of follicles’ viability at the various stages of hair transplantation.

Material and methods
All the patients included into the study underwent autologous hair transplantation by the method of micrografting with use of strip technique. After excision of donor strip, dissecting the grafts was performed with the use of stereoscopic microscopes, the prepared grafts (Figure 1) were collected on a gauze container soaked in saline (25-30 grafts per container) and kept in a fridge at +4 - +5°C until implantation to recipient zone. During the implantation the container was placed on the back of surgeon’s hand. This is the classical scheme of working used by the majority of hair transplantation specialists.

The research of the follicle ultra-structure has been carried out in an electrical microscope JEM-1200 EX-II according to the mainstream methodic.

The tissues were embedded and Epon-812, cut and stained as semi-thin slices for choice of the region of interest. Then the chosen areas of samples were prepared for TEM following the conventional protocol and studied under transmission electron microscope JEM-1200 EX-II (Japan).

Figure 1. The total image of micrografts.
Results

It has been shown that in 10 minutes after dissection the cells of germinative zone of follicles were well preserved in the grafts located on the preparatory table at room temperature (22°C) (Figure 3).

The dynamics of the grafts viability, located on the preparatory table, depending on the period of their being on the container has shown that after 12 minutes there were significant changes at the ultra-structural level, and in 20 minutes the irreversible changes were noticed, meaning cellular death (Figure 4). These changes indicated rupture of cell membranes (plasma membranes were not visible), destruction of cytoplasmic organelles, elution of chromatin from nuclei.

The plasma membranes are not visible. The cytoplasmic organelles are destroyed, washed chromatin nuclei. Changes are irreversible - cellular death.

The grafts placed on surgeon’s glove remained intact during the first 4 minutes (Figure 4).

The dynamics of the study showed that after 5 minutes their viability notably decreased and on the 8th minute the grafts died (Figure 6).

The grafts, which were kept in a fridge at +4 - +5 °C, demonstrated perfect structural conditions during the first 3-4 hours, while a viability rate at 24 hours was about 71%.

| Time (min) | Total number of grafts | Number of viable grafts |
|-----------|------------------------|-------------------------|
| 10        | 5                      | 5                       |
| 12        | 5                      | 4                       |
| 14        | 5                      | 2                       |
| 16        | 5                      | 2                       |
| 18        | 5                      | 1                       |
| 20        | 5                      | 0                       |

Table 1. Viability of grafts depending on the period of their being on the container.

Conclusion

Performing the electro microscopic study of the structural condition of the grafts has allowed to identify time frames of their survival.

1. Graft spending time on the container during dissecting not more than 10 minutes.
2. Graft placing time on the doctor’s hand during the
transplantation, not more than 4 minutes (optimally 2-3 min.)

3. The optimal time of the graft kept in the fridge at +4-5°C is 3-4 hours.

On the base of presented results it can be concluded that we can optimize the duration of different stages of hair transplantation. This will increase the survival rate of grafts and improve the results of treatment.

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