



forum

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The Okuda Papers

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I have known of the existence of these historic papers for many years. Due to the old kanji (Japanese pictographs) employed, the writing is unintelligible in parts to modern Japanese medical readers. In addition, the work is very long (50 pages of kanji), so for these reasons it is unlikely that any previous English translation exists. It is possible that there was a German translation in the 1940s, as Rolf Nordstrom was told of the existence of this work by a German surgeon Professor H.C. Friederich over 20 years ago. The technique employed by Okuda was virtually identical to that employed by Orentreich some 16 years later and Professor Friederich preferred to use the term Okuda/Orentreich technique when referring to modern punch grafts.

When visiting Japan in August 2003, I



Dr. Yoshihiro Imagawa, at the request of his son Dr. Kenichiro Imagawa, translated the Okuda papers into English.



Kenichiro Imagawa, MD was shown the papers in the original Japanese by ISHRS colleague, Dr. Kenichiro Imagawa, who practices in Yokohama. We discussed what a pity it was that these pages, loaded with scientific detail, were not available to us. He explained that he personally found it very difficult to read the work, but that his father, Dr. Yoshihiro Imagawa, a retired Gynaecologist who had lived some years in the United States, may be able to help with the outdated Kanji. True to his word, the translation, in near-perfect English, was ready by the time of the New York ISHRS meeting two months later, written neatly in long-hand and covering 211 pages; an amazing achievement for anyone, and a miraculous labor for the love of science for a man of 82 years.

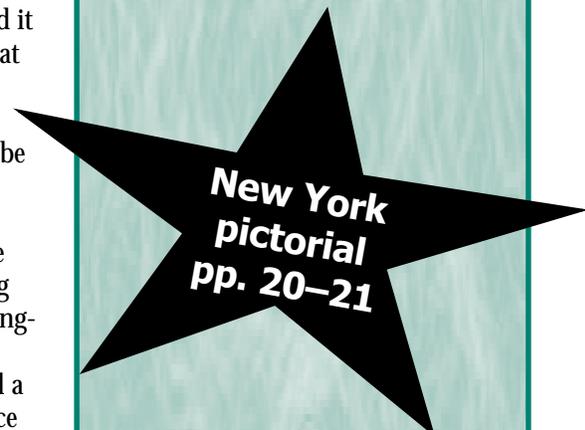
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Okuda the Man

We know nothing about Shojui Okuda or his contemporaries, although we have begged our Japanese colleagues to try and investigate these men for the past eight years. We do not know if he was a dermatologist, plastic surgeon, or histologist, though it likely he was the former. It is to be hoped that the publication of this summary of Okuda's work on hair transplantation will stimulate research on their rich scientific past and the men responsible for it.

The Papers

Okuda's work is divided into 5 separate sections and may have been intended for publication in 5 separate issues of the *Japanese Journal of Dermatology and Urology*. It was eventually published in a single issue of the *Journal* (Vol. 46:6) in 1939, so one can only speculate that, with war looming, the contributions were light that month and the Editor needed to fill some space urgently. That each section was meant to stand alone is evident by the frequent repetition of material that has not been edited out. This is most apparent when the work is read at one sitting (as I did on the plane flying back from New York in October this past year).

The opus is entitled *Clinical and Experimental Study of Living Hair Transplantation*. The individual sections are:

- I. Clinical and Experimental Studies of Living Hair Transplants to Alopecia
- II. Histological Studies in Humans after Hair Transplantation
- III. Experimental Studies with Homografts and Heterografts in Animals
- IV. Histological Results from Animal Experiments in Autografts and Heterografts
- V. Studies in the Nerve Changes in skin after Living Hair Transplantation

PART I. CLINICAL AND EXPERIMENTAL STUDIES OF LIVING HAIR TRANSPLANTS TO ALOPECIA

CHAPTER 1. This section of the paper reviews the past literature on the transplantation of small free hair-bearing skin grafts and cites Schweininger (1875), Tieffenbach (1882), Thiersh, Eisenberg, Krause (1896), Reverdin, Devis, Braun, Kromayer, Enderlin, Takahashi, and others, all long forgotten. He also mentions the successful use of pediculated skin flaps by Gussman in 1872. Working with guinea pigs, Makita showed that auto-transplantation of skin and hair was successful, but that hetero-transplantation was not.

Sasagawa in 1929, using a needle of his own design, implanted doubled-over human hairs into scar and pubic regions with variable results. Some hairs remained in place for many months, while others became infected and fell out. Kruius developed a special implanting needle, and this was used by Sasagawa in 1929 to implant eyelashes using scalp, pubic, and axillary hair as donor material.

Okuda, writing these 5 papers in 1939, claimed to have successfully used homografts for 10 years in over 200 cases of cicatricial and congenital alopecia of the scalp and pubic hair loss.

CHAPTER 2. Okuda describes his specially designed "round saws," which he said were similar to those of Kromayer (1936). They came in a range of sizes from 1.0–5.0mm in diameter and seem similar to Orentreich's early finger-operated punches. Okuda used scalp, brow, axillary, and pubic hair, but preferred scalp hair, because it was easier to acquire and gave him the best results.

He emphasized that the cylinders of skin must be full thickness and noted that the smaller cylinders were cosmetically advantageous. He said that 1.0mm grafts were extremely difficult to cut, and one seldom obtained the hoped-for 1–3 intact hair follicles. For practical reason, larger caliber trephines of 2.5–4.0mm, which contained many intact follicles, were generally used.

Okuda described his technique in detail. He clipped the donor scalp with scissors, painted the scalp with tincture of iodine and then 70% alcohol. After local anesthesia, the trephine was rotated deeply to the level of the subcutaneous fat layer, taking particular care with hair direction and depth of the hair roots. The incised plug was pulled up with tweezers, and the subcutaneous attachments were then cut with fine scissors. Injured hairs and connective tissue that might act as a foreign body were trimmed away with scissors. Smaller donor holes were allowed to heal spontaneously, but larger ones, or those that continued to bleed, were stitched. He said that hair growth could be expected within 3–4 months.

Okuda noted that recipient sites were made in the same manner, but should be prepared with trephines of 0.5–1.0mm, smaller than the diameter of the grafts, and the donor plugs were to be inserted so as to be level with the recipient site or slightly lower. Tens to hundreds of plugs could be prepared and inserted at one time, and no sutures were required to hold them in place. The grafts were completely accepted within a few days.

CHAPTER 3. Okuda details his experimental results in 1 male and 4 females, ranging in ages from 23 to 51 years, in whom he grafted 2.0–4.0mm hair-bearing plugs from the scalp onto the upper arm. He described in detail the changes that were observed in the grafts from day 1 to day 300. All grew well, but the larger sizes were more successful.

CHAPTER 4. Okuda repeated his arm transplant experiments with patients of similar and dissimilar blood groups and between related and unrelated individuals. The grafts all gradually became necrotic, and none of the patients grew hair. Okuda used plugs from these patients for his later histological papers.

In a follow-up of the 200 cases performed over the preceding 10 years, Okuda was able to locate 30 individuals

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and reported fair to excellent results in 9 males (eyebrow and moustache areas) and in 21 females aged 21-30 (pubic area). He includes photographs of several typical results. There was no record of any attempt to treat male or female pattern baldness. In a paragraph forestalling Sungjoo Hwang by 60 years, he states: *“Transplanted eyebrow hairs continue to grow, due to their inherent nature and need to be continually trimmed with scissors for several years. Later they gradually assimilate the recipient graft area morphology.”*

PART II. HISTOLOGICAL STUDIES IN HUMANS AFTER HAIR TRANSPLANTATION

This section covered the detailed histological findings that Okuda observed in his experiments with autografts and heterografts in human subjects. He removed his experimental grafts from their recipient site on the outer surface of the subject's arm at regular intervals and detailed his macroscopic and microscopic findings in some 10 pages of concise Japanese. Those with a particular interest in the progressive histological changes should write for further details.

With heterografts, the intense cellular infiltration and rapid breakdown of structures was noted. The hair follicle was completely destroyed within 3 weeks of transplantation, with only scattered melanin granules remaining. The skin had sloughed off, and the sebaceous and sweat glands had disappeared from the specimen within 4 weeks. The void was filled with developed connective tissue containing a paucity of elastic fibres.

In homografts the cellular infiltration was much less intense and typical of any acute diffuse inflammation. Eosinophils and lymphocytes were less numerous. The upper layer showed mild degeneration, but the lower layers remained healthy and the follicles soon regenerated.

PART III. EXPERIMENTAL STUDIES WITH HOMOGRAFTS AND HETEROGRAFTS IN ANIMALS

In this paper Okuda describes his experiments of 1–3mm homografts and heterografts of hairy skin in several species of laboratory animals. He used rabbits, guinea pigs, and a calf. He worked on both normal and scarred skin grafting black-haired grafts to white-haired regions and visa versa.

He found similar results as with humans, but noted that the hair fall-out was quicker, and regeneration occurred within 50–60 days in rabbits as opposed to 80–90 days in humans. In guinea pigs the cycle of fall-out and regeneration is even faster at 20–30 days. With calf skin he experienced very little telogen and most hairs were actively growing within 30 days.

In all three species he noted donor dominance in regard to hair color. White hair remained white when transplanted into a black region, and the black donor grafts remained black in a white recipient zone. In one experiment he transplanted what we would describe as micrografts from a rabbit's 3–6cm long eyebrow hair (the tentacle) into 1mm holes in the rabbit's shaved nape of the neck. In many cases these hairs grew to full length within 100 days.

The heterografts, even between mother and offspring or between litter mates, all failed to grow, except in a single instance where a white-haired rabbit, showing a good growth of black hair from a litter-mate suddenly died after 37 days.

PART IV. HISTOLOGICAL RESULTS FROM ANIMAL EXPERIMENTS IN AUTOGRAFTS AND HETEROGRAFTS

As in PART II above, Dr. Okuda carefully correlates the physical findings in PART III with the histological findings in great detail (some 11 pages of Japanese kanji). This is painstaking

research, and anyone with a specific interest in the details should consult the Japanese original or contact the author for access to the 30 pages of Dr. Imagawa's English translation.

PART V. STUDIES IN THE NERVE CHANGES IN SKIN AFTER LIVING HAIR TRANSPLANTATION

This was an histological examination of the nerve breakdown and regeneration in homografts and heterografts of humans and animals, using **two** special staining techniques (the nerve fibres do not show up under normal skin tissue stains). One method was developed by Dr. Furui at the Dept. of Pathology at Osaka University where, it would seem, all the above research was performed. The second method was developed by Dr. Kubo at the Kyoto University Dept. of Pathology and further refined by Tominaga at Osaka University. This is a variation on the traditional Ramon y Cajal method for nerve staining, but was much faster (although still taking 31 days in slide preparation).

In human homografts Dr. Okuda noted the richness of the nerve supply to each hair, noting the presence of a nerve plexus just below the hair papilla and a single nerve entering the papilla. Another plexus was seen surrounding the follicle just inferior to the opening of the sebaceous gland, with up to 50 unmyelinated “micronerve fibres” running up and down the long axis of the follicle.

Signs of nerve regeneration occurred within 30 days in human homografts and within 20 days in rabbits, guinea pig, and calf. With heterografts of all species tested most nerve tissue was severely degenerated within 10 days and no trace remained within 20 days. ♦

For further details, please contact either Dr. Richard Shieff (Melbourne, Australia) or the current *Forum* Editors.