

Last updated: October 10, 2019

Annotated Bibliography – PubMed Articles

Sorted by year, then author last name

2019

Ahmad M, Mohmand MH. Effect of surgeon's workload on rate of transection during follicular unit excision/extraction (FUE). Journal of Cosmetic Dermatology. 2019. PMIC: 31317641. doi: 10.1111/jocd.13078

Clinical Data.

This study compared transection rates at the beginning vs the end of the FUE procedure. Twenty five patients were included. This study found significantly higher transection rates at the end of the FUE procedure compared to the beginning, concluding that the surgeon's workload increases hair transection rate during FUE.

Bared A. What's new in facial hair transplantation?: effective techniques for beard and eyebrow transplantation. Facial Plastic Surgery Clinics of North America. 2019. PMID: 31280852. doi: 10.1016/j.fsc.2019.04.003.

Opinion.

This article describes the techniques refined for facial hair transplantation of beard and eyebrow hair with natural appearing results. The authors describe the preoperative consultation, operative technique, and postoperative care developed from their experience of over 1000 facial hair restoration procedures.

Chouhan K, Kota RS, Kumar A, Gupta J. Assessment of safe donor zone of scalp and beard for follicular unit extraction in Indian men: a study of 580 cases. Journal of Cutaneous and Aesthetic Surgery. 2019. PMID: 31057266. doi: 10.4103/JCAS.JCAS_142_18.

Clinical Data.

This cross-sectional study assessed follicular unit (FU) density in the donor area (both scalp and beard) in 580 Indian men, and proposes simplified guidelines for FUE. This study defines 3 areas on the scalp and 1 area in the beard as donor regions and quantifies the total available number of FUs for extraction (considering 25% extraction): 2064, 3097, and 3612 for the three areas on the scalp and 824 for the area in the beard. This paper provides useful guidelines of the estimation of the number of FUs that can be harvested from these defined areas.

Ekelem C, Pham C, Atanaskova Mesinkovska N. A systematic review of the outcome of hair transplantation in primary scarring alopecia. Skin Appendage Disorders. 2019. PMID: 30815438. doi: 10.1159/000492539.

Review.

Hair transplantation for primary scarring alopecia is a debated treatment option. This review determines efficacy of hair transplantation as a treatment option for primary scarring alopecia. FUE is viewed as a gold standard method due to the ability to individually pick desirable follicular units, no suturing required, and minimal scarring occurs. This study does not distinguish between the type of hair transplant technique used, but concludes that hair transplant surgery may represent a viable treatment option for controlled CCCA, en coup de sabre, DLE, pseudolade de brocq, and folliculitis decalvans, whereas LPP and FFA have reported both negative and positive results. The authors caution that these results must be interpreted with caution as they suspect a positive-result publication bias across the papers included in this review.

Gupta J, Chouhan K, Kumar A, Chandrasegaran A. A comparative study on the rate of anagen effluvium and survival rates of scalp, beard, and chest hair in hair restoration procedure of scalp. Journal of Cutaneous and Aesthetic Surgery. 2019. PMID: 31413480. Doi: 10.4103/JCAS.JCAS_49_18.

Clinical Data.

This study compared the survival rates of scalp, beard, and chest hair transplanted into the scalps of 5 patients. Hairs were excised using a sharp punch and simultaneously implanted (into slits made with a 0.9 mm blade) with forceps using a “no touch to root” technique. During the first two months post-implantation, anagen effluvium in scalp (40%) and beard (30%) were significantly less than body hair (53.3%). At 1 year post-implantation, excellent survival rates were achieved with beard (95%) followed by scalp (89%), then chest hair (76%).

Joshi R, Shokri T, Baker A, Kohlert S, Sokoya M, Kadakia S, Epstein J, Ducic Y, and Johnson RM. Alopecia and techniques in hair restoration: an overview for the cosmetic surgeon. Oral and Maxillofacial Surgery. 2019. PMID: 30788753. doi: 10.1007/s10006-019-00750-9.

Review.

This paper provides a comprehensive review of alopecia and the current techniques used in hair transplantation. This paper concludes that FUE and FUT are both widely used transplantation techniques and each has their own pros and cons. Optimization of outcomes has been possible with hair restoration technologies such as robotics and motorized FUE. Transplantations using FUE or FUT can be augmented with adjuvant treatments such as platelet-rich plasma injections.

Kerure A, Rohatgi S, Patwardhan N. Kerure Clamp: A new age tool to improve extraction technique in follicular unit extraction. Journal of Cutaneous and Aesthetic Surgery. 2019. PMID: 31413485. doi: 10.4103/JCAS.JCAS_185_18.

Clinical Data.

This study addressed the use of an innovative tool for FUE - the Kerure clamp. Twenty patients with male-pattern baldness underwent FUE using the clamp. A statistically significant improvement in the follicular transection rate was found on the side of the head where the clamp was used compared to the side where the clamp was not used.

Kerure AS, Agrawal S, Dhurat R, Ginzburg A, Sharma A. Using the combination of the Kerure clamp and serrated punch to decrease the transection rate in follicular unit extraction (FUE). Journal of the American Academy of Dermatology. 2019. PMID:31351095. doi: 10.1016/j.jaad.2019.07.056.

Opinion.

One of the biggest challenges of FUE is high follicular transection rate. Factors that contribute to high transection rates include acute angulation of the hair, increased skin laxity especially over the nape of the neck which makes scoring difficult. This article describes a traction device to overcome these issues. The device stretches the skin and aligns the hair straighter. The author recommends using a serrated punch along with this traction device which allows alignment of hairs to reduce transection rates.

Kim YS, Na YC, and Park JH. Comparison of postoperative pain according to the harvesting method used in hair restorative surgery. Archives of Plastic Surgery. 2019. PMID: 31113186. doi: 10.5999/aps.2018.00843

Clinical Data.

This study sought to investigate postoperative pain after hair transplantation using FUT vs FUE technique. Postoperative pain was assessed with the Wong-Baker Faces pain Scale on 241 enrolled patients (202 FUT; 39 FUE). The results indicate that the FUE group experienced significantly less pain than patients in the FUT group.

Kim YS, Na YC, Park JH. Hair transplantation in patients with hair loss or scar deformity in the side hairline after midfacelifting surgery. Archives of Plastic Surgery. 2019. PMID: 30934179. doi: 10.5999/aps.2018.00591.

Clinical Data.

This study evaluated effective means of approaching an altered hairline and the unavoidable scarring arising from midface-lifting surgery. Thirty seven patients were enrolled (24: FUT, 12: non-shaven FUE, 1: partial shaving FUE). All patients achieved a natural and satisfactory appearance regardless of the technique used. Thus, side-hairline correction surgery using FUT or FUE can be considered an effective method of correcting an altered hairline due to midface-lifting surgery.

Li KT, Qu Q, Fan ZX, Wang J, Liu F, Hu ZQ, Miao Y. Clinical experience on follicular unit extraction megasession for severe androgenetic alopecia. Journal of Cosmetic Dermatology.

2019. PMID:31529675 doi: 10.1111/jocd.13156.

Clinical Data.

The mega-session hair transplant procedure is a promising treatment for severe androgenetic alopecia. This study aimed to introduce the procedure and technical details of follicular unit extraction mega-session and to present the findings of the surgery outcome. Extraction was performed using a 1.0 mm punch, the number of FUs transplanted was 3000 - 6000, and the surgery duration ranged from 6-12 hours. Graft survival rate varied from 93.5% to 96.6%. Of the 273 male patients enrolled, 81% of them were satisfied with the outcomes, 19% of them had a second procedure performed to provide further hair density, and none of them had infection after the surgery. This study concludes that FUE mega-session is advantageous over multi-stage hair transplantation due to reducing operation frequency and overall surgery duration.

Mohmand MH and Ahmad M. Battle of the punches: comparison of transection rates of different punches during FUE. Journal of Cosmetic Dermatology. 2019. PMID: 31106951. doi: 10.1111/jocd.12957.

Clinical Data.

The objective of this study was to compare transection rates using three types of punches (sharp, serrated, and blunt) of the same size (0.9 mm) in the FUE technique. Ten patients were enrolled in the study. Each patient had 3 test areas, one for each punch type. The results indicate that transection rate is highest with the sharp punch (23.9%), followed by the serrated punch (18.8%), and the blunt punch (14.5%).

Park JH. Reply to nonshaven follicular unit extraction: personal experience. Annals of Plastic Surgery. 2019. PMID 31356233. Doi: 10.1097/SAP.0000000000002032.

Opinion.

One of the biggest obstacles with non-shaven FUE is difficulty identifying the hair exit angle. The author describes their personal experience with the non-shaven FUE technique and gives suggestions to overcome this barrier. The suggestions include having the patient in the sitting position, pre-trimming for the novice non-shaven FUE hair surgeon, frequent saline spray to overcome blood clots in the hair, and staff training as skillfulness of the assisting staff is crucial.

Park JH, Kim N, You SH. Secondary revision of female hairline correction surgery: personal experience. Aesthetic Plastic Surgery. 2019. PMID: 3098927. doi: 10.1007/s00266-019-01372-y.

Clinical data.

This study evaluated various surgical techniques in secondary hairline correction surgery in female patients. A total of 246 patients undergoing hairline correction surgery via hair transplantation were enrolled (156: FUT, 12: partial-shave FUE, 24: combination of FUT + FUE, and 54: non-shaven FUE). The results indicate that the FUE technique should be used on patients where additional strip surgery is not possible due to low scalp laxity. Due to the differing needs and characteristics of this patient population, evaluation of the donor and recipient areas and considering the patient's occupation, preferred hairstyle, age, and other factors are imperative when choosing the optimal harvesting method.

Park JH, You SH, Kim NR. Nonshaven follicular unit extraction: personal experience. Annals of Plastic Surgery. 2019. PMID: 30418195. doi: 10.1097/SAP.0000000000001679.

Opinion.

Within the field of FUE, non-shaven FUE (NS-FUE) is currently the most state-of-the-art surgical techniques. NS-FUE can either be done without cutting the hair, or pre-trimming. This article presents the authors' approach and methods for NS-FUE for different indications. The article details the surgical planning, preparation, patient position, anesthesia, and the NS-FUE procedure using a motorized FUE machine with a 1 mm sharp punch.

Rosati P, Barone M, Alessandri Bonetti M, Giorgino R, Panasiti V, Coppola R, Tambone V, Persichetti P. A systematic review of outcomes and patient satisfaction following surgical and non-surgical treatments for hair loss. Aesthetic Plastic Surgery. 2019. PMID: 31451851. doi: 10.1007/s00266-019-01480-9.

Review.

This systematic review identified 11 studies evaluating surgical treatment for hair loss that met their inclusion criteria. Questionnaires to analyze patient satisfaction were only used in 2 of these studies. A study on Micromotor FUE had the longest follow-up of 5 years. None of the studies compared FUE to FUT. This comparison would be beneficial to understand which technique gives superior and more permanent results. The paper concludes that at present, there is no clear and precise indications on which surgical technique should be preferred based on the defect to correct.

Rose PT, Nusbaum AG, Nusbaum BP, and Morgan MB. A comparison of apoptotic activity for follicular unit extraction hair grafts stored in different holding solutions. Dermatologic Surgery. 2019. PMID: 31274532. doi: 10.1097/DSS.0000000000001977.

Clinical Data.

Preserving FU grafts while they are outside of the body is a critical factor in obtaining optimal growth of transplanted follicles. This study compares saline, HypoThermosol, or HypoThermosol + ATP as holding solutions to prevent cell death (measured by anti-apoptotic Bcl-

2 expression) in FUE grafts. The results show that induction of Bcl-2 was greatest in follicles stored in HypoThermosol + ATP, followed by HypoThermosol alone, then saline; suggesting the use of HypoThermosol + ATP may offer protection against apoptotic mechanisms and result in enhanced follicle viability.

Seong GH, Lee DY, Kim MH, Park BC. Excessive and persistent local bleeding at the hair transplant site of a patient taking warfarin and its effect on hair survival. Dermatological Surgery. 2019. PMID: 31577566. doi: 10.1097/DSS.0000000000002190.

Case Study.

This article presents an FUT hair transplant patient on warfarin for atrial fibrillation. One day post-surgery the patient presented with a large amount of diffuse uncontrolled local bleeding, blood clots, and scalp swelling at the recipient site. The authors recommend that warfarin should have been stopped 5 days before surgery and replaced with a bridging agent. These results are applicable to the FUE procedure since the bleeding occurred at the recipient site.

Vano-Galvan S, Villodres E, Pigem R, et al. Hair transplant in frontal fibrosing alopecia: A multicenter review of 51 patients. Journal of the American Academy of Dermatology. 2019. PMID: 31350039. doi: 10.1016/j.jaad.2019.05.031.

Clinical Data.

The usefulness of hair transplants (HTs) in frontal fibrosing alopecia (FFA) patients is controversial. The main outcome this study measured was survival of the grafts after the HT, as evaluated clinically and by trichoscopy. FUT was performed in 44 patients, FUE in 7. All 12 patients presented with a graft survival rate of lower than 60% within a 5 year follow up window. This paper does not distinguish the results between FUT and FUE, however, these results are noteworthy for FUE HTS treating patients with FFA.

Yen CF, Lee MC, Huang YL. Refining techniques in eyebrow transplantation. Journal of the American Academy of Dermatology. 2019. PMID: 30802560. doi: 10.1016/j.jaad.2019.02.045.

Clinical Data.

FUE is typically performed to restore eyebrows, however problems that arise from this include injury of neighboring follicles, multiple punch-shaped scars at the donor site, and the donor hairs from the mid-occipital donor region are often thicker than eyebrow hair and look unnatural. This study investigated a variation of FUE to try to overcome these issues. The technique was to choose only three-hair follicular units to excise from the mid-occipital region, then longitudinally dissect them into one-hair units under a stereoscope. Micro-slits were created with a 20-G needle in the eyebrow, which hair grafts were immediately inserted into. The authors claim that the advantages of this technique includes: lower chance of injury to

neighboring hair follicles due to fewer FUs being excised, and less scarring.

Yoo H, Moh J, Park JU. Treatment of postsurgical scalp scar deformity using follicular unit hair transplantation. BioMed Research International. 2019. PMID: 31214613. doi: 10.1155/2019/3423657.

Clinical Data.

Post-surgical scar tissue on the scalp poses a challenge for hair transplantation due to tissue stiffness and poor blood circulation. This study sought to determine if FUE is a successful technique to use on patients with post-surgical scar tissue on their scalp. Fifteen patients with post-surgical scalp scar tissue underwent a single session of FUE. Evaluation at 12 months revealed mean graft survival rate of 80.67%. The authors conclude that FUE is a promising and effective method for hair transplantation on post-surgical scar tissue on the scalp.

2018

Ahmad M. A new practical classification for spatial distribution and morphology of human hair: Ahmad's LGMA classification. Journal of Cosmetic Dermatology. 2018. PMID: 28990286. doi: 10.1111/jocd.12427.

Guidelines.

There is a large variation in the distribution and spatial arrangement of hairs. This paper develops a new classification system for follicular units containing 4 categories: linear, grouped, mixed, and angular. The classification system was designed using high-resolution photographs of adult human scalps. This classification system will help hair transplant surgeons identify the 4 various patterns and aid in the decision making process of which size punch to use when conducting FUE.

Ahmad M, Mohmand MH. Analysis of the changes in scalp hair angles: In vivo and in vitro comparison before and after tumescence. Journal of Cosmetic Dermatology 2018.

PMID:29707914. doi: 10.1111/jocd.12556. [Epub ahead of print]

Original Clinical Data.

This article examines the hair shaft exit angles of grafts harvested using the strip technique. Although a strip procedure was used to acquire the hair samples, the results are applicable to the FUE procedure. Hair angle can influence the choice of punch and corresponding scar size. Hair angle can also influence transection rates.

Ahmad M. Comparison of tissue loss by different punches: a new A-design. Journal of Cosmetic Dermatology 2018. PMID: 29921001. doi: 10.1111/jocd.12538.

Case Study.

The type of punch used during FUE will impact wound size and scar size. In this study, four different punches were compared in 5 different patients undergoing FUE; a sharp, blunt, serrated and a new “A-design” punch. Initially the smallest wound size was found with the sharp punch, however, after 24 hours the A-design punch had the smallest wound size. The A-design punch also produced the smallest scar size 1 month post-surgery.

Akdag O, Evin N, Karamese M, Tosun Z. Camouflaging Cleft Lip Scar Using Follicular Unit Extraction Hair Transplantation Combined with Autologous Fat Grafting. Plastic and Reconstructive Surgery 2018;141(1):148-151. PMID:28938366. doi: 10.1097/PRS.0000000000003956.

Original Clinical Data.

FUE can be used to camouflage cleft lips. To help camouflage scarring and alopecia this study investigated the use of FUE in 20 different moustache transplantations. The transplanted grafts had a high survival rate 73.6% to 88.6% the 12 month follow period. Scars were less noticeable 12 months after surgery, rating a 3.2 on the Patient and Observer Scar Assessment Scale.

Almohanna HM, Perper M, Tosti A. Safety concerns when using novel medications to treat alopecia. Expert Opinion on Drug Safety. 2018 Oct 13. PMID:30318935. doi: 10.1080/14740338.2018.1533549. [Epub ahead of print]

Review.

This article reviews the adverse effects of new therapeutic including FUE, minoxidil and platelet-rich plasma. Hypopigmentation and other mild complications such as subdermal cysts and drug gastritis secondary to NSAID analgesics are among FUE’s reported adverse events.

Donor area thinning may also be a negative cosmetic result of this harvesting technique.

Bared A. Introducing Hair Transplantation into a Facial Plastic Surgery Practice. Facial Plast Surg. 2018 Aug;34(4):384-388. PMID:30041271. doi: 10.1055/s-0038-1666785.

Review.

Facial plastic surgery practices maybe have a great need for hair transplantation. These two field can complement each other helping to strengthen the natural appearance of reconstructive and aesthetic surgery results. No further information could gathered as the full text of the article is not available.

Garg AK, Garg S. Donor harvesting: follicular unit excision. Journal of Cutaneous and Aesthetic Surgery. 2018. PMID: 30886473. doi: 10.4103/JCAS.JCAS_123_18.

Review.

This article is a comprehensive review of the FUE technique. The authors provide historical perspective, nomenclature, science behind FUE, types of punches, a guide for the novice surgeon, complications, disadvantages and advantages, and ethical issues relating to FUE.

Kerure AS and Patwardhan N. Complications in hair transplantation. Journal of Cutaneous and Aesthetic Surgery. 2018. PMID: 30886471. doi: 10.4103/JCAS.JCAS_125_18.

Review.

Although hair transplantation is a relatively safe surgery, it is important to be aware of the complications that can occur. This review outlines the complications that can arise with FUT and FUE and presents procedures and techniques to help reduce and manage these complications.

Kim N. Park JH. Pubic Hair Restorative Surgery Using Grafts Harvested by the Nonshaven Follicular Unit Extraction Technique. Dermatology Surgery 2018;44(8):1115-1120. PMID: 29462020. doi: 10.1097/DSS.0000000000001497.

Original Clinical Data.

The non-shaven follicular unit extraction procedure can be successfully used in pubic restorative surgery. Fifty female patients with a history of abdominal liposuction, abdominoplasty, and/or a cesarean section underwent non-shaven follicular unit extraction procedures. Satisfactory results were found 10 months post-surgery.

Klingbeil KD, Fertig R. [Eyebrow and Eyelash Hair Transplantation: A Systematic Review](#). The Journal of Clinical and Aesthetic Dermatology 2018;11(6):21-30. PMID: 29942421.

Review.

FUE could be quite advantageous in the context of eyebrow and eyelash surgery. For thin eyebrows, one hair follicle/unit can be extracted using FUE and if maximum density is desired four hair follicle/units can be harvested. FUE allows harvesting to occur outside the

scalp regions which can help match the desired density of the eyebrow. FUE is also commonly used to harvest a small number of follicles to help reconstruct eyelashes. The increased operating time and the need to shave prior to harvesting are among the drawbacks of using FUE.

Kumaresan M and Mysore V. Controversies in hair transplant. Journal of Cutaneous and Aesthetic Surgery. 2018. PMID: 30886470. doi: 10.4103/JCAS.JCAS_118_18.

Review.

This article details the issues that are arising in the field of hair transplantation such as ethical issues and lack of evidence. Regarding FUE, this review discusses the following topics: safe

donor area, FUT vs FUE (donor scarring, quality of graft, transection rates, graft number yield, technical expertise, complications, team and set-up), and who can perform hair transplant surgery.

Mohebpour A, Gianfaldoni S, Lotti T, Ramirez-Fort MK, Lange CS, Sadeghi-Bazargani H, Wollina U, Tcherney G, Feily A. Recycling of Previously Transplanted Hair: A Novel Indication for Follicular Unit Extraction. Open Access Macedonian Journal of Medical Science 2018;6(6):1095-1097. PMID: 29983809. doi: 10.3889/oamjms.2018.096.

Case Report.

Poorly implanted hairs can be reused with the aid of FUE as shown in a case study of a 26 year old man. In this case study, FUE was used to obtain 32 grafts from a previously transplanted area and re-implanted into desired locations. A high survival rate ($26/34 = 76\%$) was found 5 months post-surgery.

Navarro RM, Pino A, Martinez-Andres A, Molina C, Martinez AM, Martinez N, Orive G, Anitua E. The effect of plasma rich in growth factors combined with follicular unit extraction surgery for the treatment of hair loss: A pilot study. J Cosmet Dermatol. 2018 Oct;17(5):862-873. PMID:29076290. doi: 10.1111/jocd.12446.

Original Clinical Data.

PRP can reduce postsurgical crust healing and decrease inflammatory pain when incorporated into FUE procedures. This small, randomized study compared hair transplant subjects that underwent PRP during their FUE procedures ($n=15$) with 15 hair transplant subjects that did not (FUE alone, $n=15$). The addition of PRP induced a faster crust healing and hair fixation ($p<0.05$), significantly decreasing postsurgical inflammation ($p<0.05$).

Rodman R, Sturm AK. Hairline Restoration: Difference in Men and Woman-Length and Shape. Facial Plastic Surgery 2018;34(2):155-158. PMID:29631285. doi: 10.1055/s-0038-1636905.

Original Clinical Data.

Understanding the differences between men and women's hairlines are pivotal to obtaining a more natural appearance. With the aid of FUE patients can achieve natural looking results with very little downtime. Further detail could not be obtained as the full text was unavailable.

Rose PT. Advances in Hair Restoration. Dermatologic Clinics 2018 Jan;36(1):57-62. PMID:29108547. doi: 10.1016/j.det.2017.09.008.

Review.

This article summarizes the advancements made in hair restoration. Robotics, motorized

follicular unit extraction, platelet-rich plasma injections, lasers and stem cells are among the subjects discussed. Further detail could not be obtained as the full text was unavailable.

Sadick NS. New-Generation Therapies for the Treatment of Hair Loss in Men. Dermatologic Clinics 2018;36(1):63-67. PMID:29108548. doi: 10.1016/j.det.2017.08.003.

Review.

This article summarizes new generation therapies in the field of hair restoration.

Follicular unit extraction, adjuvant modalities such as stem cells, and platelet-rich plasma are among the subjects discussed. Further detail could not be obtained as the full text was unavailable.

Tan JJ, Kang L. Engineering the future of hair follicle regeneration and delivery. Therapeutic Delivery 2018;9(5):321-324. PMID:29681238. doi: 10.4155/tde-2018-0007.

Review.

Abstract and full text is unavailable.

Venkataram A, and Mysore V. Logic of hair transplantation. Journal of Cutaneous and Aesthetic Surgery. 2018. PMID:30886469. doi: 10.4103/JCAS.JCAS_183_18.

Review.

This article is a comprehensive review of hair distribution, the sequence of balding, and hair transplant techniques and limitations. Regarding FUE, this article details the considerations needed to optimize the FUE technique and how this technique affects the donor area. Donor-site density and reduction of density due to FUE is an important consideration when planning a repeat harvest. Steps are detailed regarding harvesting the donor area so as to avoid thinning and over-harvesting, and avoiding nonsafe areas.

2017

Akingbola CO, Vyas J. Traction alopecia: A neglected entity in 2017. Indian Journal of Dermatology, Venereology and Leprology 2017;83(6):644-649. PMID:29035284. doi: 10.4103.

Review.

This article reviews the epidemiology, diagnosis, and current management of traction alopecia. Anecdotal evidence suggests that the transection rates associated with FUE could be influenced by follicular characteristics. A high transection rate (approximately 1.7-15% of patients) has occurred in patients with curved follicles whereas follicular unit transplants maybe more suited for straighter hair stands.

Au JK, Palma Diaz MF, Aghaloo T, St John MA. Scaffold-Assisted Artificial Hair Implantation in a Rat Model. JAMA Facial Plastic Surgery 2017 Dec 28 [Epub ahead of print]. PMID:29285533. doi: 10.1001/jamafacial.2017.2186.

Original Clinical Data.

This article has provided some evidence to suggest that scaffold-assisted artificial hair implants could be a future avenue to explore, potentially replacing autograft harvesting techniques. Due to FUE's low yields, multiple rounds of harvesting maybe required to obtain the desired number of hair follicles. Multiple FUE surgeries may result in hair thinning and cobble stoning, limiting the possibility of future hair restoration procedures. In addition to these limitations, long-lasting results are not guaranteed as follicular morbidity can be associated with autograft hair transplantations. To address these limitations, scaffold-assisted artificial hair implants could be used. The rat models used in this study showed that 75% of the artificial hair follicular units remained intact after 24 weeks and were well tolerated.

Avram MR, Finney R, Rogers N. Hair Transplantation Controversies. Dermatologic Surgery 2017 Nov;43 Suppl 2:S158-S162. PMID:29064980. doi: 10.1097/DSS.0000000000001316.

Review.

This article explores the superiority of different harvesting techniques as well as other controversies surrounding hair transplantation. FUE has many advantages over other harvesting techniques (e.g., Ellipse) however FUE is not appropriate for all hair loss patients. Both the Ellipse and FUE method have variable transection rates however FUE does not require sutures whereas the Ellipse method does. Scarring and hair trimming also differ between Ellipse and FUE methods with extensive trimming a requirement for harvesting using the FUE method. This can limit candidacy as trimming hair to 1 mm may not be preferred (e.g., women with shoulder length hair). Despite their differences, both FUE and FUT should be considered state of the art in hair transplantation and should be discussed during consultations.

Bernstein RM. Commentary on Association Between Scalp Laxity, Elasticity, and Glidability and Donor Strip Scar Width in Hair Transplantation and a New Elasticity Measuring Method. Dermatologic Surgery 2017;43(3):582. PMID: 28060174. doi: 10.1097/DSS.0000000000001002.

Commentary.

This article is in response to a previously published article by Park et al., entitled "Association between scalp laxity, elasticity and glidability and donor strip scar width in hair transplantation and a new elasticity measuring method". The method implored by Park et al., can help determine problematic patients as scalp elasticity can have a negative impact on extraction and scarring during FUT and FUE. This novel method is helpful in patients with looser scalps, where increased transection rates and decrease yields are common.

Capitan L, Simon D, Meyer T, Alcaide A, Wells A, Bailon C, Bellinga RJ, Tenorio T, Capitan-Canadas F. Facial Feminization Surgery: Simultaneous Hair Transplant during Forehead Reconstruction. Plastic and Reconstructive Surgery 2017;139(3):573-84. PMID: 28234823. doi: 10.1097/PRS.0000000000003149.

Original Clinical Data.

FUE can be used successfully in facial feminization surgery. The article details observations and tools used by the authors in over 400 transgender patients. FUE was noted to be very useful in redefining hairlines, proving a more natural look. Hairline-lowering surgery, forehead reconstruction and strip surgery were also mentioned as successful procedures to use during feminization surgery.

Civas E, Aksoy B, Ozer F, Eski M. Long-term result of hair transplantation for therapy resistant alopecia areata of eyebrows. Indian Journal of Dermatology, Venereology and Leprology 2017;83(5):618-619. PMID:28731020. doi: 10.4103/ijdv.IJDVL_913_16.

Case study.

Long term success may not be found with eyebrow replacement therapy using FUE techniques. An eyebrow replacement using scalp hair was conducted in a 24 year old therapy-resistant alopecia patient using 425 grafted hairs. A high hair regrowth rate (80%) occurred at the 24 month follow up. Five years after treatment all eyebrow and scalp hair was lost.

Cohen B, Bashey S, Wysong A. Literature Review of Cosmetic Procedures in Men: Approaches and Techniques are Gender Specific. American Journal of Clinical Dermatology 2017;18(1):87-96. PMID: 28004257. doi: 10.1007/s40257-016-0237-x.

Review.

Approaches and techniques associated with cosmetic procedures can be gender specific. FUE was mentioned among the several non-surgical interventions undertaken by male patients. Men with shorter hair may prefer FUE over FUT as there is reduced scarring. Despite its advantages, FUE can be associated with a greater risk of transection during harvesting. FUE is also limited to smaller transplants as there are fewer grafts available to harvest.

Epstein JS, Kuka G. The Role of Hair Transplantation for Managing Facial Trauma. Facial Plastic Surgery 2017;33(6):613-620. PMID:29195242. doi: 10.1055/s-0037-1608782.

Review

The advantages and limitations of FUE and other hair transplantation techniques such as follicular unit grafting and follicular unit transplantation are the main focus of this article. Hair trimming is limited with the use of the no-shave FUE technique, which can create instant camouflage post-procedure. In addition to restoring hair loss in anatomical areas such as the

eyebrows, eyelashes and beards, facial scars can also be easily managed with the use of hair transplantation. Inappropriate handling of grafts during FUE can lead to follicular trauma and desiccation.

Gupta J, Kumar A, Chouhan K, Ariganesh C, Nandal V. The Science and Art of Eyebrow Transplantation by Follicular Unit Extraction. Journal of Cutaneous and Aesthetic Surgery 2017;10(2):66-71. PMID:28852290. doi: 0.4103/JCAS.JCAS_27_17.

Review.

Recipient site creation, hairline design, implantation and post-operative care preferences in relation to FUE have been summarized in this article. The authors suggest coronal slits should be used to achieve better angle control. Only 200 FU should be taken at a time to keep the out of body time limited (< 1 hour). The authors believe that excellent and beautiful results can be found with FUE.

Jimenez-Acosta F, Ponce-Rodriguez. Follicular Unit Extraction for Hair Transplantation: An Update. Actas Dermosifiliogr. 2017;108(6):532-537. PMID:28483047. doi: 10.1016/j.ad.2017.02.015

Review.

Even though FUE is a recognized alternative to FUT there are still some disadvantageous and controversies surrounding its use in the field of hair restoration. FUE instrumentation (manual, motorized and robotic systems) can allow the removal of follicular units from non-scalp regions and can help hide linear scarring. Despite FUE's advantages, this extraction method is very laborious and does create scarring. The donor area could be damaged if a large number of extractions are performed. There is also controversy surrounding whether or not the growth of FUE grafts are the same as strip grafts.

Karayazgan-Saracoglu B, Ozdemir A. Fabrication of an Orbital Prosthesis Combined with Eyebrow Transplantation. Journal of Craniofacial Surgery 2017;28(2):479-481. PMID: 28045822. doi: 10.1097/SCS.00000000000003319.

Case Study.

Natural looking eyelashes and eyebrows can be achieved through FUE. Through the use of a fabricated orbital prosthesis, and eyebrow transplantation using FUE, a patient with an orbital defect was able to obtain a more natural look. Follicular units were obtained from the back of head using a punch, 0.8 to 1 mm in diameter. The patient was satisfied with FUE results.

Liu YS, Jee SH, Chan JL. Hair transplantation for the treatment of lichen planopilaris and frontal fibrosing alopecia: A report of two cases. Australasian Journal of Dermatology 2017 Jul 24. PMID:28736812. doi: 10.1111/ajd.12682.

Case Studies.

Promising results have been found using FUE in 2 lichen planopilaris patients. After disease stabilization, a 44 year old woman underwent FUE (extraction of 360 follicular units) with best results achieved 13 months post-surgery. FUE extraction was also successfully used in additional lichen planopilaris patient with no hair loss noted at the recipient site post-surgery.

Mohamed EM, Younes AK, Osman A, Mohamed R, Makki M, Younis M. Punch graft versus follicular hair transplantation in the treatment of stable vitiligo. Journal of Cosmetic and Laser Therapy 2017 Oct;19(5):290-293. PMID: 28272910. doi: 10.1080/14764172.2017.1303170.

Original Clinical Data.

Follicular grafting may not be as effective as punch grafting when treating stable vitiligo. To allow for a direct comparison, punch grafting (a 2 mm punch used to obtain required grafts) and follicular grafting (1 cm strip harvested to obtain grafts) were compared in 32 vitiligo patients. The punch grafting showed greater improvement as compared to the follicular grafting, with repigmentation occurring at 2.5 weeks. Punch grafting resulted in a cobble stone appearance in 90% of patients.

Moon MS, Choi JP. An Innovative Scalp-Dyeing Technique with Gentian Violet Solution During Follicular Unit Extraction for White-Haired Follicular Units. Archives of Plastic Surgery 2017;44(2):170-172. PMID: 28352608. doi: 10.5999/aps.2017.44.2.170.

Original Clinical Data.

Dying scalp skin in white-haired patients may enhance visualization of the donor site and aid in microdissection. The authors suggest that applying Gentian violet solution to the scalp of white-haired patients can result in better visibility. Dying can avoid the need for specialized punch processes. This method is not new as it has previously been mentioned at an ISHRS Annual Meeting (2012), and is used in Gram staining. Compared to patients dying their hair at home, this technique allows better coverage and complete visualization. This violet solution can help during harvesting, trimming and extraction.

Navarro RM, Pino A, Martinez-Andres A, Molina C, Martinez AM, Martinez N, Orive G, Anitua

E. The effect of plasma rich in growth factors combined with follicular unit extraction surgery for the treatment of hair loss: A pilot study. Journal of Cosmetic Dermatology 2017 Oct 26 [Epub ahead of print]. PMID:29076290. doi: 10.1111/jocd.12446.

Original Clinical Data.

Combining FUE with plasma rich in growth factors (PRGF) can result in faster postsurgical crust healing and can reduce postsurgical inflammation period associated with FUE surgery. This study was conducted in 30 hair transplant subjects; 15 underwent traditional FUE surgery (group 1) and 15 underwent FUE surgery combined with PRGF treatment (group 2). In group 2, recipient areas were injected with activated PRGF prior to implantation of pre-immersed PRGF hair follicles. The time associated with postsurgical crust healing and hair fixation was halved when FUE surgery was combined with PRGF treatment (group 1: 9 ± 1 day versus group 2: 18 ± 5 days). In addition, the inflammation period was 5 days shorter in the combination group (FUE + PRGF) as compared to the traditional FUE group.

Ors S. Hair Transplantation in Migraine Headache Patients. Plastic and Reconstructive Surgery - Global Open 2017;5(9):e1503. PMID:29062667. doi: 10.1097/GOX.0000000000001503.

Original Clinical Data.

Hair transplantations have recently been associated headache alleviation. Six of the 811 FUE transplant patients included in this study had suffered migraine headaches for 6-20 years. All 6 of these patients experienced headache reduction, specifically a decrease in headache intensity and headache frequency, after hair transplantation. Migraine pain also reduced post-surgery.

Park JH. Association Between Scalp Laxity, Elasticity, and Glidability and Donor Strip Scar Width in Hair Transplantation and a New Elasticity Measuring Method. Dermatologic Surgery 2017;43(4):574-581. PMID: 28005630. doi: 10.1097/DSS.0000000000001006.

Original Clinical Data.

The focus of this study was to determine if there is a relationship between donor strip scar width and preoperative laxity, elasticity, and glidability. It was determined that scalp scar width can be reflective of scalp laxity and elasticity. The authors noted that FUE could be a great alternative to strip if the patient is more susceptible to scar widening due to scalp laxity and scalp elasticity.

Park JH, Park JM, Kim NR, Manonukul K. Hair diameter evaluation in different regions of the safe donor area in Asian populations. International Journal of Dermatology 2017;56(7):784-787. PMID:28436024. doi: 10.1111/ijd.13638.

Original Study.

The diameters of anagen hairs among the strip donor site were evaluated to aid in hair transplantation. Hair diameters in target areas were significantly different between males and female patients ($p < 0.0001$). The authors state that hairs above and below the strip harvesting area could be removed using FUE if a larger number of hairs are required. This combination may limit the length of the donor strip.

Rassman W, Pak J, Kim J. Combining Follicular Unit Extraction and Scalp Micropigmentation for the Cosmetic Treatment of Alopecias. Plastic and Reconstructive Surgery - Global Open. 2017 Nov 7;5(11):e1420. PMID:29263945. doi: 10.1097/GOX.0000000000001420.

Review.

This article reviews how the combination of FUE with scalp micropigmentation (SMP) can be an effective way to treat hair loss. To avoid donor area depletion, SMP can be used to decrease the contrast between the patient's hair and skin color, helping to achieve the desired level of fullness. This change in contrast can reduce the number of transplanted hairs required. FUE combined with SMP can be used in nearly all types of balding patients regardless of hair loss severity or race.

Saxena K, Savant SS. Body to Scalp: Evolving Trends in Body Hair Transplantation. Indian Dermatology Online Journal 2017;8(3):167-175. PMID:28584752. doi: 10.4103/idoj.IDOJ_283_16.

Review.

FUE can be used successfully in body hair transplantations. Evaluating how many grafts can be used is crucial to body hair transplantations as only terminal hair can be used. Both motorized and manual punches are suitable for this type of transplant with minoxidil a suggested postoperative treatment. There are 5 key patient characteristics necessary for a successful body hair transplant using chest hair; a density $< 40 \text{ FU/cm}^2$, similarity between scalp and torso hair, proportion of 2-3 hair follicular units, size of the hair bearing area and length of torso hair.

Vano-Galvan S, Camacho F. New Treatments for Hair Loss. Actas Dermosifiliogr 2017 Jan. [Epub ahead of print]. PMID: 28061966. doi: 10.1016/j.ad.2016.11.010.

Review.

This article summarizes the new treatments available in the field of hair restoration. Oral therapies, topical treatments, Janus kinase inhibitors, antiandrogens and new robotic devices were among the topics discussed. Further information could not be obtained as the article is in Spanish.

Yun SS, Park JH, Na YC. Hair Diameter Variation in Different Vertical Regions of the Occipital Safe Donor Area. Archives of Plastic Surgery 2017;44(4):332-336. PMID:28728330. doi: 10.5999/aps.2017.44.4.332.

Original Study.

Hairs in the superior region (superior to the upper boarder of the helical rim) of the safe donor area were found to be the thicker than those located in inferior zones. Follicles taken from these inferior zones would be ideal for eyebrows, eyelashes and female hairline correction. This finding can be helpful in determining which follicles to extract using the FUE method.

Zontos G, Williams KJ, Nikiforidis G. Minimizing injury to the donor area in follicular unit extraction (FUE) harvesting. Journal of Cosmetic Dermatology 2017;16(1):61-69. PMID: 27557792. doi: 10.1111/jocd.12267

Original Clinical Data.

Donor injury during FUE harvesting can be minimized with a saline injection prior to harvesting. In a study of 35 patients, skin injury during FUE harvesting was investigated using acute extraction and vertical extraction. In acute extraction, the punch removed the follicular unit parallel to the exit angle of the hair follicle. In vertical extraction, a similar process was used with the addition of an intradermal saline injection prior to harvesting. Wound surfaces and skin mass values were significantly reduced when vertical extraction was used as compared to acute extraction.

2016

Avram MR. Commentary on Hidden Transection of Follicular Unit Extraction in Donor Site. Dermatologic Surgery 2016;42(4):489-90. PMID:26990258. doi: 10.1097/DSS.0000000000000645.

Commentary.

Sharp instruments and tumescence are recommended to help with the hidden transection rates. Successful harvesting will vary among patients even if the main goal is zero transected follicular units. The use of optics and software to determine which techniques is ideal for each patient was a future avenue mentioned.

Avram MR. Commentary on Robotic Follicular Unit Graft Selection. Dermatologic Surgery 2016;42(6):715-6. PMID: 27176861. doi: 10.1097/DSS.0000000000000759.

Commentary.

Despite the benefits, FUE still has serious drawbacks. FUE can help reduce the need for a large team, can allow for a smaller incision and is a less invasive technique. With this technique there is also the possibility of depleting the donor region and straying outside the safe region.

With the addition of robotic devices, more grafts can be harvested and physician fatigue avoided.

Azar RP, Thomas AH, Maurer M, Lindner G. Alterations in Hair Follicle Morphology and Hair Shaft Production After Follicular Unit Transplantation. Am J Dermatopathol 2016;38(10):732-8. PMID: 26844618. doi: 10.1097/DAD.0000000000000526.

Case Study.

Transplanted hair follicles may not retain their original morphological characteristics. Native and transplanted FUE hair follicles were removed in two male patients for comparison purposes. The transplanted FUE hair follicles were scrubbier, darker, and had an increased diameter as compared to the native hair follicles. Transplanted hair follicles also had a thicker hair bulb, contained more cells and had a more developed vessel network as compared to native hair follicles. These differences could be due to different in molecular cues in the recipient and donor site or the harvesting method used.

Azar RP, Thomas AH, Maurer M, Lindner G. Asymmetry of the Receding Hairline in Men with Early Androgenetic Alopecia. Journal of Cutaneous Medicine and Surgery. 2016;20(6):546-549. PMID: 27421295.

Case Study.

A new approach to ascertain the progression of hair loss in androgenetic alopecia (AGA) patients shows promising results. The need for a more precise classification arises from the fact that the Norwood classification ignores subtle differences between AGA patients of the same class. The results of this study showed that among 41 AGA patients (39 of which shared the same Norwood classification) the frontotemporal recessions were not the same size, the right forehead being significantly larger than the recessions found on the left. This subtle difference was found through the use of a reference line.

Bater KL, Ishii M, Joseph A, Su P, Nellis J and Ishii LE. Perception of Hair Transplant for Androgenetic Alopecia. JAMA Facial Plastic Surgery 2016;18(6):413-418. PMID: 27560098. DOI: 10.1001/jamafacial.2016.0546.

Original Clinical Data.

This article seeks to determine if hair transplants (e.g., FUE and strip) alter perceived age, attractiveness, successfulness and approachability in men with androgenetic alopecia.

Using randomized, controlled web-based surveys it was discovered that there were significant positive effects on perceived age, attractiveness, successfulness and approachability.

Translating these results into a real world setting, hair transplants could impact success in the workplace as well as social interactions.

Bernstein RM, Wolfeld MB. Robotic Follicular Unit Graft Selection. Dermatologic Surgery 2016;42(6):710-4. PMID: 27176871. doi: 10.1097/DSS.0000000000000742.

Original Clinical Data.

Through robotic follicular unit graft selection the amount of hairs yielded per donor wounds increases. Twenty four androgenetic alopecia patients were enrolled in a bilateral controlled, randomized study with one side harvested with a high selection setting and a 2 pass technique while the other side follicular units were selected randomly. The robotic follicular unit graft selection side produced more hairs per harvest attempts as compared to the randomized follicular unit side ($p < 0.01$). There was a 6.4% clinical benefit (increase in hairs/graft) using the 2 pass technique as compared to the random harvesting technique ($p < 0.01$).

Goyal N. Reply: "Repigmentation of Vitiligo Using Follicular Unit Extraction Technique" - Dermatologic Surgery 2016;42(4):562-4. PMID: 26885835. doi: 10.1097/DSS.0000000000000638.

Case Study.

FUE can help re-pigment non-hair bearing areas as evidence in three case studies. Donor hair was removed with specialized jeweler's forceps and placed into a vitiligo patch. Within 4 months there was a uniform perifollicular spread of pigment in all patches.

Kim DY, Choi JP, Hwang YJ, Kim HS. Hidden Transection of Follicular Unit Extraction in Donor Site. Dermatologic Surgery 2016;42(4):485-8. PMID: 27035500. doi: 10.1097/DSS.0000000000000631.

Original Clinical Data.

When performing FUE, hidden transection rates can occur. Hair follicle damage at the donor site was examined in 20 patients who underwent follicular unit strip surgery with the aid of a motorized FUE device. Transection occurred under the scalp surface with most transections occurring on the superior side of the punch site. These hidden transection rates were lower with an experienced hair transplant surgeon (2%) as compared to a beginner (8%). Possible causes of hidden transections include excessive pressure and/or deep insertion. These hidden transection rates should be incorporated in the overall transection rates associated with FUE.

Lee IJ, Jung JH, Lee YR, Kim JC, Hwang ST. Guidelines on Hair Restoration for East Asian Patients. Dermatologic Surgery 2016;42(7):883-92. PMID: 27286415. doi: 10.1097/DSS.0000000000000773.

Review.

Due to specialized characteristics (e.g., head shape, hair, skin color) and other unique features, East Asian patients may require certain modifications during hair transplantation procedures and/or treatments. East Asian patients have been associated with a higher rate of hypo-pigmentation, dot-like changes in the donor area after FUE harvesting. With a low hair density East Asian patients may need a larger donor zone when undergoing FUE harvesting.

This can increase the risk of harvesting outside the safe area. Additionally, varying lengths of East Asian hair grafts can mean that finer depth control is needed when performing FUE.

Mansur AT, Demirci GT, Uzunismail MA, Yildiz S. A rare complication of follicular hair unit extraction: Kaposi's varicelliform eruption. Dermatology Practical Conceptual 2016;36(1):15-7. PMID: 26937302. doi: 10.5826/dpc.0601a05.

Case Study.

A case of Kaposi's varicelliform eruption (KVE) has been reported following a FUE hair transplant. Approximately, 6 days after a FUE hair transplant in a 34 year old man, the presence of vesiculopustular lesions appeared. These lesions rapidly spread to the whole scalp, neck and upper chest. After clinical diagnosis of KVE was determined, the corresponding treatment was given and lesions disappeared. The wounds created by FUE could be a possible trigger and/or cause of the infection.

Miao Y, Liu BC, Fan ZX, Hu ZQ. Evaluation indicators of aesthetic effects on hair transplantation: hair transplantation. Annals of Plastic Surgery 2016;77 Suppl 1:S30-1. PMID: 26954740. doi: 10.1097/SAP.0000000000000778.

Review.

Donor site selection, grafted hair direction, density and survival rate of grafted hair follicles all influence the aesthetic results achieved with hair transplants. The best location to harvest grafts using FUE is from the occiput with hair follicle implanted in the natural direction of growth. An appropriate density of implanted hair follicles is also needed to achieve optimal results.

Miao Y, Fab ZX, Hu ZQ, Jiang JD. Single Hair Grafts of the Hairline to Aesthetically Restore Eyebrows by Follicular Unit Extraction in Asians. Dermatologic Surgery 42(11):1300-1302. PMID: 27618392. doi: 10.1097/DSS.0000000000000809.

Original Clinical Data.

FUE can be successfully used in eyebrow restoration with single periauricular hair follicles. Using a 0.8 mm diameter punch, 38 eyebrows underwent hair restoration. Patients were satisfied with both the immediate findings and long term results. The authors noted that the key to their success was due to the specific direction and angle of the inserted hair as well as obtaining patient feedback throughout the entire process.

Oh JW, Kloepper J, Langan EA, Kim Y, Yeo J, Kim MJ, Hsi TC, Rose C, Yoon GS, Lee SJ, Seykora J, Kim JC, Sung YK, Kim M, Paus R, Plikus MV. A Guide to Studying Human Hair Follicle Cycling In Vivo. Journal of Investigative Dermatology 2016;136(1):34-44. PMID: 26763421. doi: 10.1038/JID.2015.354.

Review.

Mice hair models do not adequately depict hair follicle cycling in humans. This article focuses on hair follicle cycle stages, examining both morphological characteristics and immuno-histochemical markers for each stage. In hair transplants (e.g., FUE or strip), hair follicles predominately move from rapid growth (anagen) to regression (catagen). This can allow for a speedy recovery from any damage conducted during surgery.

Saxena K, Saxena DK, Savant SS. Successful Hair Transplant Outcome in Cicatricial Lichen Planus of the Scalp by Combining Scalp and Beard Hair Along with Platelet Rich Plasma. Journal of Cutaneous and Aesthetic Surgery 2016;9(1):51-5. PMID: 27081255. doi: 10.4103/0974-2077.178562.

Case Study.

FUE combined with PRP was found to be successful in a case study of end-stage lichen planopilaris patient. FUE followed by PRP was used in a test patch (50 grafts from scalp and beard) with most follicles showing regrowth (80%). This procedure was repeated 10 months later for all other scarring alopecia patches. The transplanted grafts had a survival rate of 80% with faster growth occurring in beard hair implants.

Umar S. Body Hair Transplant by Follicular Unit Extraction: My Experience with 122 Patients. Aesthetic Surgery Journal 2016;36(10):1101-10. PMID: 27241361. doi: 10.1093/asj/sjw089

Original Clinical Data.

Body hair as harvested by FUE can be a successful method for individuals with severe baldness or inadequate scalp donor areas. FUE was used to harvest body hair and scalp hair where possible in 113 patients. Overall patients were satisfied with results with scores > 7.8

(out of 10) when asked about their healing status, recipient hair growth, and overall satisfaction with their surgeries.

Volgel JE. Commentary on: Body Hair Transplant by Follicular Unit Extraction: My Experience With 122 Patients. Aesthetic Surgery Journal 2016;36(10):1111-1112. PMID: 27329659. doi: 10.1093/asj/sjw110

Opinion.

As beneficial as body hair can be as a donor source its clinical application is quite limited. The use of body hair is rare in clinical practice despite its low complication risks. Technical difficulties and fragility of body hair can limit the use of this technique. Additionally, time required and high labor intensity can also hinder its applicability.

2015

Chen H, Zhang J, Li J, Jian M, Guo X, Wang Y, Shen H. [Application of soft tissue expansion combined with follicular unit extraction for burn cicatricial bald]. Zhonghua Zheng Xing Wai Ke Za Zhi 2015;31(1):36-9. PMID: 26040017.

Original Clinical Data.

With the aid of soft tissue expansion, follicular unit extraction was performed on cicatricial balding patients (n=48) with high levels of satisfaction after 5 years of follow up. Further detail could not be obtained as article is in Chinese.

Cole JP, Insalaco C, Reiter J. A comparison of reticle size to determine follicular unit density in hair restoration. Dermatologic Surgery 2015;41(3):426-8. PMID: 25705953. doi: 10.1097/DSS.0000000000000301.

Original Clinical Data.

Standardization of predictive factors for successful hair transplantation can be done in a timely manner through using a smaller reticle size. Photographs of 40 male participants were used to calculate follicular unit densities within boundaries of different reticle sizes (1.0 cm², 0.5 cm², and 0.1 cm²). It was found that the reticle size did not impact the quality of the data gathered. Therefore instead of using a reticle size of 1.0 cm² (golden standard), a reticle size of 0.1 cm² can allow for follicle counts to be done quickly without the need of photographs. This can decrease the amount of time required for follicular density quantification to be calculated.

Gho CG, Neumann HA. Advances in hair transplantation: longitudinal partial follicular unit

transplantation. Current Problems in Dermatology 2015;47:150-7. PMID: 26370653. doi: 10.1159/000369416.

Review Article.

Partial longitudinal-follicular unit transplantation (PL-FUT) is a more effective and advantageous way of harvesting follicles as compared to strip and FUE. The method allows the donor area to regrow and can provide regeneration in the receipt area. Ideal candidates for PL-FUT can include androgenic alopecia patients, burn victims and scarring alopecia patients.

Further detail could not be obtained as this is a chapter in a book that is unavailable for public viewing.

Mohebbipour LA, Mirmohammadi R, Rezaei BM, Manoochchri S. Hair Follicles are viable after delayed FUE procedure. Journal of Cosmetic and Laser Therapy 2015;17(6):353-4. PMID: 25968165. doi: 10.3109/14764172.2015.1039037.

Case Study.

Hair follicles could be viable three days post extraction. A three-day consecutive hair transplant was conducted in an individual using FUE. A fraction of the hairs were implanted on day 1, 2 and 3. After 5 months, normal hair growth was over 68% for all grafts with the highest amount of growth occurring with the follicles implanted immediately after extraction.

Ors S, Ozkose M, Ors S. Follicular Unit Extraction Hair Transplantation with Micromotor: Eight Years Experience. Aesthetic Plastic Surgery 2015;39(4):589-96. PMID: 25948066. doi: 10.1007/s00266-015-0494-8.

Original Clinical Data.

Even though FUE is not the most frequently used method, it is an efficient way of harvesting hair follicles. When graft intake using FUE is easy more than 2,000 grafts could be harvested per hour. More difficult graft intakes can result in a longer harvesting time and can increase transection rates. With the addition of the micromotor to assist FUE harvesting, more follicle units can be harvested as compared to manually performed FUE (n=1000). The micromotor can also decrease graft transection.

Rogers NE. Hair transplantation update. Seminars in Cutaneous Medicine and Surgery 2015;34(2):89-94. PMID: 26176286. doi: 10.12788/j.sder.2015.0131.

Review Article.

Hair transplant surgery should be accompanied with medical therapy to help protect surgical results as well as thinning in other regions. Elliptical harvesting and follicular unit extraction are contemporary hair transplant surgeries that allow for more natural results.

Further detail could not be obtained as the full text was unavailable.

Rose PT. Hair Restoration surgery: challenges and solutions. Clinical, Cosmetic and Investigational Dermatology 2015;8:361-70. PMID: 26203266. doi: 10.2147/CCID.S53980.

Review Article.

Hair restoration has come a long way since its creation in 1939, however it is not perfect. Trichophytic closure, extracellular matrix material, platelet-rich plasma, micropigmentation, FUE and FIT methods can help enhance healing as well as limit scarring typically associated with hair transplants. The learning curve for FUE and FIT can be aided with robotic devices, increasing the number of grafts and decreasing transection rates. Creation of effective holding solutions and therapies such as oral drugs and laser therapies, donor hair preservation can be achieved with greater success. The creation of completely new hairs, through cloning, stem cells or growth factors might be a future avenue to explore.

Schicho K, Seemann R, Binder M, Figi M. Optical coherence tomography for planning of follicular unit extraction. Dermatol Surg 2015;41(3):358-63. PMID: 25742558. doi: 10.1097/DSS.0000000000000252.

Original Clinical Data.

An educated success rate of a planned FUE procedure can be found through imaging. Optical coherence tomography can allow an over-estimation of the angle distribution of hair follicles. As transection rates are more likely to occur with non-parallel hair follicles this can provide a realistic expectation of what to expect during the procedure.

Umar S. Use of nape and peri-auricular hair by follicular unit extraction to create soft hairlines and temples: my experience with 128 patients. Aesthetic Surgery Journal 2015;35(8):903-9.

PMID: 26399317. doi: 10.1093/asj/sjv137.

Original Clinical Data.

Nape and peri-auricular hair (NPA) can be used successfully to create natural-looking hairlines. Full hair coverage occurred around 9.6 months in those that underwent NPA hair FUE transplantation (n=128). Approximately 40 patients experienced no graft loss with 19 patients noting loss of grafts at 10 months post-surgery. Graft survival rate was 75% as found through follow up visits. Patients were satisfied with results and were pleased with how natural and soft the hairline was.

Williams KL, Gupta AK, Schultz H. Ergonomics in hair restoration surgeons. Journal of Cosmetic Dermatology 2015;15(1):66-71. PMID: 26440582. doi: 10.1111/jocd.12188.

Original Clinical Data.

Hair restoration surgeons can be at risk for musculoskeletal disorders when regularly performing FUE. Approximately 50% of hair restoration surgeons experienced musculoskeletal symptoms during or after performing hair restoration surgery (n=38). Greater amounts of pain is associated with FUE (69% moderate/severe pain) as compared to strip (35% moderate/severe pain) (n=19). Fatigue during the procedure was also higher with FUE (69%) as opposed to strip (53%) (n=19). Quality of life can also be impacted, with 74% reporting mild or moderate limitations due to musculoskeletal symptoms.

2014

Avram MR, Rogers N, Watkins S. Side-effects from follicular unit extraction in hair transplantation. Journal of Cutaneous Aesthetic Surgery 2014;7(3):177-9. PMID: 25538444. doi: 10.4103/0974-2077.146681.

Review Article.

Common misconceptions and guidelines for FUE were the main focus of this article. While FUE does not create linear scarring, scarring does occur in pinpoint white macules that can be seen upon close examination. Harvesting from any region is not the best practice as regions of high-risk areas can increase the likelihood of thinning or balding. Depletion of hair in donor regions can occur with both manual and robotic FUE procedures, so proper spacing and using the correct number of follicular grouping is key.

Avram MR, Watkins SA. Robotic follicular unit extraction in hair transplantation. Dermatologic Surgery 2014;40(12):1319-27. PMID: 25418806. doi: 10.1097/DSS.0000000000000191.

Review Article.

Robotic follicular unit extraction can eliminate drawbacks found with manual FUE. Operator fatigue, overharvesting and scarring are common drawbacks that can be eliminated or decreased with robotic FUE. Angle of hair growth, density of hair and number of grafts obtained are constantly monitored and displayed on the robotic device. This allows for a more effective and expedient harvesting. However robotic FUE requires extensive trimming and hair coloring, which has led to men dominated robotic FUE procedures. Cost, space requirements and limited studies comparing manual versus robotic FUE have also limited the use of robotic FUE. Robotic devices have not replaced traditional hair transplantation techniques but can supply several advantages when it comes to harvesting grafts.

Bicknell LM, Kash N, Kavouspour C, Rashid RM. Follicular unit extraction hair transplant harvest: a review of current recommendations and future considerations. Dermatology Online Journal 2014;20(3). PMID: 24656268.

Review Article.

FUE can be promising alternative to strip surgery. Patients that specifically benefit are those that scar easily, prefer their hair short or have an aversion to pain. FUE variations (the 2 step or 3 step method) and powered FUE devices can allow for lower transection rates and decrease the time required to harvest. Limitations to FUE include inadequate donor supply, increased risk of desiccation, and specific patient candidacy (with low FOX grades). Also, recognizable hair removal pattern or hyperpigmentation could be noticed if a random pattern of extraction is not preformed. Future endeavors including cloning of hair follicles and the use of robotics could elevate these issues.

Gupta AK, Lyons DC, Daigle D, Harris JA. Surgical hair restoration and the advent of a robotic-assisted extraction device. Skinmed Jul-Aug 2014;12(4):213-6. PMID: 25335349.

Review Article.

This article seeks to critically examine the advances made within the context of surgical hair restoration. Advances include strip removal, manual FU extraction and robotic surgical assistive devices. Limited follicle transection rates are a nice feature of strip harvesting however scarring can be difficult to conceal. To avoid linear scarring, FUE can be used, but it does require an experienced surgeon to perform. Using a robotic surgical device such as ARTAS the limitations commonly found with strip and FUE can be eliminated. This device however may not outperform an experienced surgeon's result but does have a transection rate of less than 10%.

Loganathan E, Sarvajnamurthy S, Gorur D, Suresh DH, Siddaraju MN, Narasimhan RT. Complications of hair restoration surgery: a retrospective analysis. International Journal of Trichology 2014;6(4):168-72. PMID: 25368473. doi: 10.4103/0974-7753.142861.

Retrospective Analysis.

Most complications found during and after hair restoration surgery (e.g., strip, FUE) are not severe and can be easily treated. Postoperative edema is the most frequently reported complication, followed by sterile folliculitis, wide donor scar, numbness/paresthesia and bacterial folliculitis (n=73). Despite trying to foresee and account for all possible complications, some complications are inevitable. These complications can include poor growth of transplanted hair and dissatisfaction of patients.

Rashid RM. Follicular unit extraction with the Artas robotic hair transplant system system: an evaluation of FUE yield. Dermatology Online Journal 2014;20(4):22341. PMID: 24746303.

Case Study.

Automation could replace the manual approach to FUE, by reducing the difficulties commonly associated with this technique. Despite the advantages of automated FUE devices provide, the quality of the graft is not evaluated by the device. Additionally this device can create several harvest sites with no graft. If a specific number of grafts are required, manual FUE will be need to accompany automated FUE increasing cost and time. Procedure cost for the patient should be re-evaluated to allow for this by charging per attempt or number of grafts collected.

Rogers NE, Callender VD. Advances and challenges in hair restoration of curly Afrocentric hair. Dermatologic Clinics 2014;32(2):163-71. PMID: 24680003. doi: 10.1016/j.det.2013.12.004.

Review Article.

Curly haired individuals should be treated with special consideration when it comes to hair restoration (e.g., strip, FUE). Curly hair can influence clinical characteristics, hair grooming techniques, surgical instrumentation required and could increase the amount of complications. Proper knowledge of these factors is necessary when considering hair restoration on these individuals.

Rose PT, Nusbaum B. Robotic hair restoration. Dermatologic Clinics 2014;32(1):97-107. PMID: 24267426. doi: 10.1016/j.det.2013.09.008.

Review Article.

Follicular unit extraction and follicular isolation techniques are ideally suited for robotic systems. Through images of the donor area using an ARTAS system, a dual-chamber needle and a dissecting punch can be used to harvest follicular units. Further detail could not be obtained as full text was unavailable.

Zontos G, Rose PT, Nikiforidis G. A mathematical proof of how the outgrowth angle of hair follicles influences the injury to the donor area in FUE harvesting. Dermatologic Surgery 2014;40(10):1147-50. PMID: 25255277. doi: 10.1097/01.DSS.0000452652.52507.9d.

Mathematical Proof.

Through a mathematical proof, solutions to decrease trauma in the donor area, can be found. It was found that the higher the outgrowth angle of the hair follicle, the smaller the surface of the wound. This means that an angle of 30° increases trauma by 100% in the donor

area. To allow hair follicles to be more vertical during harvesting and be less inflicted by trauma, saline injections are suggested. These injections could allow the skin to be stretched, decreasing the wound area when drained.

2013

Chouhan K, Kumar A, Kanwar AJ. Body hair transplantation in vitiligo. Journal of Cutaneous and Aesthetic Surgery 2013 Apr;6(2):111-2. PMID:24023436. doi: 10.4103/0974-2077.112675.

Case Study.

FUE harvesting can successfully re-pigment scarring vitiligo patches. In a case study, phototoxicity created depigmented macules in multiple locations in a 28 year old male. In order to help camouflage this scarring, thigh hair was harvested using FUE. Complete pigmentation was found at 12 weeks. This harvesting method is less invasive but requires experienced surgeons to successfully perform.

Cole JP. An analysis of follicular punches, mechanics, and dynamics in follicular

unit extraction. Facial Plastic Surgery Clinics of North America 2013 Aug;21(3):437-47. PMID: 24017985. doi: 10.1016/j.fsc.2013.05.009.

Review.

In order to avoid high transection rates of follicular units, high quality punches are needed during FUE harvesting. There are many different factors to consider when choosing a punch which include diameter, cutting edge location, wall thickness, sharpness and shape.

Understanding how follicular dissection occurs can help provide consistent graft quality. Specific punch sizes can alter wound healing rates, length and depth of the incision. FUE harvesting can also be influence by follicular grouping, skin elasticity and tethering.

Harris JA. Follicular unit extraction. Facial Plastic Surgery Clinics of North America 2013 Aug;21(3):375-84. PMID: 24017979. doi: 10.1016/j.fsc.2013.05.002.

Review.

Despite the advantages of FUE, there are some disadvantages associated with this harvesting technique. FUE can be used in body hair harvesting, repair procedures, and donor area management. Further information cannot be provided as full text was unavailable.

Kumar A, Gupta S, Mohanty S, Bhargava B, Airan B. Stem Cell Niche is Partially Lost during Follicular Plucking: A Preliminary Pilot Study. International Journal of Trichology 2013 Apr;5(2):97-100. PMID:24403776. doi: 10.4103/0974-7753.122973.

Case Studies.

Stem cell fraction is significantly higher in FUE as compared to follicular plucking (FP). In a case study of 3 subjects, stem cell markers were examined using these two harvesting techniques (FUE and FP). A larger amount of CD200 (stem cell marker) was found with FUE as compared to FP ($p=0.0152$). FUE also showed a greater cell yield per follicle, ten times the amount found with FP.

Kumar A, Mohanty S, Sahni K, Kumar R, Gupta S. Extracted hair follicle outer root sheath cell suspension for pigment cell restoration in vitiligo. Journal of Cutaneous and Aesthetic Surgery 2013 Apr;6(2):121-5. PMID: 24023440. doi: 10.4103/0974-2077.112679.

Review.

Re-pigmentation in vitiligo patients can be obtained using extracted hair follicle outer root sheath cell suspension. This procedure has been successfully performed in a few case studies with > 75% re-pigmentation occurring in disease stable patients. Further research is needed as this is a new technique.

Lam SM. Hair transplant and local anesthetics. Clinics in Plastic Surgery 2013 Oct;40(4):615-25. PMID: 24093656. doi: 10.1016/j.cps.2013.08.006.

Review.

Several advances such as FUE and platelet-rich plasma have recently occurred in the hair-transplant field. Using FUE, linear scarring can be avoided and wide scarring can be repaired. The ARTAS robotic FUE system is a reliable device that can also be used to aid harvesting.

Mysore V. Direct Hair Transplantation (DHT): An Innovative Follicular Unit Extraction (FUE) Technique of Hair Transplantation. Journal of Cutaneous and Aesthetic Surgery 2013 Apr;6(2):106. PMID: 24023434. doi: 10.1016/j.cps.2013.08.006.

Review.

This article focuses on addressing aspects covered in a previously published article by Sethi and Bansal. Immediate implantation of grafting can help decrease the out of body time associated with FUE as pointed out by Sethi and Bansal. However, there are some limitations with this technique, such as limited operative area. This limitation could possibly cause graft damage. Further research is needed to directly compare immediate transplantation to the conventional method.

Poswal A. Use of body and beard donor hair in surgical treatment of androgenic alopecia. Indian Journal of Plastic Surgery 2013 Jan;46(1):117-20. PMID: 23960316. doi: 10.4103/0970-0358.113728.

Original Clinical Data.

Body hair may help increase density in the recipient area but proper planning is needed as these hairs retain their original characteristics (e.g., color, curl etc.). Body hair was extracted and implanted in 35 patients to help camouflage scarring. All implanted hairs did retain their original characteristics with beard hair providing better coverage as compared to other body locations. Patient acceptability was highest when implanted body hair was mixed with scalp donor hair.

Poswal A. Expanding needle concept for better extraction of body hair grafts. Indian Journal of Dermatology 2013 May;58(3):240. PMID: 23723487. doi: 10.4103/0019-5154.110845.

Review.

The expanding needle concept may help address the difficulties encountered with rigid punches. Excessive skin laxity and acute angles can create difficulties when using punches to extract follicles. Adversely, using the expanding needle concept, transection and follicular damage can be avoided. In this procedure the needle is used to score around the follicular unit and helps retrieve the follicular unit along with the adjacent fatty tissues.

Sacchidanand S, Thakur P, Purohit V, Sujaya SN. Follicular unit extraction as a therapeutic option for vitiligo. Journal of Cutaneous and Aesthetic Surgery 2013 Oct;6(4):229-31. PMID:24470722. doi: 10.4103/0974-2077.123413.

Case Study.

FUE can achieve re-pigmentation in a stable vitiligo patch as evident in a case study. In a 12 year old female FUE was used to surgically correct an eyebrow depigmented macule. No complications were reported. At 6 weeks re-pigmentation occurred with no depigmentation noticed at the 6 month follow up.

Sethi P, Bansal A. Direct hair transplantation: a modified follicular unit extraction technique. Journal of Cutaneous and Aesthetic Surgery 2013 Apr;6(2):100-5. PMID: 24023433. doi: 10.4103/0974-2077.112672.

Original Clinical Data.

Direct hair transplantation, a modified FUE technique, has been used successfully in balding patients. Direct hair transplantation involves immediate implantation of harvested grafts with little to no transit time. Majority of patients (25/27) showed good results with visible hair growth occurring between month 8 and month 18. In two patients, no noticeable photographic improvement or reduction in baldness grade had occurred.

Singh MK, Avram MR. Technical considerations for follicular unit extraction in African-American hair. Dermatologic Surgery 2013 Aug;39(8):1282-4. PMID: 23668835. doi: 10.1111/dsu.12229.

Case Study.

Large punch diameters are needed in patients with African descent who have very tight curled hair. In a 36 year old African-American man, a 1.3 mm diameter punch was needed to avoid graft transection of his c-shaped follicles. Other ways to decrease transection rates include matching the angle to the curl as the punch enters the skin and using minimal depth when making the incision.

Umar S. Use of body hair and beard hair in hair restoration. Facial Plastic Surgery Clinics of North America 2013 Aug;21(3):469-77. PMID: 24017988. doi: 10.1016/j.fsc.2013.05.003.

Review.

Body and beard hair can be used successfully with FUE. When a patient lacks scalp hair in the donor region or has extensive balding, body hair can be used. Body hair can contain desired characteristics like coarseness (beard hair) and softness (leg hair). There is some preoperative planning (e.g., patient selection), preparation and procedural approaches that are recommended when using body hair. Styling gels and hair dye can be used to help tame implanted beard hair and help match recipient hair color.

Vogel JE, Jimenez F, Cole J, Keene SA, Harris JA, Barrera A, Rose PT. Hair restoration surgery: the state of the art. Aesthetic Surgery Journal 2013 Jan;33(1):128-51. PMID: 23169821. doi: 10.1177/1090820X12468314.

Review.

Minimally invasive and cell based therapies might be the future direction of hair restoration surgery. The isolation and removal of a single follicular unit is the common goal across all FUE techniques. Power-assisted technology has helped advance this harvesting technique with surgeons using FUE for small and large sessions. Drawbacks associated with this technique include decreased donor density, overharvesting and extensive punctate scarring.

Williams KL Jr. Current practices and controversies in cosmetic hair restoration. Dermatologic Surgery 2013 May;39(5):797-801. PMID: 23464750. doi: 10.1111/dsu.12163.

Review.

Despite its failed attempts in history, FUE is used successfully today. Motorized, robotic FUE devices and varying punches (e.g., size, diameter, sharpness etc.) can allow for shorter harvesting times and limited scarring. Some disadvantages of this technique include higher transection rates, risk of harvesting outside the safe donor area and the steep learning curve.

2012

Bunagan MJ, Banka N, Shapiro J. Hair transplantation update: procedural techniques, innovations, and applications. Dermatologic Clinics 2013 Jan;31(1):141-53. PMID: 23159183. doi: 10.1016/j.det.2012.08.012.

Review.

The FUE harvesting technique includes manual, motorized, automated and robotic instrumentation. Since FUE can create natural looking results it can be used to improve scars but can also create scarring of its own. FUE can be useful in patients with a history of previous hair transplants and with the aid of motorized and automated punches; time needed to harvest is shortened. Robotic FUE can address some of the disadvantages associated with FUE and body hair can be used for patients that have depleted scalp donor areas.

Karacal N, Uraloglu M, Dindar T, Livaoglu M. Necrosis of the donor site after hair restoration with follicular unit extraction (FUE): a case report. Journal of Plastic, Reconstructive Aesthetic Surgery 2012 Apr;65(4):e87-9. PMID: 21768010. doi: 10.1016/j.bjps.2011.06.040.

Case Study.

Cicatricial alopecia was a complication found in a 22 year old male patient that had previously undergone FUE. Necrosis was found in the left occipital region after 950 follicles were removed using FUE. After 3 months of treatment, the condition was successfully managed. With an increase in the number of follicles removed using FUE, an increase in the amount of injury can occur, jeopardizing scalp integrity. Additionally, necrosis has been previously reported to occur after the use of local anesthetics. Both of these factors could have contributed to this complication.

Rashid RM, Morgan Bicknell LT. Follicular unit extraction hair transplant automation: options in overcoming challenges of the latest technology in hair restoration with the goal of avoiding the line scar. Dermatology Online Journal 2012 Sep 15;18(9):12. PMID: 23031379.

Review.

The challenges of FUE can be minimized or improved with a few simple suggestions. Automated FUE devices can be helpful as FUE can be time intensive and requires a skilled surgeon to perform. FUE grafts may have a longer out of body time as compared to strip and this can be addressed with a collection device that continuously hydrates grafts at all times. With the addition of a reusable ice pack, harvested FUE grafts can be cooled as they wait to be implanted, thereby enhancing their survival rate.

Stroud CM, Rashid RM. Analysis of patient awareness and demographic studies in follicular unit extraction. Skinmed 2012 Sep-Oct;10(5):324-5. PMID: 23163080.

Original Clinical Data.

The internet and passive modalities (e.g., TV, radio, print) can effectively reach FUE interested patients. In a study with 169 interested patients, most gathered their information from the internet and high income-targeted print media. It was found that approximately 14% of interested FUE patients had a previous history of strip surgeries.

2011

Caroli S, Pathomvanich D, Amonpattana K, Kumar A. Current status of hair restoration surgery. International Surgery 2011 Oct-Dec;96(4):345-51. PMID: 22808618.

Review.

This article encompasses a review of the history of hair restoration with current trends highlighted. Minimal donor scarring and good hair density could be obtained with the new ultrarefined follicular unit hair transplantation. Further information could not be obtained as full text was unavailable.

Kumaresan M. Single-hair follicular unit transplant for stable vitiligo. Journal of Cutaneous and Aesthetic Surgery 2011 Jan;4(1):41-3. PMID: 21572681. doi: 10.4103/0974-2077.79191.

Case Study.

FUT was successfully used in a 30 year old vitiligo-diagnosed male. Follicles harvested from the scalp were dissected into single follicular units and implanted in the moustache

region. Complete pigmentation occurred by week 8 with no post-operative complications arising.

Lin X, Nakazawa T, Yasuda R, Kobayashi E, Sakuma I, Liao H. Robotic hair harvesting system: a new proposal. Medical Image Computing and Computer-Assisted Intervention 2011;14(Pt 1):113-20. PMID: 22003607.

Original Clinical Data.

A new hair harvesting robot equipped with a digital microscope and a punch device may provide greater accuracy. The microscope can be used to localize target hairs and help aid in harvesting. Further information could not be obtained as full text was unavailable.

Mohanty S, Kumar A, Dhawan J, Sreenivas V, Gupta S. Noncultured extracted hair follicle outer root sheath cell suspension for transplantation in vitiligo. British Journal of Dermatology 2011 Jun;164(6):1241-6. PMID: 21275943. doi: 10.1111/j.1365-2133.2011.10234.x.

Original Clinical Data.

Non-cultured extracted outer root sheath (ORS) can be effective in vitiligo diagnosed patients. FUE was used to harvest hair follicles with incubation and filtering enabling the separation of ORS cells. Repigmentation (>75%) occurred in 9/14 patients with higher repigmentation found in patients that were more stable (≥ 1 year stability vs. < 1 year stability, $p=0.02$).

Poswal A, Bhutia S, Mehta R. When fue goes wrong! Indian Journal of Dermatology 2011 Sep-Oct;56(5):517-9. PMID: 22121268. doi: 10.4103/0019-5154.87140.

Case Study.

Cystic masses have been found in post-FUE case studies. In three patients, who were 6 months to 2 years post FUE, multiple nodules and swelling was noticed. Using strip, these nodules were removed and it was discovered that full thickness scalp grafts must have been used. Improper FUE harvesting (e.g., deep coring etc.) could be a possible contributing factor in the creation of these cysts.

Umar S. Hair transplantation in patients with inadequate head donor supply using nonhead hair: report of 3 cases. Annals of Plastic Surgery 2011 Oct;67(4):332-5. PMID: 21540728. doi: 10.1097/SAP.0b013e318209a61a.

Case Study.

Body hair has been successfully used with FUE as evident in a case study (n=3). High graft survival offered three patients alternative non-scalp harvesting options. This technique may allow patients with inadequate donor regions to undergo hair transplants. Further information could not be obtained as full text was unavailable.

Unger R, Alsufyani MA. Bilateral Temporal Triangular Alopecia Associated with Phakomatosis Pigmentovascularis Type IV Successfully Treated with Follicular Unit Transplantation. Case Reports in Dermatological Medicine 2011;2011:1-3. PMID: 23198168. doi: 10.1155/2011/129541.

Case Study.

Follicular unit transplantation was successfully performed in a 25 year old male with temporal triangular alopecia. At total of 1449 follicular units were used to achieve a density of 35 FU/cm².

2010

Dua A, Dua K. Follicular Unit Extraction Hair Transplant. Journal of Cutaneous and Aesthetic Surgery 2010;3(2):76-81. PMID: 21031064. doi: 10.4103/0974-2077.69015.

Review Article.

This article is an overview of FUE balancing the limitations with the advantages found with this technique. FUE may be a step towards minimally invasive hair restoration with many patient and surgeon benefits. FUE is not suited for everyone, FOX tests can exclude patients from this technique and an experience surgeon is necessary. Automated FUE can be a step towards eliminating limitations commonly associated with FUE.

Gho C, Martino Neumann H A. Donor hair follicle preservation by partial follicular unit extraction. A method to optimize hair transplantation. Journal of Dermatological Treatment 2010;21:337-349. PMID: 20388024. doi: 10.3109/09546630903359814.

Original Clinical Data.

Partial longitudinal FUE methods cab enable multiple hair transplantations from the same donor sites as evident in five androgenetic alopecia patients. Suitable follicle units in donor areas were examined for re-growth, characteristics and multiplication of hairs 12 months after partial longitudinal FUE was performed. After 3 months, characteristics between the recipient area and donor area were the same. There was re-growth and an increased number of hairs found 12 months post sugery in donor site. In addition to no visible bald spots, high multiplication rates (83.2% to 102.1%) also occurred in the donor area. With established re-

growth, maintained hair characteristics and high multiplication 12 months post procedure, these donor sites have the potential to be re-used in future hair transplantation. Caution should be given with these results as no statistical analysis was performed.

Mysore V. Hair Transplantation Surgery – Its Current Status. Journal of Cutaneous and Aesthetic Surgery 2010;3(2):64-68. PMID: 21031062. doi: 10.4103/0974-2077.69013.

Review Article.

As impressive techniques in hair restoration surgery are being developed (e.g., FUE, body hair etc.), miscommunications of these techniques are being discovered. Patients using the internet as a platform, public awareness of hair restoration surgeries have increased. This has resulted in the popularity of certain techniques (e.g., FUE), had increased the number of interested surgeons and has allowed for personal hair restoration stories to be shared. This has led however to exaggerated results, unmet patient expectations and the need for proper counselling for patients.

Toscani M, Curinga G, Trignano E, Bistoni G, Rusciani A. A Modified Scalpel in Hair Restoration. Journal of Drugs in Dermatology 2010;9(10):1266-67. PMID:20941952.

Review Article.

A modified scalpel can better enable surgeons to effectively harvest donor hair in a timely manner with limited scarring. A modified scalpel, folded at 120 degrees, can allow precise parallel incisions of the hair follicles. Minimal damage, such as cumulative scarring created by FUE, and resection of the hair follicle (commonly caused by single-strip techniques) can be avoided through this modification.

2009

Avram M, Rogers N. Contemporary hair transplantation. Dermatologic Surgery 2009 Nov;35(11):1705-19. PMID: 19674037. doi: 10.1111/j.1524-4725.2009.01283.

Review Article.

FUE is an advantageous option for clients who prefer shorter hairstyles, have scarring or have small localized alopecia areas. Disadvantages include larger time required and higher transection rates. These disadvantages can be resolved by using the strip method.

Avram MR, Rogers NE. Use of nonablative laser for corrective hair transplantation. Dermatologic Surgery 2009 Apr;35(4):717-8. PMID: 19415802.

Case study.

A non-ablative laser can be a non-invasive alternative to the FU technique when donor regions are depleted. A cosmetic improvement was achieved three months after three non-ablative laser sessions in a 45 year old male with a history of hair transplant procedures was performed.

Dudrap E, Divaris M, Bouhanna P. Hair micrograft technique for eyebrow reconstruction. Annales de Chirurgie Plastique Esthétique 2010 Jun;55(3):219-24. PMID: 19939542. 10.1016/j.anplas.2009.08.004.

Case Study.

Successful eyebrow reconstruction was reported in 3 clinical cases. In these cases hair from the opposite eyebrow or hair from the scalp was used.

Fan JC, Wang JP. Plastic surgical management of large cicatricial scalp alopecia. Zhonghua Yi Xue Za Zhi 2009;89(16):1098-101. PMID: 19595137.

Original Clinical Data.

Hair-grafting and tissue expansion are successful techniques that can be used for hair restoration in cicatricial scalp alopecia patients. Hair-grafting showed a 98% hair survival rate 8 months post procedure. Minimal complications were found using tissue expansion techniques. Further information could not be obtained as the article is in Chinese.

Hwang ST, Kim HY, Lee SJ, Lee WJ, Kim DW, Kim JC. Recipient-site influence in hair transplantation: a confirmative study. Dermatologic Surgery 2009;35(6):1011-4. PMID: 19397651. doi: 10.1111/j.1524-4725.2009.01175.x.

Case Study.

Body hair transplanted to the scalp region showed different growth characteristics as compared to native hairs. Characteristics such as length and hair growth rate were significantly different in the transplanted body hair grafts as compared to the surrounding scalp hair.

Inui S, Itami S. Dr. Shoji Okuda (1886-1962): the great pioneer of punch graft hair transplantation. Journal of Dermatology 2009;36(10):561-2. PMID: 19785715. doi:10.1111/j.1346-8138.2009.00704.x

Opinion.

Dr. Shoji Okuda is the first recorded surgeon to use punch graft hair transplantation.

He used his own circular punch to aid hair restoration procedures in cicatricial alopecia and female pubic atrichosis or hypotrichosis patients.

Jiménez-Acosta F, Ponce I. Hair transplantation in triangular temporal alopecia. Actas Dermosifiliogr 2009 Dec;100(10):913-5. PMID: 20038375.

Unknown.

Article is in Spanish and no abstract is available.

Laorwong K, Pathomvanich D, Bunagan K. Eyebrow transplantation in Asians. Dermatol Surg 2009;35(3):496-503. PMID: 19292838. doi: 10.1111/j.1524-4725.2009.01073.x

Case Studies.

Single follicular units harvested from the scalp were used successfully in five eyebrow transplantation surgeries. Eyebrow transplantations can help with thinning eyebrows; help cover tattoos and can be used in cicatricial alopecia patients.

Lee TS, Minton TJ. An update on hair restoration therapy. Current Opinion in Otolaryngology Head Neck Surgery 2009;17(4):287-94. PMID: 19528800. doi: 10.1097/MOO.0b013e32832da13b

Review.

This article focuses on reviewing recent literature, focusing on follicular unit transplant surgery. Topics discussed include FUE, strip surgery, hairlines and complications. Further information could not be obtained as full article was not available.

Miao Y, Hu ZQ, Sun XJ, Tan T, Chen MJ. Effects of different parts of the follicle-unit grafts subjected to controlled injury. Nan Fang Yi Ke Da Xue Bao 2009;29(9):1793-5. PMID: 19778792.

Original Clinical Data.

No morphological changes to FU grafts occur when the dermal papilla is injured.

Differences in elongation of the hair shaft could be impacted by this type of injury. Further information could not be obtained as the article is in Chinese.

Otberg N, Wu WY, Kang H, Martinka M, Alzolibani AA, Restrepo I, Shapiro J. Folliculitis decalvans developing 20 years after hair restoration surgery in punch grafts: case

report. Dermatologic Surgery 2009;35(11):1852-6. PMID:19691663. doi: 10.1111/j.1524- 4725.2009.01305.x

Case Study.

Folliculitis decalvans was a side-effect discovered in a 43-year old male. This side effect was a result of a 20 year old hair punch graft hair restoration surgery. Topical and oral treatments resolved the folliculitis decalvans.

Perez-Meza D, Niedbalski R. Complications in Hair Restoration Surgery. Oral and Maxillofacial Surgery Clinics of North America 2009;21(1):119-48. PMID:19185800. doi: 10.1016/j.coms.2008.10.010

Review.

In order to correctly perform follicular unit transplantations, correct placement, planning and expertise is needed. Improperly placed hairlines, angulation of the hair graft and the creation of large scars are complications that can occur if proper planning is not performed. To minimize complications and increase survival rates, follicular transections need to be minimized.

Puig CJ, Beehner ML, Cotterill PC, Elliott VW, Haber RS, Harris JA. Core competencies for hair restoration surgeons recommended by the International Society of Hair Restoration Surgery. Dermatologic Surgery 2009;35(3):425-7. PMID: 19292834. doi: 10.1111/j.1524-4725.2008.01059.x

Opinion.

The ISHRS has outlined skills and guidelines that should be put into clinical practice. Techniques used should minimize follicular damage, encourage maximal graft survival and minimize trauma upon implantation.

Ramirez AL, Ende KH, Kabaker SS. Correction of the high female hairline. Archives of Facial Plastic Surgery 2009;11(2):84-90. PMID: 19289679. doi: 10.1001/archfacial.2008.528

Retrospective Review.

Follicular unit grafting can be used successfully to camouflage scars created by moving hairlines in female patients. Using an irregular trichophytic incision to move the hairline forward 2.1 cm, 3 patients with cowlicks used follicular unit grafting. This technique

covered the scar created at the edge of the posterior growth hair.

Toscani M, Rotolo S, Ceccarelli S, Morrone S, Micali G, Scuderi N, Frati L, Angeloni A, Marchese C. Hair Regeneration from transected follicles in duplicative surgery: rate of success and cell populations involved. Dermatologic Surgery 2009; 35(7):1119-25. PMID: 19438685. doi:10.1111/j.1524-4725.2009.01197.x

Original Clinical Data.

Transected hair follicles still have the capacity to re-grow as they contain some of the essential markers required. Duplicative surgeries conducted in 28 patients showed similar hair growth rates between with upper and lower transected follicles 12 months post-surgery.

Differences in markers (e.g., K19 and CD34) present did occur between upper and lower transected follicles.

Wang JP, Fan JC, Chai JK. The treatment of cicatricial alopecia after burn with the technique of synchronously perforating and transplanting hair follicular-units. Zhonghua Shao Shang Za Zhi 2009 Dec;25(6):411-4. PMID: 20193160.

Large-scale Case Series.

Grafts dissected from strips harvested from occipital or temporal regions can produce successful results. Patients (n=166) with cicatricial alopecia and bald scar areas were treated with one or two surgeries. A 96.5% mean hair survival rate was found with 166 patients very satisfied / satisfied with the results. Further information could not be obtained as article is in Chinese.

Wu WY, Otberg N, Kang H, Zanet L, Shapiro J. Successful treatment of temporal triangular alopecia by hair restoration surgery using follicular unit transplantation. Dermatol Surg 2009;35(8):1307-10. PMID:19496794. doi:10.1111/j.1524-4725.2009.01233.x

Case Study.

Follicular units, obtained with stereomicroscopic dissection, were successfully transplanted in a 17 year old boy. New growth occurred at 4 months post-surgery and patient was pleased with the results.