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Opinion

Updates and Evolution in Fat Graft Murine Models and Plastic Surgery

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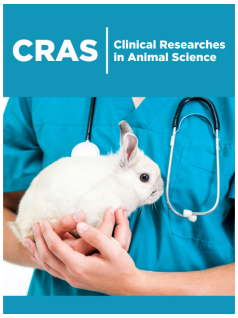

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Introduction

Fat graft is one of the most used and safe procedures on aesthetic and reconstructive plastic surgery, historically, the evolution of harvesting, preparation and application technique showed us the importance of a full understanding of all related issues to maximize best results. Animal research and experimentation is maybe the most important tool, because allows surgeons and researches to find a common ground for improvement of results and innovation of techniques for the good of patients. When a surgeon chooses to use fat graft, he needs to ensure and recognize the viability, risks, graft survival rate, scope and advantages; animal experimentation helps to answer all this questions and facilitates surgeon's decisions.

Historical Perspective

The use of fat as a graft for plastic surgery proposes is not new, is been used for at least a century since Neuber first reports in 1893 [1]. On animal research, one of the first fat graft reports occurred in 1954 when Hausberger successfully transplanted immature testicle fat tissue to the oblique muscle on rats [2]. Since then, a significant number of studies in this field have been carried out contributing to the progress and future of plastic surgery. In 1982, Van and Rocari successfully demonstrated full cellular differentiation and survival of cultured rat adipocytes re-implanted to a superficial intramuscular location; they observed fat pads in the recipient site six months after the implantation [3]. In 1990 Antoine conducted a 27 months fat and dermo fat isograft study on mice and conclude that vascularization by a major artery seemed to ensure preservation of up to 75% of the volume of the graft [4]. Later in 1994 Von Heimburg made the first free transplantation of fat expanded flaps from inguinal areas to the back of rats, he found by the end of the first expansion period that fat pad decreased by 53%, and full volume recovery was observed one week after implantation on the expanded flaps, he concluded that previous expanded flaps survive better [5]. Perhaps Guerrerosantos et al. [6] performed one of the largest studies in this topic in 1996. They fat grafted 120 wistar rats for a period of 12 months, and divided the animals in 6 groups, the donor site was the inguinal area and periurinary bladder, half of the groups were fat grafted intramuscular and other subcutaneously, the results showed clinical and microscopic success on the intramuscular grafted groups [6]. This progress occurred when fat grafting was used more for aesthetic and reconstructive proposes all over the world, on the 90s when Coleman popularize his fat graft technique in humans for multiple aesthetic issues, and started the fat graft revolution [7,8]. In 2005, Yamaguchi studied the use of vascular inhibitor TNP 470 in fat grafts on mice and concluded the weight of transplanted tissues and the size of adipocytes in the grafts were significantly lower in mice treated with TNP-470 than in control mice. These results found the inhibition of the revascularization of fat grafts after transplantation reduces graft volume retention and cellular function [9]. As well as in previous studies this one also highlighted the importance of arterial supply on the fat grafts showing to the new generations of surgeons that blood supply is vital in the recipient site.

Current Studies

Recently more advanced studies have been exploiting the maximum capacity of the fat graft and adding new pharmacological and technical tools. In 2014, Constantine RS implanted human lipoaspirate in two locations in the subcutaneous plane and into two inguinal fat pads in each of four athymic rats, after 47 days, they collected specimens and immunohistochemistry was used to determine angiogenesis on the grafts. They conclude no significant difference on angiogenesis signals between both groups [10]. This is an important finding because reinforced the idea of good subcutaneous adipocytes xenograft survival. The use of fat graft in plastic surgery is not confined only for volumetric proposes is also been used for healing and regenerative improvement, as showed in 2015 Tuncel by grafting fat on sciatic nerve injured rats, concluding better regeneration on the fat grafted group [11]. In 2018 Akgul, highlighted the importance of the ratio difference between the contain of free lipid and stem cell bearing stromal vascular fractions (SVF) on fat grafted athymic rats from human donor. Concluding in this murine xenograft model, 10% of free lipid provides the best condition for fat graft differentiation into viable fat tissue formation as well as collagen and elastin production [12]. More recently, studies have been exploring adipocyte survival with the use of insulin, deferoxamine, metoprolol, rosmarinic acid, alcohol and cigarette smoke among others this study showed some survival improvement for metoprolol and rosmarinic acid on fat grafted rats and negative effects in smoke exposure [13-15].

Fat graft rat experimentation started by numerous authors trying different kinds of fat implant locations like intramuscular, subcutaneous and sub periosteal, a variety of fat preparation techniques and harvesting. Over time this research gets more precise, adding and excluding, chemo tactical factors like SVF among others, and lastly the use of drugs as metoprolol among others [16]. Evolution on the field is helping new generations to improve patient results. Future generations of researchers most focus in improvement of minimal invasive procedures for growing, storage, multiplication and maybe production, of multicellular complexes of all cell lineage and for all recipients, to maximize the development of cell and factor therapies and to potentiate technical and technological improvements. Definitely, cell therapy will be in a near future the next step in the evolution of plastic surgery.

In conclusion fat graft is today one of the most important therapeutic options in plastic surgery, animal research is always facilitating surgeons' decisions by improving and perfecting techniques, allowing the use of new and safe strategies and therapies on patients.

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References

1. F Neuber (1893) Fettrasnsplantation Berich uber die verhandlungen der Deutschen gesellschaft fur chirurgie. Zbl Chir 22: 66.
2. Hasuberger FX (1955) Quantitative studies on the development of autotransplants of immature adipose tissue of rats. The Anatomical Record 122(4): 507-515.
3. Van RL, Roncari DA (1982) Complete differentiation *in vivo* of implanted cultured adipocyte precursors from adult rats. Cell Tissue Res 225(3): 557-566.
4. Antoine Ph (1990) Fat and dermofat isografts: an experimental study on mice. European Journal of Plastic Surgery 13: 247-250
5. Von Heimburg D, Lemperle G, Dippe, B, Kruger S (1994) Free transplantation of fat autografts expanded by tissue expanders in rats. British Journal of Plastic Surgery 47(7): 470-476.
6. Guerrerosantos J, Gonzalez Mendoza A, Masmela Y, Gonzalez MA, Deos M, et al. (1996) Long-term survival of free fat grafts in muscle: an experimental study in rats. Aesthetic Plast Surg 20(5): 403-408.
7. SR Coleman (1994) Lipoinfiltration of the upper lip white roll. Aesthet Surg J 14: 231-234.
8. SR Coleman (1994) The technique of the periorbital lipoinfiltration. Oper Tech Plast Reconstr Surg 1(3): 120-126.
9. Yamaguchi M, Matsumoto F, Bujo H, Shibasaki M, Takahashi K (2005) Revascularization determines volume retention and gene expression by fat grafts in mice. Experimental Biology and Medicine 230(10): 742-748.
10. Constantine RS, Harrison B, Davis KE, Rohrich RJ (2014) Fat graft Viability versus the local fat pad. Plast Reconstr Surg Glob Open 2(12): e260.
11. Tuncel U, Kostakoglu N, Turan A, Cevic B, Cayli S, et al. (2015) The effect of autologous fat graft with different surgical repair methods on nerve regeneration in rat sciatic nerve defect model. Plast Reconstr Surg 36(6):1181-1191.
12. Akgul Y, Constantine R, Bartels M, Scherer P, Davis K, et al. (2018) Utility of Adipocyte fractions in fat grafting in an athymic rat model. Aesthet Surg J 38(12): 1363-1373.
13. Okyay MF, Kumurcu H, Baghaki S, Demiroz A, Aydm O, et al. (2019) Effects of insulin, metoprolol and deferoxamine on fat graft survivval. Aesth Plast Surg 43(3): 845-852.
14. Sin B, Ciloglu NS, Omar S, Terzi NK (2019) Effect of rosmarinic acid and alcohol on fat graft survival in rat model. Aesth Plast Surg 44(1): 177-185.
15. Ercan A, Baghaki S, Suleimanov S, Aydin O, Konukoglu D, et al. (2019) Effects of Cigarette smoke on fat graft survival in an expermental rat model. Aesth Plast Surg 43(3): 815-825.
16. Esparza R, Valanci S, Robles JM, Gonzalez H, Baro C, et al. (2013) Autologous mesothelial cells transplantation as accelerator and skin healing modifier in rats. Cir plást Ibero-Latinoam 39(1): 47-51.