METHODS: The rat (n = 16) hindlimb femoral artery and vein were transmurally micropunctured using a 60-µm diameter needle at 1-mm intervals over a 15-mm length, just prior to implantation of a Type I bulk collagen scaffold. The contralateral hindlimb served as a normal (non-micropunctured) internal control. The femoral vasculature and implanted scaffold were circumferentially wrapped with a thin silicone sheet in eight animals to isolate intrinsic vascular growth. In remaining animals (n = 8), segments were not isolated from the extrinsic environment, allowing for both intrinsic (femoral vessels) and extrinsic (femoral vessels plus contiguous tissue) vascularization. At the four-week timepoint, animals underwent in situ fluorescence angiography. Following explantation of the scaffolds and femoral vasculature, samples were prepared for thin section and whole mount histology. Specimens were examined for various vascular metrics, including diameters, lengths, branch points, and density using ImageJ software (NIH). Mean vascular density (vessel area/total area) was compared in detail within groups (control versus MP) and between groups (with or without a silicone wrap). Statistical significance was defined as P < 0.05.

RESULTS: Following a four-week scaffold implantation period, mean vascular density was found to be increased in MP limbs when compared with non-MP internal controls across both silicone (intrinsic vascularization only) and no-silicone (intrinsic/extrinsic vascularization) wrapped cohorts. MP dramatically increased the amount of intrinsic scaffold vascularization (33.5% versus 17.0%, P < 0.001). MP effects also contributed to non-silicone wrapped collagen vascularization, but to a lesser degree (20.9% versus 17.4%, P = 0.063).

CONCLUSIONS: The angiogenic effects of our novel micropuncture technique continue to persist for at least 4 weeks. Our results suggest that MP has a profound impact on intrinsic vascularization emanating from the femoral vessels. It is not surprising that when both intrinsic and extrinsic contributions were analyzed together, the differences in scaffold vascularization was reduced between the MP and non-MP groups. This suggests that micropunctured vessels act as an angiogenic pedicle that can support a graft on its own. But, much like in clinical plastic surgery practice, its central importance is lessened as vascular ingrowth from contiguous tissues becomes more prevalent for flap survival.

REFERENCE:
1. Hancock PC, Koduru SV, Sun M, Ravnic DJ. Induction of scaffold angiogenesis by recipient vasculature precision micropuncture. Microvasc Res 2021;134:104121.

The Most Disruptive Publications in Plastic Surgery

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BACKGROUND: The impact of academic publications is often characterized by the total number of future citations of the work. However, this metric does not adequately characterize the true impact in terms of changing practices or paradigms. A newly created metric called the “disruption score” (DS) has been developed and validated in non-surgical publications. This study aimed to evaluate the DS metric to identify the most disruptive publications in the Plastic Surgery literature.

The DS, a ratio of two numbers, varies between −1 and +1. The numerator is the number of articles that cited the focal article without also citing any of its references minus the number of articles that cited the focal article and at least one of its references. The denominator is the total number of times the focal article was cited plus the number of papers that cited at least one of the references of the focal paper, but not the focal paper itself. Scores closer to −1 are developing articles that summarize the known literature, whereas articles closer to +1 are disruptive—they result in a paradigm shift in the field of study.

METHODS: A search was performed for all articles from 1954 to 2014 in the following journals: Plastic and Reconstructive Surgery, Aesthetic Surgery Journal, Journal of Plastic, Reconstructive, and Aesthetic Surgery, Annals of Plastic Surgery, Aesthetic Plastic Surgery, Clinics in Plastic Surgery, and Plastic Surgery. The DS was calculated for each journal article.

The top 100 articles ranked by DS were examined and any editorials/viewpoints, publications with less than 26 citations, or less than three references were excluded due to their subjective nature and smaller academic contribution. The remaining 64 publications were analyzed for topic, study type, and citation count. Sub-analysis of the 36 excluded articles was performed.
RESULTS: A total of 32,622 articles were found in the seven journals. The DS Score ranged from 0.385 to 0.923. The mean score of the top 64 articles was 0.539 with an average citation count of 195 and 9 references. Plastic and Reconstructive Surgery had the most disruptive articles with 50, Journal of Plastic, Reconstructive, and Aesthetic Surgery had the next most with 12, and Annals of Plastic Surgery had 2. There were no randomized control trials with a majority of the studies being technical descriptions or case series.

CONCLUSIONS: There are many ways to measure academic success, but there are fewer ways to measure the impact of academic contributions on a field. The DS is a novel measurement that can demonstrate when an article results in a paradigm shift as opposed to just total citation count. When applied to the body of plastic surgery literature, the DS demonstrates that technical innovation and creativity is the most academically impactful. Future evaluations of academic success should include the Disruption Score to measure the quality of academic contributions.

REFERENCE:
1. Wu L, Wang D, Evans JA. Large teams develop and small teams disrupt science and technology. Nature 2019;566(7744):378–382. doi:10.1038/s41586-019-0941-9

The Effect of Pre- and Postsurgical Topical Tacrolimus on Pedicled Flap Survival in Rats: A Pilot Study

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PURPOSE: Our previous rodent studies demonstrated significantly decreased full thickness necrosis in pedicled dorsal skin flaps with topical tacrolimus when compared with petroleum jelly. Histologically, we found that topical tacrolimus was correlated with increased vascular growth in areas more susceptible to ischemic damage. The purpose of this study was to investigate the potential benefits of pre-treatment with tacrolimus. By applying tacrolimus in advance of raising the dorsal skin flaps, we hoped to increase vascularity and thus increase the overall viability of the flaps.

METHODS: In total, 18 Sprague-Dawley rats were randomized to four groups based on timing of tacrolimus treatment (pre/post-surgical treatment): Control/Control (C/C), Control/Tacrolimus (C/T), Tacrolimus/Control (T/C), and Tacrolimus/Tacrolimus (T/T). Treatments consisted of 0.2 g of the control (topical petroleum jelly) and 0.1% topical tacrolimus to the rat dorsum twice per day. After 7 days of pre-surgical treatment, a cranially based dorsal skin flap measuring 3 × 10 cm was created. Each rat was treated for a further 7 days and killed. Two blinded reviewers marked the total skin flap area as well as areas of viable tissue, reversible ischemia, and full thickness necrosis. Percentage areas were calculated using Fiji:ImageJ and statistical analysis was performed in R.

RESULTS: The average viable areas for C/C, C/T, T/C, and T/T was 31.4%, 31.9%, 35.6%, and 22.6%, respectively. The average reversible ischemic area for C/C, C/T, T/C, and T/T was 53.1%, 54.0%, 54.1%, and 71.5%, respectively. The average necrotic area for C/C, C/T, T/C, and T/T was 15.4%, 14.0%, 10.2%, and 5.9%, respectively. For areas of reversible ischemia, T/T arm had higher areas compared with C/T ($P = 0.004$) and T/C ($P = 0.044$). There was no significance between treatment arms for areas of viable and necrotic tissue. Interestingly, when compared with C/C, the T/T arm marginally did not reach significance in both reversible ischemia ($P = 0.059$) and necrosis ($P = 0.062$).

CONCLUSIONS: We observed higher areas of reversible ischemia for continuous tacrolimus treatment compared with only pre- or post-tacrolimus application. This suggests that tacrolimus application before and after surgical insult may be associated with improved ischemic survival of the skin. Although we did not observe decreased areas of necrosis for tacrolimus treatment compared with control, this was likely due to the limited number of rats available in each arm to reach significance. Further study is needed to fully elucidate the encouraging trends that were observed.

Reduction of Work-related Musculoskeletal Disorders in Plastic Surgeons via Introduction of a Posture-training Device

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