

Percentage of Graft Viability Versus Injected Volume in Adipose Autotransplants

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Abstract. An adipose tissue graft's ability to obtain nutrition through plasmatic imbibition occurs approximately 1.5 mm from the vascularized edge. This and the observation that only 40% of this peripheral margin is viable led the authors to create spherical and cylindroid models to correlate the volume and the percentage of graft viability to the initial injected volume in adipose autotransplants. The authors concluded that the percentage of graft viability depends on the thickness and the geometrical shape and is inversely proportional to the graft diameter if grafts with a diameter greater than 3 mm are considered.

Key words: Adipose grafts — Fat grafts — Percentage of the fat graft viability

Study of the literature on fat autografts shows the high degree of graft reabsorption and the difficulties found in clinical evaluation to determine graft viability. Moreover, there are conflicting results about the percentage of viability; some authors even believe that adipose grafts are inviable [3–5].

The fat graft can obtain nutrition through plasmatic imbibition approximately 1.5 mm from the edge. This fact and the observation that 60% of this region is inviable led us to conclude that graft viability is about 40% of 1.5 mm from its vascularized periphery [1, 2]. Thus, our purpose in this article is to make a quantitative evaluation of graft viability with respect to the initial injected volume in a single site.

We created spherical and cylindroid models which

simulated adipose grafts in the host site in order to perform a computer analysis of the percentage of graft viability with respect to the total graft volume in a single site. The percent values were based on the data that only 40% of the graft that is 1.5 mm from the graft edges is viable (Figs. 1, 2). The values our models came up with for the viable volume and the viable percentage with respect to the initial injected volume are given in Tables 1 and 2 and in Figure 3.

Discussion

The results suggest that both the volume and percentage of graft viability depend on the thickness and geometric shape assumed by the graft in the host site. The maximum viable percentage is about 40% when the distance from the vascularized edge of the graft is no greater than 1.5 mm. Thus, a remarkable decrease of this percentage is noticed when the injected volume surpasses this limit.

Figure 3 shows that the viable percentage is inversely proportional to the injected volume if injection is at a single site. This percentage may decrease according to the management of the adipose tissue during the grafting procedure. Therefore, several steps should be observed if good results are to be achieved:

1. harvesting techniques of the adipose grafts (e.g., cannula length and diameter, exerted pressure)
2. management techniques of the adipose tissue (e.g., the solution used to wash out the graft from blood clots and free fat, time interval between the harvesting and the grafting procedures, environmen-

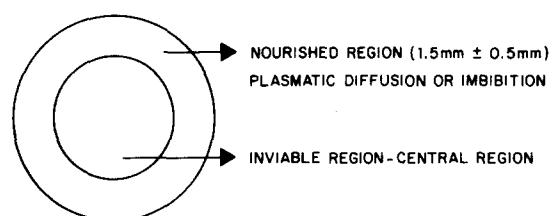


Fig. 1. Scheme of nutrition for the spherical adipose graft larger than 3 mm in diameter

Table 1. Relationship between injected volume and final viable grafted volume for the spherically shaped model, according to the plasmatic imbibition ability^a

Vt	Rt	Ri	Vi	Vt - Vi	Vv	%
0.01	0.15	0.00	0.000	0.010	0.004	40.0
0.20	0.36	0.21	0.039	0.171	0.064	32.0
0.25	0.39	0.24	0.058	0.192	0.077	30.8
0.50	0.49	0.34	0.165	0.335	0.134	26.8
1.00	0.62	0.47	0.435	0.565	0.226	22.6
2.00	0.78	0.63	1.047	0.953	0.381	19.0
5.00	1.06	0.91	3.156	1.843	0.737	14.8
10.00	1.34	1.19	7.059	2.941	1.176	11.7
20.00	1.68	1.53	15.002	4.998	1.999	10.0

^aVt = total volume (ml), Rt = sphere ray of the total volume, Ri = sphere ray of the invialbe volume, Vi = invialbe volume, Vv = viable volume = (Vt - Vi) · 0.4, % = viable percentage

Table 2. Relationship between injected volume and final viable grafted volume for the cylindroid-shaped model, according to the plasmatic imbibition ability^a

Vt	Rt	Ri	Vi	Vt - Vi	Vv	%
0.01	0.00	0.00	0.000	0.010	0.004	40.0
0.20	0.15	0.00	0.000	0.200	0.080	40.0
0.25	0.16	0.01	0.008	0.242	0.097	38.8
0.50	0.23	0.08	0.054	0.446	0.178	35.6
1.00	0.33	0.18	0.275	0.725	0.290	29.0
2.00	0.46	0.31	0.815	1.185	0.474	23.7
5.00	0.73	0.58	2.853	2.147	0.859	17.2
10.00	1.03	0.88	6.569	3.431	1.372	13.7
20.00	1.46	1.31	14.556	5.444	2.178	10.9

^aVt = total volume (ml), Rt = cylinder ray of the total volume, Ri = cylinder ray of the invialbe volume, Vi = invialbe volume, Vv = viable volume = (Vt - Vi) · 0.4, % = viable percentage. Height of cylinder = 3 cm

tal temperature, exposure to air, size and shape of the adipose fragments to be grafted)

3. grafting techniques (e.g., cannula types, pressure)

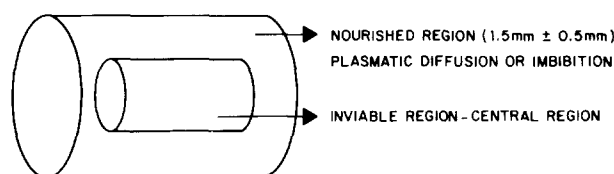


Fig. 2. Scheme of nutrition for the cylindroid-shaped graft larger than 3 mm in diameter

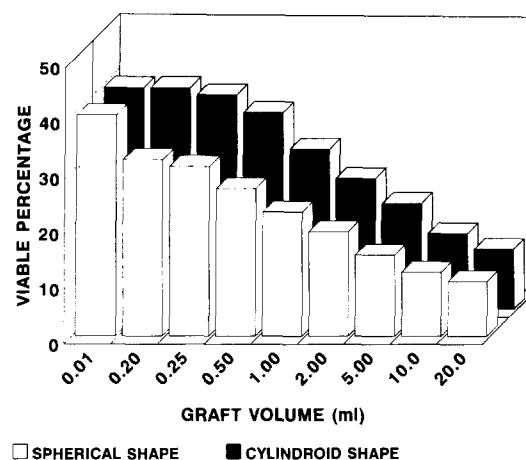


Fig. 3. Histogram of the fat graft volume in relation to the percentage of viable graft for the cylindroid and spherical models

4. donor and host sites' characteristics (e.g., anatomic, histologic, and physiologic properties)

5. individual intrinsic factors related to the inflammatory response to the graft.

We believe that a better knowledge of the adipose tissue's physiology, histochemistry, and inflammatory alterations, as well as how to adequately manage it during harvesting and grafting will lead us to a rational use of this valuable technique. Thus, alterations such as edema, inflammatory infiltration, collagen turnover, and the long interval requested for the pseudocysts' degradation and reabsorption will be better accepted as natural stages of adipose autografting and will permit a better clinical evaluation of these phenomena.

Conclusion

The results of our study disclose that the percentage of fat graft viability depends on the thickness and the geometric shape assumed by the graft in the recipient site. The maximum percentage is about 40% when the graft is no greater than 3.0 mm thick. The percentage gradually decreases as the injected volume surpasses this total diameter.

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