

Original Research Article

Effectiveness of autologous lipoinjection into the hand to improve function in patients with scleroderma: pilot study

Juan Pablo Espinosa-Torres¹, Pedro Grajeda-López², María del Pilar Cruz-Domínguez³, Luis Rodrigo Carazo-Quiroz⁴, Edgar Ramírez-López⁵, Maribel Belmontes-Castillo⁶, Alan Isaac Valderrama-Treviño⁷, Rodrigo Banegas-Ruiz⁸, Víctor Manuel Ramos-Lojero⁹, Baltazar Barrera-Mera^{10*}

¹Department of Pediatric Plastic and Reconstructive Surgery, HGCMN La Raza, IMSS, CDMX, Mexico

²Department of Plastic and Reconstructive Surgery, HECMN La Raza, IMSS, CDMX, Mexico

³Department of Research Division, HECMN La Raza, IMSS, CDMX, Mexico

⁴Department of Plastic and Reconstructive Surgery, CMNSXXI, IMSS, CDMX, Mexico

⁵Department of Plastic and Reconstructive Surgery, Regional General Hospital El Marques, IMSS, Qro. Mexico

⁶Fellow in Plastic Surgery and Facial Aesthetics, Innovare Hospital, Zapopan Jalisco, Mexico

⁷Laboratory of experimental immunotherapy and tissue engineering, Faculty of Medicine, UNAM, CDMX, Mexico

⁸Service of Traumatology, Rehabilitation Hospital, Luis Guillermo Ibarra Ibarra, CDMX, Mexico

⁹Epidemiology Service, General Directorate of Epidemiology, CDMX, Mexico

¹⁰Department of Physiology, Faculty of Medicine, UNAM, CDMX, Mexico

Received: 17 June 2019

Revised: 22 June 2019

Accepted: 26 June 2019

*Correspondence:

Dr. Baltazar Barrera-Mera,

E-mail: baltazar.barrera.mera@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Scleroderma is a rare disease of the tissues that is characterized for being inflammatory and developing fibrosis in the skin. Typically, this disease affects middle-aged women.

Methods: A study was conducted in which 10 patients with scleroderma with involvement in the sclerotic stage were included. One of the hands was chosen randomly for treatment with fatty graft processed by Coleman technique and the other hand, physiological solution was placed. Patients were evaluated at 45 and 90 days after the procedure using the Cochin Hand Functional Scale (CHFS) questionnaire, modified Rodnan scale for the skin (mRSS), grip strength with dynamometer and measurement of fingertip to palm of hand in flexion.

Results: The average of CHFS before treatment was 42.30 and 25.70 at 90 days $p=0.007$. The average strength in the experimental hand before treatment was 11.67 and 14.58 at 90 days $p=0.007$, in the control hand $p=0.873$. The mean finger-palm tip distance before treatment was 44.80 and from 36.00 to 90 days $p=0.019$, in the control hand $p=0.149$. There is a significant difference in the degree of severity at 90 days of the mRSS of the back of the hands $p=0.011$ and phalanges $p=0.000$ between the patients with lipoinjection and physiological solution.

Conclusion: Significant improvement was observed in patients with scleroderma treated with autologous lipoinjection.

Keywords: Atologous transplant, Fibrosis, Lipoinjection, Scleroderma, Sclerotic stage, Thickened fingers

INTRODUCTION

Scleroderma is a rare disease of the tissues characterized for inflammation and developing fibrosis in the skin.¹ Typically, this disease affects middle-aged women, where

vascular and immunological problems are involved.² From 1970, the incidence of this disease increased considerably, during the decade of the 90's of the last century where it reached a prevalence of 242 cases per million, with an incidence of 19 per million.³ For the last decade the prevalence increased to 860 cases per 100,000 people and an incidence of 1.4 per 100,000 per year in the United States.⁴

The hand with scleroderma

One of the main regions that suffer fibrosis in scleroderma is the hand, which is the sign of the disease for diagnosis and at the same time one of the main aesthetic alterations. It generates an appearance of thickened fingers in the first stages in conjunction with edema in the rest of the hand. Later in the sclerotic phase the skin thickens and acquires a bright appearance, in addition to becoming firm. This induces a lack of mobility in the hand and fingers. Additionally, changes in skin pigmentation develop (Figure 1).⁵



Figure 1: Characteristics of scleroderma in hands.

Damage to the hand due to scleroderma is one of the disabilities in this pathology, this directly influences the work as well as in daily activities.⁶

It represents 75% of the disabilities associated with scleroderma, and with the onset of anxiety and depression.^{7,8} Additionally, the fibrosis of the hand is refractory to treatment with antifibrotic drugs, so it is limited to the care and protection of the hand with physiotherapy, vasodilators, trauma protection and aesthetic care.⁹

METHODS

A prospective, experimental, longitudinal, comparative, blind study was carried out with simple random sampling. The study was carried out in the Plastic and Reconstructive Surgery service located in the Specialty Hospital of the UMAE "Dr. Antonio Fraga Mouret", from

the National Medical Center" La Raza ", IMSS, January 2018 - January 2019.

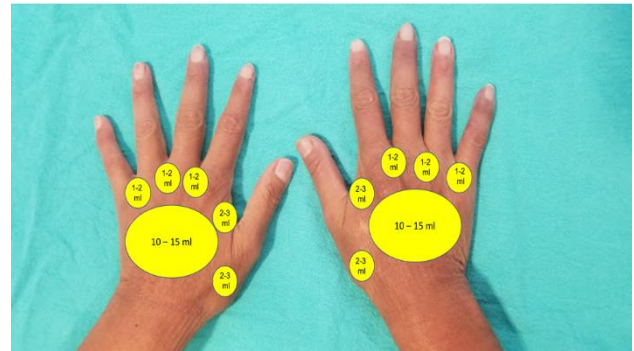


Figure 2: Recommended amounts of fatty tissue infiltration in the back of the hands.

Table 1: Criteria for inclusion, exclusion and elimination.

| Inclusión criteria | Exclusion criteria | Elimination criteria |
|---|--|--------------------------------------|
| Both sexes, over 18 years old. | Patients with high surgical risk. | Voluntary abandonment of the patient |
| Scleroderma / sclerosis with fibrotic stage. | Active infection or ulcers on hands. | Leave medical consultations |
| Functional alteration in the hands CHFS > 20/90. | Condition in hands in edematous stage or atrophic stage. | |
| Affected hand with Rodnan between 3 to 5 points. | Pregnant patients | |
| Fingertip to palm in flexion from 2 to 4.9 cm. | | |
| Availability and access to the electronic clinical file. | | |
| No adjustment of systemic treatment for scleroderma in the last 3 months. | | |

HFG A single study group was used, patients with systemic sclerosis, with hand involvement in the fibrotic stage of the disease, with some level of dysfunction assessed with the Cochin test, of hand functionality. Each patient received treatment in one hand and placebo in another hand. Figure 2. The inclusion, exclusion and elimination criteria are shown in Table 1.

Statistical analysis

It was carried out in the SPSS program, where the Chapiro Wilk test was used to corroborate normality and the Student's T test to compare before and after the

treatment at 90 days and determine if it has significant effects on patients. The Mann-Whitney U test was performed for the mRSS categorical variables.

RESULTS

CHFS evaluation, the data is summarized in Figure 3.

The mean CHFS before treatment was 42.30 and 25.70 at 90 days $p=0.005$, so it is concluded that the treatment does have significant effects on the CHFS of the patient.

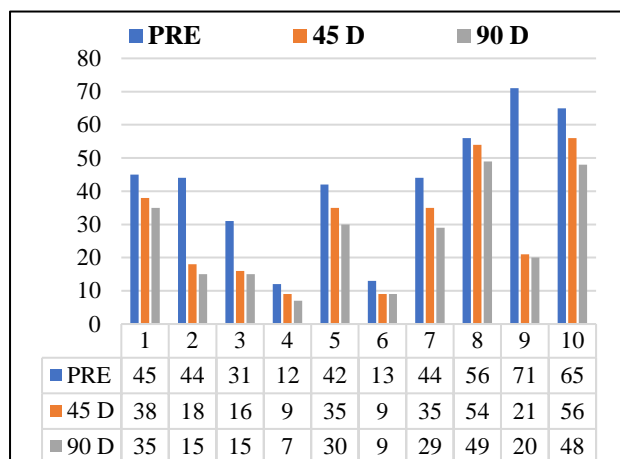


Figure 3: CHFS results are preoperatively, at 45 and 90 days postoperatively.

Strength evaluation

The mean strength before treatment was 11.67 and 14.58 at 90 days $p=0.007$, so it is concluded that the treatment does have significant effects on the strength of the patient. Hand infiltrated with physiological solution. No significant difference, $p=0.873$.

Distance

The mean distance before treatment was 44.80 and from 36.00 to 90 days, $p=0.019$, so it is concluded that the treatment does have significant effects on the phalange-palm distance in the patients. Hand infiltrated with physiological solution. No significant difference, $p=0.149$.

DISCUSSION

Different investigations have been carried out on the autologous fatty tissue graft since not only has a filling effect, it also has a regenerative potential. Its use can revert fibrosis in different pathological conditions, among them scleroderma.¹⁰ Regarding its safety, it does not immune response, and it is not carcinogenic, teratogenic or infectious. It is easily accessible in areas such as the abdomen or gluteus and being a self-transplant tissue, is not necessary to purchase synthetic materials.¹¹ The limitations of this therapy are a low body volume that

prevents the correct aspiration of the adipose tissue, severe and irreversible retraction of the fingers, and the need for a suitable laboratory to obtain a functional sample.¹²

Among its many functions, the transfer of adipose tissue produces a decrease in the deposition of collagen and increases the elasticity and vascularity of the tissue, while its range of proliferation, metabolic activity, migration potential and invasion of adipose-derived stem cells decrease in comparison with adipose cells of healthy patients. Approximately 25% of patients adipose tissue was reabsorbed between 6-12 months, but the improvement in mobility and function remained.^{12,13}

In the endocrine system, stem cells derived from adipose tissue are able to secrete cytokines and growth factors such as SDF-1, (Factor 1 derived from stromal cells) and VEGF (produces an activation of differentiated surrounding cells and neighboring stem cells), progenitors endothelial cells, hepatocyte growth factor (HGF), placental growth factor (PGF), fibroblast growth factor b (b-FGF), transformation growth factor (TGF- β), interferon gamma (IFN- γ), are factors that participate in tissue angiogenesis and repair in addition to having a large number of fibroblasts capable of secreting collagen and organizing an extracellular matrix.¹³⁻¹⁵ With the use of the most up-to-date techniques, the autologous fatty tissue graft is associated with few complications. Within the procedures performed in the Plastic and Reconstructive Surgery service, there are rejuvenation procedures in hand, specifically with autologous fatty tissue. This fatty tissue is used in other cases, such as body asymmetries, atrophies, sequelae of burns and radiodermatitis by radiotherapy. Due to the benefits offered by this treatment, the use of this technique is proposed to improve the quality of skin on the back of the hands in patients with scleroderma and assess its functional improvement.

CONCLUSION

As in many other autoimmune pathologies, there is no curative treatment in patients with scleroderma and at the level of the damages generated, such as hand disability, there is no completely reversible treatment. The present study provides a possible therapeutic option for patients with scleroderma, which demonstrates the effectiveness of autologous lipoinjection.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Eckes B, Moinzadeh P, Sengle G, Hunzelmann N, Krieg T. Molecular and cellular basis of scleroderma. J Mol Med (Berl). 2014;92(9):913-24.

2. Katsumoto TR, Whitfield ML, Connolly MK. The pathogenesis of systemic sclerosis. *Annu Rev Pathol.* 2011;6:509-37.
3. Mayes MD. Scleroderma epidemiology. *Rheum Dis Clin North Am.* 1996;22(4):751-64.
4. Cooper GS, Stroehla BC. The epidemiology of autoimmune diseases. *Autoimmun Rev.* 2003;2(3):119-25.
5. Mouthon L. Hand involvement in systemic sclerosis. *Presse Med.* 2013;42(12):1616-26.
6. Guillevin L, Hunsche E, Denton CP, Krieg T, Schwierin B, Rosenberg D, et al. Functional impairment of systemic sclerosis patients with digital ulcerations: results from the DUO Registry. *Clin Exp Rheumatol.* 2013;31(2 Suppl 76):71-80.
7. Rannou F, Poiraudeau S, Berezne A, Baubet T, LeGuern V, Cabane J, et al. Assessing disability and quality of life in systemic sclerosis: construct validities of the Cochin Hand Function Scale, Health Assessment Questionnaire (HAQ), Systemic Sclerosis HAQ, and Medical Outcomes Study 36-Item Short Form Health Survey. *Arthritis Rheum.* 2007;57(1):94-102.
8. Nguyen C, Ranque B, Baubet T, Berezne A, Mestre-Stanislas C, Rannou F, et al. Clinical, functional and health-related quality of life correlates of clinically significant symptoms of anxiety and depression in patients with systemic sclerosis: a cross sectional survey. *PLoS One.* 2014;9(2):e90484.
9. Daumas A, Magalon J, Jouve E, Truillet R, Casanova D, Giraudo L, et al. Longterm follow-up after autologous adipose-derived stromal vascular fraction injection into fingers in systemic sclerosis patients. *Curr Res Transl Med.* 2017;65(1):40-3.
10. Gheisari M, Ahmadzadeh A, Nobari N, Iranmanesh B, Mozafari N. Autologous Fat Grafting in the Treatment of Facial Scleroderma. *Dermatol Research and Practice.* 2018;1-7.
11. Montero-Acebal MLM, Travesedo EE, Gomez-Bajo GJ, Autólogo IDT. Aplicaciones En Dermatología. 2015;30(3)159-68.
12. Magalon G, Daumas A, Sautereau A, Magalon JR, Sabatier F, Granel B. Regenerative Approach to Scleroderma with Fat Grafting. *Clin Plastic Surg.* 2015;353-64.
13. Griffin M, Ryan CM, Pathan O, Abraham D, Denton CP, Butler PEM, Characteristics of human adipose derived stem cells in scleroderma in comparison to sex and age matched normal controls: implications for regenerative medicine. *Stem Cell Research & Therapy.* 2017;8-23.
14. Daumas A, Eraud J, Hautier A, Sabatier F, Magalon G, Granel B. Interests and potentials of adipose tissue in scleroderma. *La Revue de Medecine Interne.* 2013 Dec;34(12):763-9.
15. Guillaume-Jugnot P, Daumas A, Magalon J, Sautereau N, Veran J, Magalon G, et al. State of the art. Autologous fat graft and adipose tissue-derived stromal vascular fraction injection for hand therapy in systemic sclerosis patients. Current research in translational medicine. 2016Jan1;64(1):35-42.

Cite this article as: Espinosa-Torres JP, Grajeda-López P, Cruz-Domínguez MDP, Carazo-Quiroz LR, Ramírez-López E, Belmontes-Castillo M, et al. Effectiveness of autologous lipoinjection into the hand to improve function in patients with scleroderma. Pilot Study. *Int J Res Med Sci* 2019;7:2883-6.