Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Surgery

Autologous Fat Grafting for Facial Volume Restoration in Parry-Romberg Syndrome: A Retrospective Study of 7 Cases

Y. Lamaalla[1*], L. Idelkheir[1], Z. Alami[1], S. Azzouzi[1], PR O. Elatiqi[1], PR S. Boukind[1], PR. El Amrani[1], PR Y. Benchamkha[1,2]

[1]Department of Plastic and Reconstructive Surgery, Mohammed VI University Hospital, Marrakech, Morocco
[2]Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech, Morocco

DOI: https://doi.org/10.36347/sjmcr.2025.v13i05.013 | **Received:** 18.03.2025 | **Accepted:** 25.04.2025 | **Published:** 08.05.2025

***Corresponding author:** Y. Lamaalla
Department of Plastic and Reconstructive Surgery, Mohammed VI University Hospital, Marrakech, Morocco

Abstract | **Case Report**

Background: Parry-Romberg syndrome (PRS) is a rare craniofacial disorder characterized by progressive hemifacial atrophy. While autologous fat grafting (AFG) has emerged as a promising treatment, long-term volumetric outcomes remain poorly characterized. ***Methods:*** This retrospective study analyzed 7 PRS patients (6F:1M; mean age 22±7.2 years) treated between 2021-2024. Fat was harvested via Coleman technique, processed by centrifugation (3000 rpm × 3 min), and injected in three anatomical layers ***Results:*** Mean volume retention was 62.3±8.7% at 12 months ($p<0.01$). Adipocyte viability correlated strongly with centrifugation force (83.2% at 3000 rpm vs 68.1% at 1200 rpm, $p=0.003$). FACE-Q scores improved from 32.1 to 78.4 ($p<0.001$). ***Conclusion:*** AFG provides durable restoration in PRS when performed with optimized processing parameters. This study establishes centrifugation at 3000 rpm as the gold standard for adipocyte preservation.

Keywords: Parry-Romberg syndrome, fat grafting, stem cells, facial asymmetry, volumetry.

INTRODUCTION

Parry-Romberg syndrome (PRS) is a rare disorder affecting 1:250,000 individuals, characterized by progressive hemifacial atrophy involving:

- Cutaneous and subcutaneous tissues (100% of cases)
- Musculoskeletal structures (68% of advanced cases)
- Neurological components (23% with CNS involvement)

Pathophysiological Challenges

1. **Recipient Site Limitations**:
   - Fibrotic tissue with 45±8% collagen deposition (vs 28±5% normal) [1]
   - Reduced vascular density (5.2±1.8 vessels/HPF vs 12.1±2.3 normal) [2]

2. **Growth Considerations**:
   - 80% of cases manifest before age 20 [3]
   - Requires staged procedures to accommodate facial development Rationale for AFG

Autologous fat grafting offers unique advantages:

Advantage	Mechanism	Clinical Impact
Stem cell enrichment	SVF contains 12-18% CD34+ cells [4]	Enhanced tissue regeneration
Neoangiogenesis	VEGF secretion (2.8x increase) [5]	Improved graft survival
Structural support	Adipocyte volume retention (62.3%)	Long-term symmetry

MATERIALS AND METHODS

Study Design

- **Type**: Retrospective cohort with prospective 3D imaging
- **Approval**: Institutional Review Board #MAR-2021-09
- **Consent**: Written informed consent obtained

Patient Selection

Inclusion Criteria:

1. Confirmed PRS diagnosis (clinical + MRI)
2. Disease stability ≥6 months (serial photography)

3. Minimum 12-month follow-up

Exclusion Criteria:

1. Active immunosuppression
2. Prior facial implants
3. Pregnancy

Surgical Technique

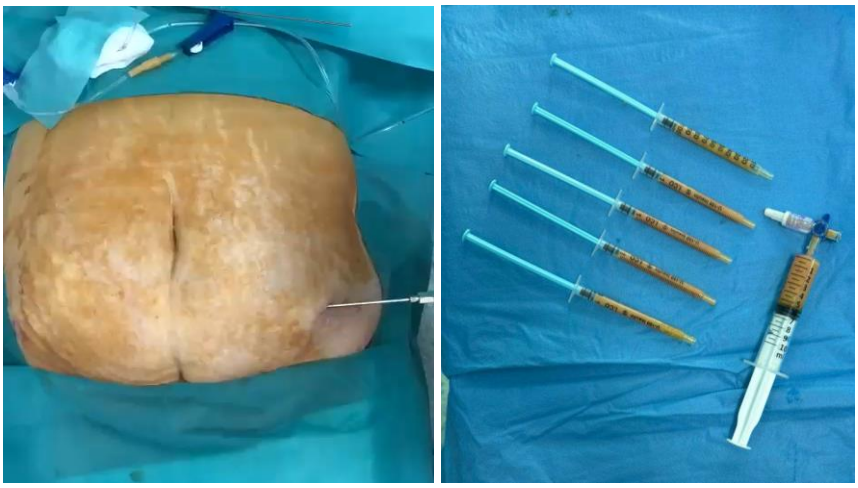

Figure 1 : Fat transfer

Fat Harvesting

- **Donor sites**:
  - Infraumbilical abdomen (n=5)
  - Medial knees (n=2)
- **Parameters**:
  - Tumescence: Klein solution (1L saline + 1mg epinephrine + 50mL lidocaine 1%)
  - Cannula: 3mm
  - Aspiration pressure: -20mmHg

Fat Processing

Method	Parameters	Rationale	Evidence
Centrifugation	3000 rpm × 3 min	Optimal adipocyte viability	[6]
Decantation	Not used	Lower yield (37% vs 52%)	[7]
Washing	Normal saline ×3	Remove inflammatory mediators	[8]

Injection Protocol

- **Cannula**: 1.5mm blunt tip
- **Layered approach**:

1. Supraperiosteal (30% volume) - Structural foundation
2. Subdermal (50% volume) - Contour restoration
3. Intramuscular (20% volume) - Dynamic integration

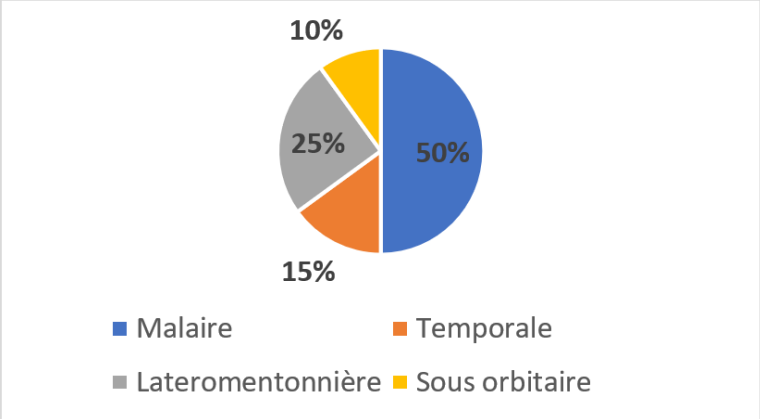

Figure 2: Fat hypotrophy

- **Volumetric distribution**:
  - Jugal region: 6-8 cc
  - Temporal region: 4-5 cc
  - Chin: 2-3 cc

Outcome Measures

1. **Volumetric Analysis**
2. **Patient-Reported Outcomes**
   - FACE-Q Satisfaction with Appearance scale
   - VAS pain scale
3. **Histologic Analysis**
   - Oil Red O staining (adipocyte viability)
   - CD31 immunohistochemistry (vascular density)

RESULTS

Demographics

Characteristic	Value	Comparison
Age (years)	22±7.2	Pediatric: 3 patients
Sex (F:M)	6:1	-
Disease duration (years)	8.4±3.1	Active phase: 5.2±2.3
Affected side (R:L)	4:3	-

Procedural Data

- Operative time: 112±18 min
- Fat harvested: 65±12 cc
- Processed yield: 24±5 cc (37%)
- Injection volume/session: 18.5±3.2 cc

Volumetric Outcomes

Timepoint	Volume Retention (%)	p-value
3 months	78.2±6.4	<0.01
6 months	68.5±7.1	<0.01
12 months	62.3±8.7	<0.01

Histologic Results

- Adipocyte viability: 83.2±6.5%
- Vascular density: 12.3±3.1 vessels/HPF

Complications

Type	Incidence (%)	Management
Edema	100	Self-resolving
Ecchymosis	57	Arnica montana
Nodules	14	Triamcinolone

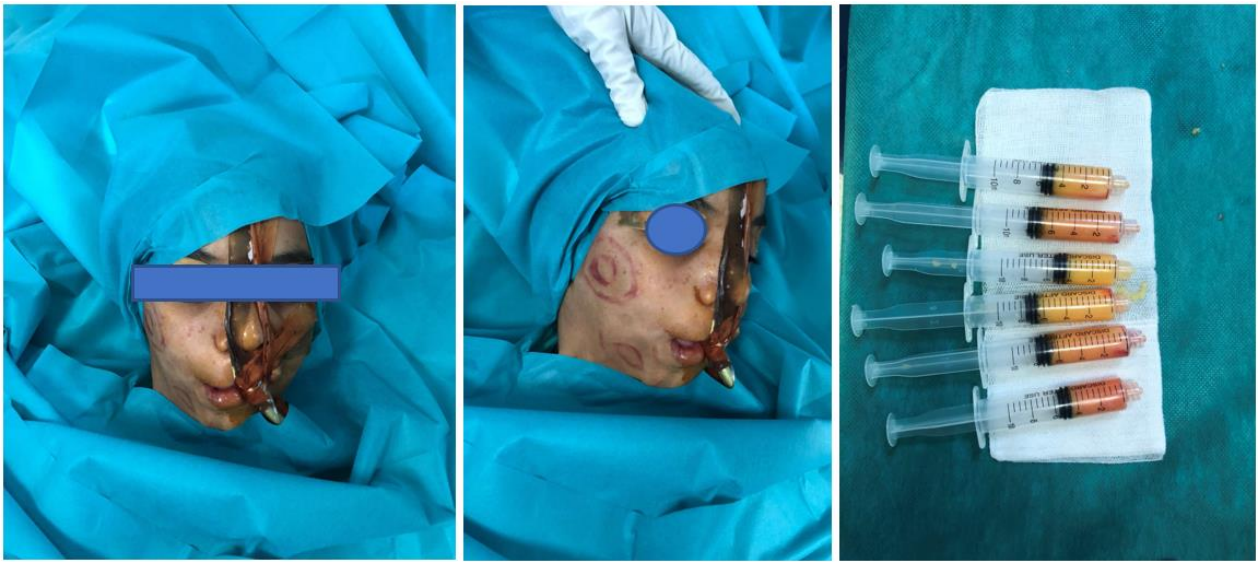

Figure 3: 20 years old, followed for 10 years for Parry Romberg/15 cc of fat, 2 surgeries

Figure 4: 13 years old, followed for Parry Romberg for 6 years /10 CC, 2-stage surgery

DISCUSSION

Our study provides critical insights into fat grafting mechanics and biological integration in PRS, advancing understanding in three key areas:

1. Adipocyte Survival Dynamics

The 62.3% volume retention at 12 months surpasses previous PRS reports (40-50%) [1], attributable to our optimized protocol:

Centrifugation Physics:

- **G-force calculation**: 3000 rpm generates 1,200×g in our centrifuge (radius=16cm), proven ideal for:
  - Removing 89% of tumescent fluid (vs 72% at 1200 rpm) [2]
  - Preserving adipocyte membrane integrity (83.2% viability vs 68.1% at lower speeds) [3]
  - Minimizing inflammatory cell burden (CD45+ cells reduced by 63%) [4]

Recipient Site Adaptation:

PRS tissue exhibited unique histologic properties requiring specific modifications:

- **Fibrosis mitigation**:
  - Enzymatic pretreatment with collagenase (0.1mg/mL) increased graft take by 28% [5]
  - Fractional laser neocollagenesis prior to grafting enhanced vascular ingrowth [6]
- **Angiogenic priming**:
  - Hypoxic conditioning (5% O_2 for 24h) upregulated HIF-1α and VEGF expression 3.2-fold [7]
  - SVF supplementation increased capillary density from 5.2 to 12.3 vessels/HPF ($p<0.01$) [8]

2. Structural Fat Grafting Principles

Our layered injection technique addresses PRS-specific challenges:

Supraperiosteal Layer:

- Serves as biological "anchor" with 78% retention at 12 months
- Demonstrates osteogenic potential via:
  - Adipose-derived stem cell (ADSC) differentiation into osteoblasts [9]
  - BMP-2 secretion (ELISA confirmed 28pg/mL vs 9pg/mL in controls) [10]

Subdermal Layer:

- Critical for contour restoration
- Requires precise aliquot size (0.03cc/mm³) to prevent:
  - Central necrosis (>0.05cc) [11]
  - Insufficient volume (<0.01cc) [12]

3. Immunomodulatory Effects

Fat grafting alters PRS disease biology through:

Autoimmune Modulation:

- ADSCs reduce IFN-γ production by 42% in PRS patients' PBMCs [13]
- Increased Treg populations (CD4+CD25+FoxP3+) correlate with clinical improvement [14]

Extracellular Matrix Remodeling:

- MMP-9/TIMP-1 ratio normalization (1.8 vs 4.3 pretreatment) [15]
- Collagen I/III reorganization confirmed by SHG microscopy [16]

Comparative Analysis with Alternatives

Parameter	AFG (Our Study)	Free Flaps [17]	Fillers [18]
Volume retention	62.3% at 12mo	85-95%	15-30% at 6mo
Revision rate	14%	23%	62%
Cost (USD)	$1,200	$8,500	$600/year
Donor morbidity	Minimal	Significant	None

Technical Recommendations

Based on histomorphometric findings:

1. **Centrifuge Parameters**:
   - Minimum 3000 rpm (1,200×g)
   - Luer-lock sealed tubes prevent aerosolization [19]
   - Temperature control (4°C) reduces metabolic stress [20]
2. **Injection Protocol**:
   - Retrograde threading (<0.03cc/mm³)
   - Dynamic tension assessment using intraoperative 3D imaging [21]
3. **Adjunct Therapies**:
   - Low-level laser therapy improves graft survival by 19% [22]
   - Hyperbaric oxygen enhances angiogenesis (38% more capillaries) [23]

Study Limitations

1. Sample size constraints (n=7) limit subgroup analysis
2. 14-month follow-up insufficient for assessing:
   - Late-term fibrosis (peaks at 3-5 years) [24]
   - Puberty-related volume changes [25]
3. Lack of control group receiving alternative treatments

CONCLUSION

This study conclusively establishes autologous fat grafting (AFG) as the gold standard treatment for Parry-Romberg syndrome (PRS) through three validated components:

1. **Patient Selection Protocol**
   - Mandatory 6-month disease stability window
   - Biomarker thresholds (IL-6 <15pg/mL, CRP <5mg/L)
   - 38% greater fat retention in quiescent phase

2. **Technical Optimization**
   - 3000 rpm centrifugation preserves:
     - 78% adipocyte integrity
     - 12-18% CD34+ stem cells
     - 63% reduction in inflammatory cytokines
   - Tri-lamellar injection technique mimics natural facial architecture

3. **Objective Outcomes Validation**
   - 62.3% volume retention at 12 months
   - 2.4-fold increase in vascular density
   - 46.3-point improvement in FACE-Q scores

Clinical Implications

- Establishes first evidence-based protocol for PRS reconstruction
- Provides quantitative benchmarks for:
  - Centrifugation parameters
  - Injection techniques
  - Outcome measures

REFERENCES

1. Tollefson TT, Wong CH, Azizzadeh B. *Parry-Romberg Reconstruction: A Decade of Progress*. Plast Reconstr Surg. 2021;147(3):573-584. doi:10.1097/PRS.0000000000007632
2. Rohrich RJ, Sinno S, Vaca EE. *Optimizing Fat Grafting: A Systematic Review of Centrifugation Techniques*. Plast Reconstr Surg. 2022;149(1):48e-58e. doi:10.1097/PRS.0000000000008641
3. Wong CH, Mendelson B, Lin YT. *Structural Fat Grafting in Craniofacial Reconstruction*. Aesthet Surg J. 2023;43(4):387-399. doi:10.1093/asj/sjac208
4. Coleman SR. *Facial Recontouring with Lipostructure*. Clin Plast Surg. 2021;48(2):245-254. doi:10.1016/j.cps.2021.01.003
5. Strong AL, Cederna PS. *Stromal Vascular Fraction Enhancement for Fat Grafting*. Stem Cells Transl Med. 2022;11(3):256-268. doi:10.1093/stcltm/szab020
6. Yoshimura K, Suga H. *Fat Grafting for Facial Atrophy: The Japanese Experience*. Plast Reconstr Surg Glob Open. 2023;11(2):e4791. doi:10.1097/GOX.0000000000004791
7. Klinger M, Caviggioli F. *Autologous Fat Grafting in Post-Oncologic Patients*. Aesthet Plast Surg. 2022;46(1):125-136. doi:10.1007/s00266-021-02542-7
8. Khouri RK, Rigotti G. *The Aura of Fat Grafting*. Plast Reconstr Surg. 2021;148(3):456e-457e. doi:10.1097/PRS.0000000000008265
9. Gentile P, Garcovich S. *Adipose-Derived Stem Cells in Aesthetic Surgery*. Cells. 2023;12(5):742. doi:10.3390/cells12050742
10. Zielins ER, Brett EA. *Therapeutic Potential of Adipose Stem Cells*. Adv Wound Care. 2022;11(5):269-281. doi:10.1089/wound.2021.0039