

原文題目(出處)：	<b>Bone regeneration in mandibular fractures after the application of autologous mesenchymal stem cells, a randomized clinical trial</b> <i>(Dental Traumatology 2017; 33: 38–44)</i>
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內文：

### Background and Aim

Autologous mesenchymal stem cells (AMSCs) transplantation is proposed as an alternative to conventional graft treatment to improve bone regeneration.

The aim was to evaluate the effectiveness of AMSCs application in mandibular fractures to reduce regeneration time and increase bone quality.

### Facial Injury result in fractures in mandible

Common age:30+

Frequent fracture: Condyle, contralateral symphysis

Diagnostic tool: Panoramic X ray, Towne’s projection, oblique projection  
Computed Tomography, Clinical analysis

If not treated properly, the soft tissue rapidly adopts the shape of the underlying bones which are displaced. → hinder the restoration of original form of face once the acute phase has ended

∴ It is fundamental to accomplish early alignment of the facial skeleton

Only those fractures which are not displaced, stable and with no objective changes in occlusion, can be treated conservatively with soft diet, absolute joint rest and expectant attitude.

Management:

1. Closed reduction (Intermaxillary fixation)
2. Open reduction and internal fixation (ORIF)

Internal fixation:

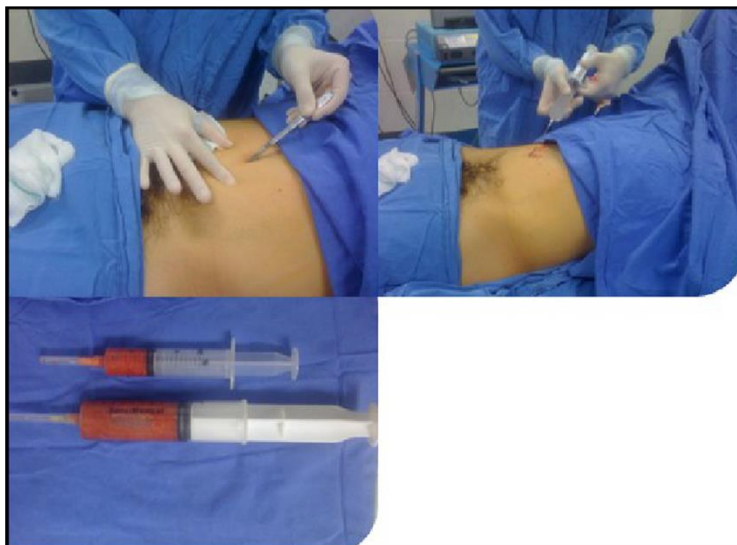
1. Non-resorbable material: Miniplates and mono- or bi-cortical screws
2. Resorbable material: Polylactic and polyglycolic acid implants  
→inflammatory response reported in patient with DM.

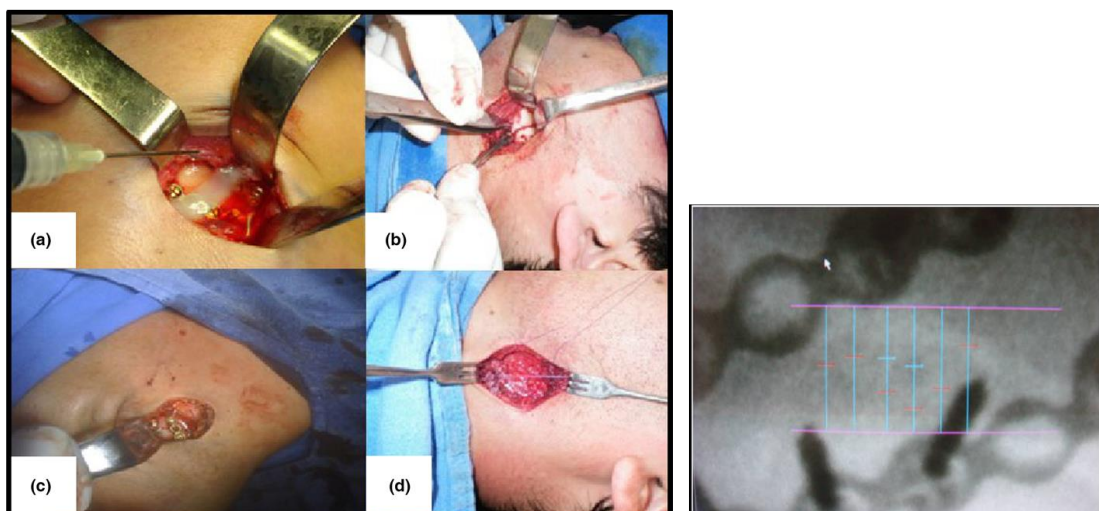
The stem cells obtained from adipose tissue have the capacity to differentiate into chondrocytes and osteogenic cells, and they can be placed in bone defects.

The expansion of these cells can be performed in vitro using various osseous morphogenetic proteins.

<b>Materials and methods</b>
Single-blind randomized clinical trial
17-59 years old male patients without chronic degenerative diseases, active smoking, collagen disorders, signs of infection
Study group(n=10): Application of AMSCs and ORIF
Control group(n=10): Fracture reduction only
Imaging study: Pano+CT of healthy bone, site of fracture, repaired bone 4 weeks after surgery, repaired bone 12 weeks after surgery
Data analysis: Image Processing and Analysis IMAGE J VERSION 1.43 software Panoramic radiography units were expressed in Voxels, and the CT units were expressed as Hounsfield Units
Statistical analysis: By SPSS statistical software (version 20)

<b>Harvest of AMSCs</b>
Obtained from adipose tissue (50 cc) 24 h before the surgery
Collagenase 0.1%
Centrifuged 2.400 RCF during 10 min
Suspension medium: 15ml Dulbecco's Modified Eagle Medium low glucose, supplemented with foetal bovine serum (FBS) 10% + antibiotic
Harvest in a carbon dioxide 5% 37 °C incubator, AMSCs adhere to the walls (usually at the bottom) of the bottle of culture → separable and extractable
The processing of 50 cc of adipose tissue can result in approximately $1 \times 10^7$ to $6 \times 10^8$ cells with more than 90% viability





**Result**

*Table 1.* Patient's general characteristics, injury localization and associated fractures

	Study group	Control group	<i>P</i> value
Number of patients	10	10	
Age (mean ± SD)	31.2 ± 6.2	29.7 ± 7.2	0.9
Fracture localization			
Right mandible angle	2	3	
Left mandible angle	6	6	1.0
Associated fractures			
Op. mandible angle	2	1	
Zygomatic complex	1	2	
Orbit floor	1	2	
Nasal bones	1	0	
Opposite condyle	1	0	
Mandible symphysis	0	1	
Zygomatic arch	1	0	
Total	6	7	0.91

Op, opposite; SD, standard deviation.

The study group had a mean age of 31.2 ± 6.3 years, and the control group mean age was 29.7 ± 7.2 years. All patients are male. Left mandible angle fracture is more common in this study.

Table 2. Results of radiographic and tomographic evaluation

	Study Group <i>n</i> = 10	Control Group <i>n</i> = 10	<i>P</i> value
Panoramic radiography <sup>1</sup>			
Normal bone	123.4 ± 4.1	121.3 ± 3.2	0.19
Site of fracture	85.4 ± 2.2	84.5 ± 2.0	0.35
Week 4	108.8 ± 3.4	93.9 ± 2.6	0.000
Week 12	153.5 ± 1.8	101.8 ± 4.8	0.000
CT <sup>2</sup>			
Normal bone	121.2 ± 8.5	121.4 ± 7.7	0.95
Site of fracture	84.2 ± 1.0	83.0 ± 3.8	0.42
Week 4	123.0 ± 4.5	99.7 ± 5.7	0.000
Week 12	165.4 ± 4.2	112.9 ± 2.0	0.000

CT, computed tomography.  
<sup>1</sup>Voxels.  
<sup>2</sup>Hounsfield units.

Bone quality measured at week 4 were (SG vs CG)

108.82 ± 3.4 vs 93.92 ± 2.6 (*P* = 0.000) using panoramic radiography (13.69% higher)

123 ± 4.53 vs 99.72 ± 5.72 (*P* = 0.000) using computed tomography. (18.93% higher)

At week 12, the measurements were (SG vs CG)

153.53 ± 1.83 vs 101.81 ± 4.83 (*P* = 0.000) using panoramic radiography (33.68% higher)

165.4 ± 4.2 vs 112.9 ± 2.0 (*P* = 0.000) using tomography (32.36% higher)

At week 12, the levels obtained using CT images (165.4 ± 4.2) were 36.48% higher compared to normal bone → reaching an earlier return to daily activity.

## Discussion

1. This study demonstrated AMSCs derived from adipose achieving an ossification rate 2.4 times higher than the conventional treatment for mandibular fractures.
2. Adipose tissue-derived stem cells demonstrate several advantages over those obtained from bone marrow
  - a) less invasive harvesting procedure
  - b) higher number of stem cell progenitors from an equivalent tissue harvested
  - c) increased proliferation and differentiation capacities
  - d) better angiogenic and osteogenic properties in vivo
3. Stanovici et al. suggested that cell therapies based on bone marrow or ex vivo expanded mesenchymal stromal stem cells may serve as an alternative to autologous bone grafting
4. Padha et al. evaluated the percutaneous application of bone marrow, in 50 post-trauma cases with failure or late bone union. They found that 46 cases had successful bone union, while four had failed.
5. Tawonsawatruk et al. tested human mesenchymal stem cells obtained

from bone marrow and adipose tissue in a rat model. They found results demonstrated that application without scaffold could be effective.

6. Quarto et al. described the use of bone marrow stromal cells to treat three patients with large bone defects. They reported that a composite prepared with osteogenically enhanced MSCs and their extracellular matrix had an unprecedented capacity for the repair of critical bone defects of murine femora. The result data is similar to this study, with a 32.36% higher value in SG in week 12.

7. Bone regeneration is frequently delayed in patients with active smoking or alcoholism, and there is a reduction in the number of progenitor cells.

8. Park et al. reported one case of a patient with mandibular reconstruction with autologous human bone marrow mesenchymal stem cells and autogenous bone graft. The patient recovered masticatory function and did not require microanastomosis to provide blood supply to the grafted bone.

9. As in the present study, this case showed favourable results with AMSCs but future studies need to be conducted in larger populations to confirm the benefits of this treatment option

### **Conclusion**

The present results support the effectiveness of AMSCs application in the treatment of mandibular fractures to improve bone regeneration. An advantage of taking AMSCs directly from the patient's adipose tissue is the minimally invasive nature of the procedure associated with more than 90% viability of the cells that translates into an improvement and acceleration of bone healing and a faster recovery time.

題號	題目
1	<b>What is the indication for open reduction?</b> <b>(A) Continued displacement of the bony segments</b> <b>(B) Unfavorable fracture</b> <b>(C) Patient want earlier return and without IMF</b> <b>(D) All of the above</b>
<b>答案</b> <b>(D)</b>	<b>出處：Contemporary Oral and Maxillofacial Surgery 4th Edition p503-504</b>
題號	題目
2	<b>In open reduction surgery, what is the general approach to anterior symphysis fracture and posterior mandible angle fracture respectively?</b> <b>(A) extra-oral / extra-oral</b> <b>(B) intra-oral / intra-oral</b> <b>(C) extra-oral / intra-oral</b> <b>(D) intra-oral / extra-oral</b>
<b>答案</b> <b>(D)</b>	<b>出處：Contemporary Oral and Maxillofacial Surgery 4th Edition p504</b>