

Smoking and other associated risk factors for delayed union and nonunion following ulnar shortening osteotomy

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Objective

- To investigate the effect of smoking and other potential risk factors on time to bony union and incidence of non-union following ulna shortening osteotomy (USO) using a dedicated osteotomy plating system.

Methods

- Retrospective review of patients who underwent USO with TriMed single osteotomy dynamic compression plating system (TriMed, Santa Clara, CA) from 2010-4
- All surgeries performed by the two senior authors (SMJ, EKS)
- Data queried: Demographics, medical co-morbidities, detailed smoking history including # of PPD smoked, length of shortening of the ulna, EtOH use
- Radiographs reviewed by a blinded (fellowship-trained hand surgeon) author to determine union time
- Bivariate statistical analysis:
 - Independent t-test for comparison of time to union time between dichotomous variables (i.e. smokers vs. non-smokers, diabetics vs. non-diabetics, etc.)
 - Chi-square test for incidence of *union* versus *delayed or nonunion* and same variables
- Binary logistic regression model developed using significant predictors from bivariate analysis

Results

Study Cohort

- 72 USOs (69 patients)
- 42 female, 27 men
- Mean age: 44 +/- 12 years
- Mean time to union 4 +/- 2 months
- 17 smokers

Bivariate Analysis

- Time to union
 - 3 +/- 1 non-smokers
 - 6 +/- 3 smokers $P = 0.001^*$
- Incidence of delayed union/nonunion
 - 4% in non-smokers
 - 59% in smokers $P < 0.001^*$
 - 14% in non-diabetics
 - 38% in diabetics $P = 0.09$

* Denotes statistical significance

Multivariate Analysis

Smoking (Odds ratio = 65) and diabetes (OR = 13) significant ($P = 0.000$); predicted 90% of outcomes (*union versus delayed or nonunion*)

Nonunions

- 3 of 4 occurred in active smokers, all requiring revision plating and bone grafting and healed in delayed fashion;
- 1 non-smoker developed nonunion secondary to hardware failure due to early ambulation on her operative arm, was treated with exchange of loose screws and did well subsequently



Left: 6-month post-operative x-ray of a 46-year-old male smoker, who developed hypertrophic non-union after his initial USO. Right: Post-revision radiographs of the same patient treated with revision plating of the non-union with ICBG and an additional orthogonal plate, which would eventually heal 11 months later.



Conclusions

- Despite the use of an osteotomy-specific plating system, smokers and diabetics remain at a significantly higher risk for both delayed union and nonunion following elective ulnar shortening osteotomy.
- Smokers in particular should be counseled on methods for cessation, with emphasis placed on the prolonged post-operative course likely to occur if they are unable to quit smoking.