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# The Efficacy of Guiding Flange Appliance in Correcting Mandibular Deviation in the Hemi-Mandibulectomy Patient. A Correlative Study

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**Keywords**
Hemi-mandibulectomy; mandibular guidance prosthesis; mandibular deviation.

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*The authors deny any conflicts of interest.*

Accepted January 11, 2014

doi: 10.1111/jopr.12189

## Abstract

**Purpose:** This report describes the efficacy of a guiding flange appliance in correcting mandibular deviation in the hemi-mandibulectomy patient and correlates the time elapsed between surgery and placement of the appliance and the extent of initial mandibular deviation to the success rate of a guiding flange appliance in correcting the deviation.
**Materials and Methods:** A total of 15 hemi-mandibulectomy patients participated in the study. All had various degree of mandibular shift consequent to surgery. The patients were given a guiding flange prosthesis for about 4 months, and the efficacy of the guiding flange prosthesis was calculated in terms of percentage deviation corrected after 4 months.
**Results:** Time elapsed between surgery and prosthetic rehabilitation was in inverse relation to the percentage correction in mandibular deviation at 4 months ($B = -7.668$; $p = 0.002$). The less the initial deviation postsurgery, the better the correction ($B = 9.798$; $p = 0.008$).
**Conclusion:** Percentage correction of mandibular deviation is dependent on the timing of prosthetic rehabilitation. The less the initial deviation, the better the correction.

Discontinuity defects of the mandible produced by surgery severely compromise function and balance, leading to abnormal movement and deviation of the remnant fragment towards the surgical side. Concurrently, the loss of sensory proprioception of occlusion causes the mandible to slip into uncoordinated and imprecise movement. Loss of muscles at the site of surgery causes the mandible to significantly rotate on forceful closure. When viewed from the frontal plane, the teeth on the surgical side of the mandible move away from the antagonist teeth of the maxilla after the initial contact on the nonsurgical side.[1-4] Mandibular deviation is dictated by the extent of hard- and soft-tissue ablation during surgery, the type of surgical closure, the extent of tongue function impairment, remnant teeth available for occlusion, and the degree of loss of sensory and motor function.[5,6] To achieve greater success in a patient's definitive occlusal relationship, mandibular guidance therapy should be started as soon as possible. Earlier reports suggest that a provisional guide plane paves the way for a more successful definitive restoration.[7] Postsurgical complications such as radical neck dissection, bulk tissue loss, tight wound closure, postsurgery radiation therapy, and flap necrosis may lead to a delay in starting mandibular guidance therapy, and can jeopardize achieving a normal maxillomandibular relationship.[8,9]

The basic objective in rehabilitation is retraining the remaining mandibular muscles to provide an acceptable maxillomandibular relationship for the remaining portion of the mandible, achieving an acceptable occlusion. This paper aims to correlate the time elapsed between surgery and placement of appliance and the amount of initial deviation to the success rate of a guiding flange appliance.

## Materials and methods

Fifteen patients who volunteered and provided written informed consent were included in the study. The study was approved by the institutional human ethical committee.

To learn the efficacy of guiding flange appliance, all patients were evaluated on three counts:

1. The extent of surgery.
2. The amount of mandibular deviation at the time of initiation of prosthetic rehabilitation.

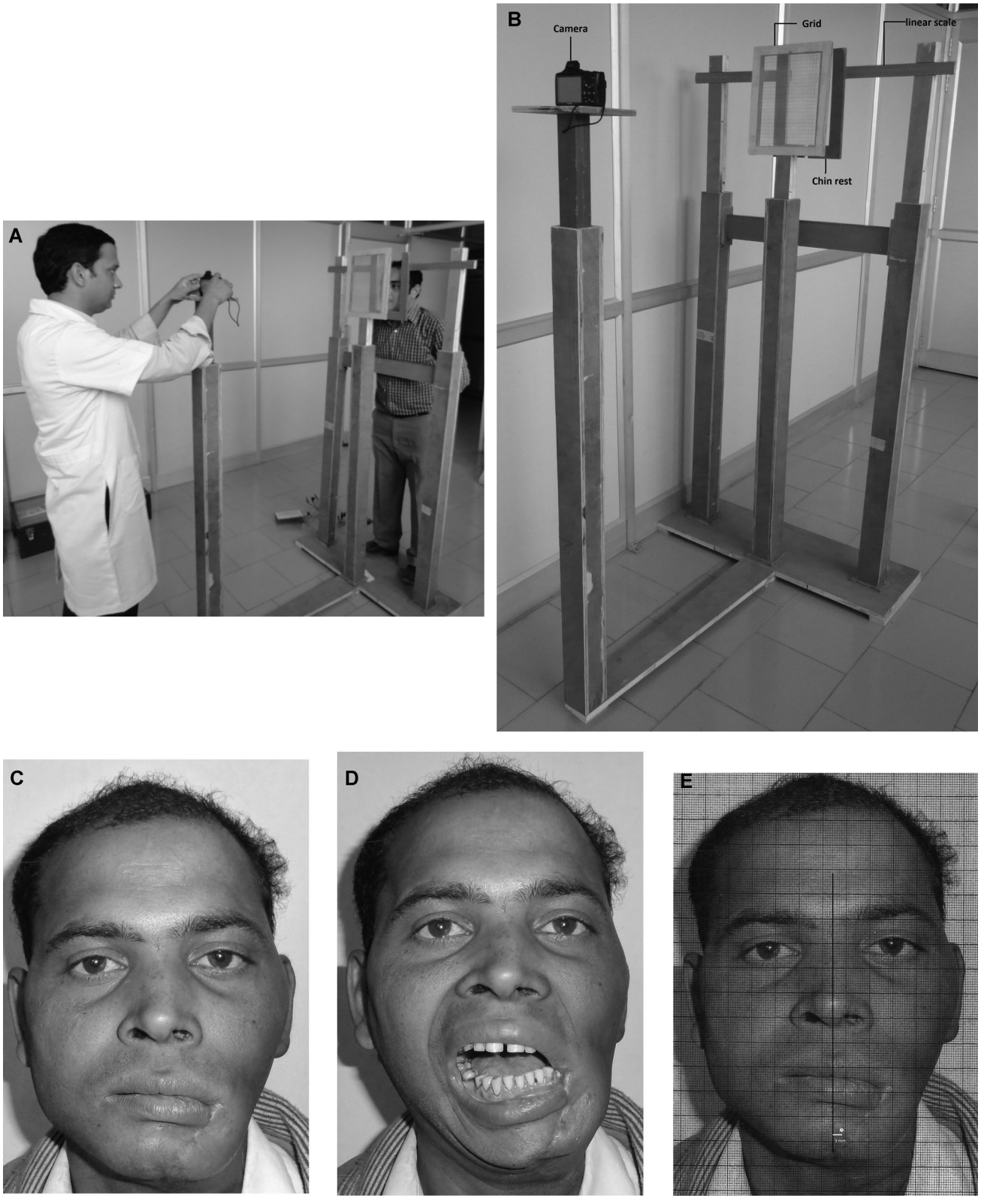


**Figure 1** (A) and (B) Position of patient, grid, and camera. (C) and (D) Preoperative. (E) Initial mandibular deviation.

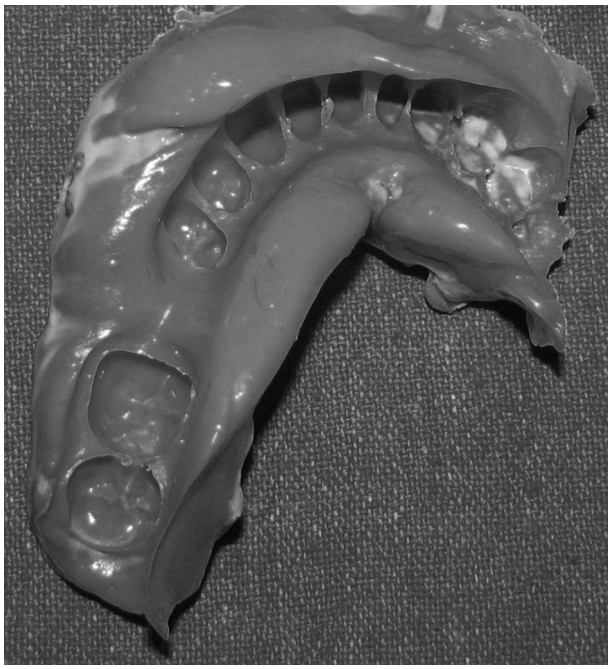

**Figure 2** Final impression.

3. Time elapsed between surgery and placement of guiding flange appliance.

The extent of surgery was defined on the basis of notes from the surgeon. Both intraoral examination and radiographic evaluation were carried out to classify the mandibular defect on the basis of Cantor and Curtis' classification.[10] Although the classification system is suggested primarily for edentulous patients, it is also applicable to partially edentulous patients.

## Method to measure the amount of deviation

To measure the amount of deviation, we made an appliance in collaboration with the National Scientific Company, Lucknow, India. The patients were made to stand between two vertical rods attached to a linear measurement scale that could slide in a horizontal plane. A grid was placed 5 cm from the patient's face, and a high resolution camera was placed 30 inches from the grid. All three components of the measuring device (rod, grid, and camera) were fixed on a solid platform. Two photographs were taken (one at the time of initiation of treatment, and one after 4 months). Deviation was calculated by measuring the distance between the most prominent point on the chin and the midline. All patients had mandibular deviation of 3 to 6 mm from the midline towards the defect side and disocclusion on the normal side (Fig 1).

Impressions were made in irreversible hydrocolloid (Zelgan; Dental Products of India, Mumbai, India) using plastic disposable trays (National Dental Supply Company, New Delhi, India). Casts were prepared. Custom-made impression trays were fabricated, and the final impressions were made with light-body vinylpolysiloxane (Coltene Whaledent, Alstatten, Switzerland) (Fig 2). The cast thus obtained was surveyed, and the RPD framework for the mandible was designed. The design included a retentive mesh on the nondefect side. The casts were mounted on an articulator with the retentive mesh seated in place. The articulator was closed, and self-cure resin (DPI; Mumbai, India) was added to this mesh. The resin was allowed to polymerize (Fig 3). The entire assembly (i.e., the retentive mesh along with the resin extension) was removed from the articulator. The cured resin was trimmed to extend 7 to 10 mm superiorly. After this, the prosthesis was inserted in the mouth. The appliance was finished, evaluated, and adjusted intraorally. It was noted that the patient was able to achieve a functional intercuspal position immediately after insertion of the prosthesis (Figs 4, 5).

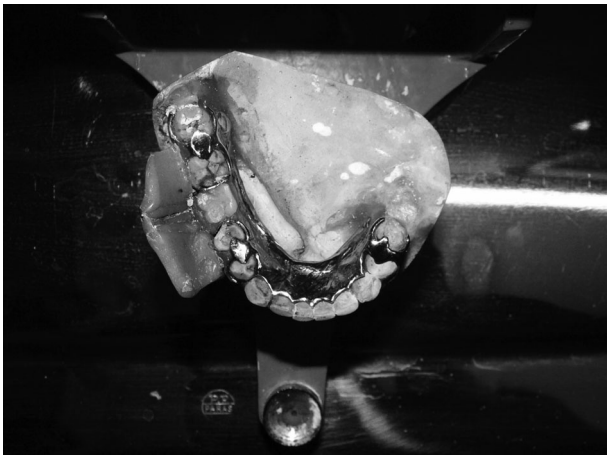

**Figure 3** Guide flange appliance on the articulator.

The data were analyzed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL) version 15.0. Multivariate assessment was done using linear regression. The confidence level of the study was kept at 95%; hence, a "*p*" value less than 0.05 indicated a significant association.

## Results

Table 1 presents the details of all 15 patients on five parameters: extent of ablative surgery, time elapsed between surgery and placement of appliance, initial extent of deviation from the midline, extent of deviation after 4 months of wearing the guiding flange appliance, and percentage of deviation corrected. Table 2 shows the association between time of reporting and mean improvement in outcome variable. Table 3 shows the association between initial deviation and mean improvement in outcome variable.

Although both Tables 2 and 3 showed no significant association between mean improvement in outcome variable and time of reporting and initial deviation, it was felt that, owing to categorization of time of reporting and initial deviation, we failed to get a significant association; hence, a linear regression was planned in which mean improvement in deviation was kept as a dependent variable on the independent variables *time of reporting* and *amount of initial deviation*. This was done because both

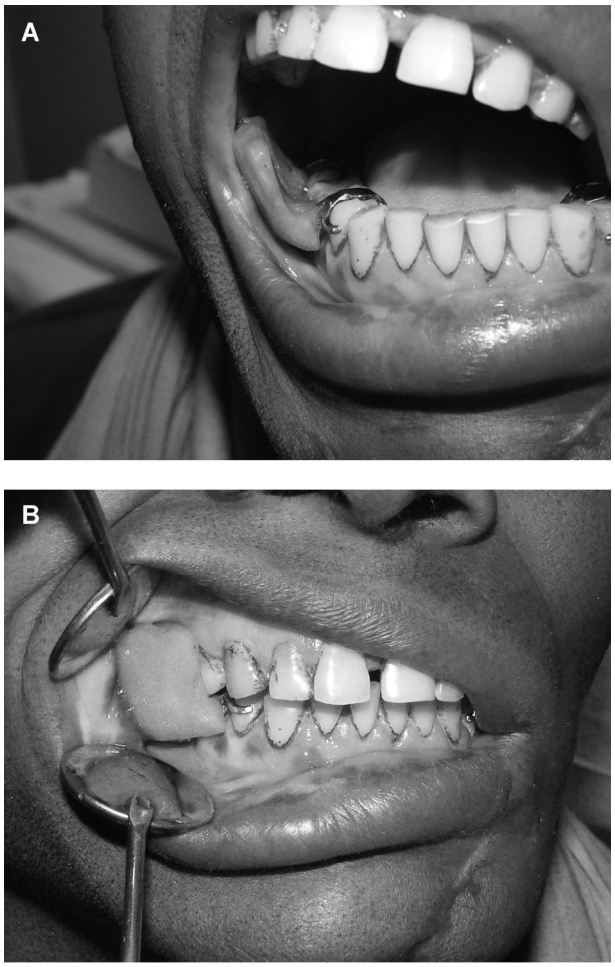


**Figure 4** (A) and (B) Guide flange appliance intraorally.

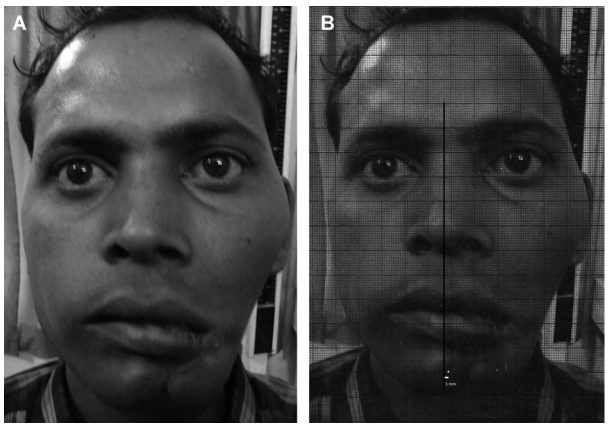


**Figure 5** (A) and (B) Mandibular deviation after 4 months.

these independent variables were continuous in nature, and the outcome was also continuous in nature.

Table 4 shows the outcome of the linear regression. On the basis of linear regression, the following relationship was obtained:

$$\%\ \text{improvement at 4 months} = 131.828 - 7.668 \times \text{time of reporting} + 9.798 \times \text{initial deviation}.$$

The regression equation generated was tested for its accuracy level on the same data set, and it predicted the cure rate to a level of ±10% in 80% of the results obtained.

## Discussion

The success of mandibular guidance therapy depends on the size of the surgical defect created, earliest possible initiation of prosthetic rehabilitation, and the patient's cooperation. Mandibular guidance therapy begins when the immediate postsurgical sequelae have subsided, usually within 2 to 3 weeks after surgery. The greater the delay in the initiation of mandibular guidance therapy, the greater the deviation, and the more time required to correct the deviation. Since most patients included in the study had reported very late for postsurgery rehabilitation (Table 1), a 4-month period was taken as a standard to evaluate the postinsertion correction effect of the mandibular guidance prosthesis. Patients who undergo mandibular resection with minimal involvement of the mouth floor, tongue, and adjacent soft tissues respond better to this therapy. Additionally, teeth must be conserved in both the maxilla and the mandible for effective resumption of normal mandibular movements.

As we wrote previously, "Mandibular deviation is primarily due to the uncompensated influence of the contralateral musculature and pull from the contraction of cicatricial tissue on the resected side. The degree of deviation is dependent on several factors which include the location and extent of osseous and soft tissue resection, the method of surgical site closure, degree of impaired tongue function, the presence and condition of the remaining natural teeth, the degree to which the innervation has been involved, the use of adjunctive procedures like radiation therapy and the timing of prosthodontic treatment."[11] Partial resection of the mandible must always be immediately followed by reconstruction to improve symmetry and function. Despite advances in reconstructive surgery and prosthodontic rehabilitation, a large number of patients still complain of reduced chewing ability.[12,13] Recent strides taken in head and neck surgery and dental and osseous implants promise a brighter and functionally stronger future for oral cancer patients.[14-16]

With the passage of time, deeper wounds heal by forming scar tissue, which shrinks and tightens as it forms. When the scar tissue forms over or near a joint, this shrinking pulls contiguous tissues and muscles inward. If nothing is done to stop this contracture, it will not only accentuate the degree of deviation but will also jeopardize temporomandibular joint mobility. Therefore, the time factor has a major effect on the improvement rate of mandibular deviation.

Considering the above factors, especially the time factor, we proposed a model with improvement rate to be a dependent variable on two independent variables—time of reporting and initial deviation. Both independent variables showed a significant association with the outcome: An increase in time led to a decline in improvement rate at 4 months (B = −7.668;

**Table 1** Patient details

| S. no. | Patient | Extent of defects | Time elapsed after surgery and placement of appliance | Amount of deviation from the midline | Amount of deviation after 4 months wearing guiding flange appliance | % of deviation corrected |
|---|---|---|---|---|---|---|
| 1. | Patient A | Cantor & Curtis type 4 | 16 weeks | 4 mm | 2.5 mm | 37.5 |
| 2. | Patient B | Cantor & Curtis type 2 | 15 weeks | 5 mm | 2.0 mm | 60 |
| 3. | Patient C | Cantor & Curtis type 1 | 15 weeks | 4 mm | 1 mm | 75 |
| 4. | Patient D | Cantor & Curtis type 4 | 15 weeks | 3 mm | 1.5 mm | 50 |
| 5. | Patient E | Cantor & Curtis type 3 | 18 weeks | 6 mm | 3 mm | 50 |
| 6. | Patient F | Cantor & Curtis type 2 | 17 weeks | 5 mm | 2.5 mm | 50 |
| 7. | Patient G | Cantor & Curtis type 2 | 15 weeks | 4 mm | 1.5 mm | 62.5 |
| 8. | Patient H | Cantor & Curtis type 3 | 17 weeks | 6 mm | 2.5 mm | 58.3 |
| 9. | Patient I | Cantor & Curtis type 4 | 15 weeks | 3 mm | 2 mm | 33.33 |
| 10. | Patient J | Cantor & Curtis type 3 | 16 weeks | 4 mm | 2 mm | 50 |
| 11. | Patient K | Cantor & Curtis type 4 | 12 weeks | 3 mm | 1 mm | 66.66 |
| 12. | Patient L | Cantor & Curtis type 4 | 16 weeks | 4 mm | 2 mm | 50 |
| 13. | Patient M | Cantor & Curtis type 3 | 20 weeks | 6 mm | 3.5 mm | 41 |
| 14. | Patient N | Cantor & Curtis type 4 | 17 weeks | 4 mm | 2.5 mm | 37.5 |
| 15. | Patient O | Cantor & Curtis type 4 | 15 weeks | 3 mm | 1.5 mm | 50 |

**Table 2** Association between reporting time and mean improvement in outcome variable

| Reporting time | N | Mean improvement (%) | Standard deviation |
|---|---|---|---|
| ≤15 weeks | 7 | 56.78 | 13.64 |
| >15 weeks | 8 | 46.79 | 7.37 |

$Z = 1.675$; $p = 0.095$ (NS).

**Table 3** Association between initial deviation and mean improvement in outcome variable

| Initial deviation | N | Mean improvement (%) | Standard deviation |
|---|---|---|---|
| ≤4 mm | 10 | 51.25 | 13.48 |
| >4 mm | 5 | 51.86 | 7.63 |

$Z = 0.253$; $p = 0.859$ (NS).

$p = 0.002$), while initial deviation had a positive association with improvement rate ($B = 9.798$; $p = 0.008$). The model had a strong explanatory ability ($r^2 = 0.757$).

We found that univariate assessment does not yield a significant association with outcome, and multivariate assessment (linear regression) showed a significant association. Both the independent variables show multidimensionality of the outcome and show the outcome's dependence on more than one factor. Inclusion of more variables in further assessments is recommended so a perfect model can be generated for predictive modeling of guiding flange outcome efficacy. The findings suggest that guiding flange outcome is dependent on a multitude of factors and should be done with consideration of individual characteristics. Further research on the issue is warranted.

**Table 4** Linear regression with improvement in deviation as a dependent variable on independent variables "time of reporting" and "amount of initial deviation"

| | Unstandardized coefficients | | Standardized coefficients | | |
|---|---|---|---|---|---|
| | B | Standard error | Beta | T | Significance |
| Constant | 131.828 | 21.977 | | 5.999 | 0.000 |
| Time of reporting | −7.668 | 1.908 | −1.189 | −4.019 | 0.002 |
| Initial deviation | 9.798 | 3.108 | 0.933 | 3.152 | 0.008 |

Dependent variable: % improvement at 4 months.
$r^2 = 0.757$.

## Conclusion

Clinical observation and statistical analysis found that the percentage of deviation corrected (efficacy of guiding flange prosthesis) is inversely proportional to the time elapsed between surgery and placement of prosthesis and amount of initial deviation.

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