

BONE DISTRACTION AS A BIOLOGICAL TREATMENT FOR UPPER CANINE IMPACTION

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Abstract: This is a study of callus distraction for dentulous fragments of maxillary bones, used for the biological treatment of upper impacted canines in cases where orthodontic treatment failed. Fifteen cases of upper impacted canines in patients aged between 14 and 24 were treated by callus distraction. Patients were randomly divided into two groups: A and B. For the daily number of distraction rates and for sensibility related to distraction were submitted to statistical analysis on small independent groups. No statistically significant differences were noted regarding sensibility related to the dimension of distraction, age of patients or the daily number of distraction rates.

Cuvinte cheie: elongare dirijată; canin inclus; sensibilitate la elongare

Rezumat: Articolul studiază elongarea dirijată a calusului pe fragmente dentate de maxilar pentru tratamentul biologic al incluziunii caninului superior în cazurile de eșec ortodontic. Un număr de 15 cazuri de canini superiori incluși la pacienți cu vârste între 15 și 24 de ani au fost tratate prin elongare dirijată. Pacienții au fost împărțiți aleatoriu în două loturi: A și B. Rezultatele, din punct de vedere al numărului zilnic de reprize de elongare și al sensibilității la elongare a pacienților au fost supuse analizei statistice pe eșantioane independente mici. Nu au fost decelate diferențe statistice semnificative ale variației sensibilității cu dimensiunea elongării, numărul zilnic al reprizelor de elongare sau cu vârsta pacienților.

INTRODUCTION

This work applies callus distraction on dentulous fragments of maxilla. The method is used for treating impacted upper canines in a vestibular position, with anatomical peculiarities such as: curved root tip, large root tip or dental-alveolar ankylosis, conditions that make orthodontic treatment difficult or impossible for these cases.

Although all conditions mentioned above were severe drawbacks and a cause of failure for a surgical-orthodontic or an orthodontic treatment, they posed no problems whatsoever to mobilizing the tooth with the bony fragment surrounding it, protecting at the same time the tooth's vascularization and ligaments (except in cases of dental-alveolar ankylosis).

MATERIAL AND METHOD

A number of 15 patients with upper impacted canines were studied. The position of the impaction was vestibular, and very close to the normal eruption axis, but anatomical conditions mentioned before made these teeth to fail to erupt or to respond to orthodontic treatment. Callus distraction method was applied to these cases, using a TRACK 1 distractor manufactured by Martin Medizintechnik GmbH Tuttlingen – Germany. (1, 2)

Surgery was similar in almost all cases with minor modifications according to the anatomical situation of the bone transport segment. Surgery was performed on an outpatient basis, under local and regional anesthesia with Articaine 4% and epinephrine (1:200000).

Surgical approach was on the anterior side of the maxilla. The distractor was shaped to fit the surface of the canine fossa where it was applied, achieving at the same time

the proper direction for distraction, in order to avoid any obstacles or occlusal interferences.

The main lines of osteotomy were parallel to the root at a safe distance to preserve the periodontal ligaments and directed to ensure no obstacles on the distraction path. A horizontal osteotomy was performed at 3 -5mm above the root tip of the canine, to unite the two main vertical lines mentioned earlier.

After complete mobilization of the transport segment, still attached to the soft tissues, the distractor was set in place and fixed with monocortical screws. The vestibular flap was then repositioned and sutured.

A period of 7 days latency was instated for periosteal healing, and then individualized distraction protocols were carried on according to each case (Fig.1).

Figure no. 1. Intraoral view after 4 days of distraction



Distraction rates were 1mm/day, for 6 to 10 days of active distraction. The distraction device was left in place for another 14 – 21 days. Then, orthodontic means were used to align distracted canines into proper occlusal rapports (Fig.2). This

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technique was used to enable movement of the teeth through orthodontic devices while the callus was still fibrous and could be reshaped with minimal effort (using Hoffmeister's "floating bone concept"(3)).

Figure no. 2. Intraoral view with canine in place at the end of distraction



A similar distraction protocol was instated in all patients for the first two days with two rates of 0.5mm. All patients were invited to evaluate on a daily basis the pain during the distraction process using a scale from 1 to 10 (where 1 was a minimal pain, as a slight pinch and 10 was the pain from acute apical periodontitis (or the most intense pain one could imagine for those who didn't experience the former). The average values of this self-evaluation of the pain levels were recorded for the entire distraction phase for all patients studied.

After two days with the same distraction protocol for all patients (two rates of 0.5mm per day), patients were randomly assigned to two groups: **group A** with patients who continued the same distraction protocol throughout the entire distraction phase and **group B** with patients who received 4 distraction rates of 0.25mm each subsequent day. All patients were kindly asked to continue the self-evaluation of pain in the same manner and average values were recorded. Data was submitted to statistical analysis for small independent groups. Results were presented as absolute frequencies and percentages or with indexes of centrality, localization and dispersion. Graphical representation of the results was in the shape of columns and scatter ("cloud of dots")charts.

Characteristics of the subjects studied were analyzed with the Mann-Whitney Wilcoxon rank test. To establish correlation between the two parameters we used the Spearman's rank correlation coefficient (r). The threshold for statistical relevance in our tests was set to: $\alpha = 0.05$. Statistical calculations were performed with SPSS 13.0 and Microsoft EXCEL.

RESULTS AND DISCUSSIONS

Distraction osteogenesis was applied for all the 15 patients in this study with impacted maxillary canines in vestibular position. Ages of these patients were between 14 and 24.

There were 7 male and 8 female patients studied.

Group A consisted of 8 patients: 2 males and 6 females, aged: between 15 and 16 – 2 patients, between 17 and 18 – 4 patients, between 19 and 20, 21 and 22 – one patient each. **Group B** had 7 patients, 5 males and 2 females, aged: between 16 and 17, 18 and 19 – 2 patients, between 19 and 20, 21 and 22, 23 and 24 – one patient each.

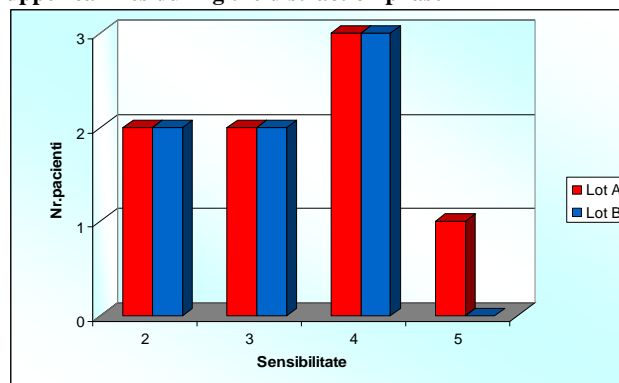
Upper right canine impaction were 62% in group A and 43% in group B, whereas left canine impaction occurred in 38% in Group A and in 57% of the patients in Group B.

Patients were submitted to distraction protocols, according to the individual dimensional needs with 1mm distraction each day, for 6 to 10 days.

Sensibility during distraction was self-assessed by

each patient daily and expressed between "a slight pinch" and the "most intense pain one can imagine" on a scale from 1 to 10. Average values are shown in the chart in Fig.3.

Figure no. 3. Chart of sensibility in patients with impacted upper canines during the distraction phase



Scatter charts (or "cloud of dots" charts) of the correlation between sensibility to distraction, age of patients and the number of days of distraction show no statistically significant relevance. (Fig.4 and Fig.5).

Figure no. 4. Variation of sensibility to distraction according to the age of patients

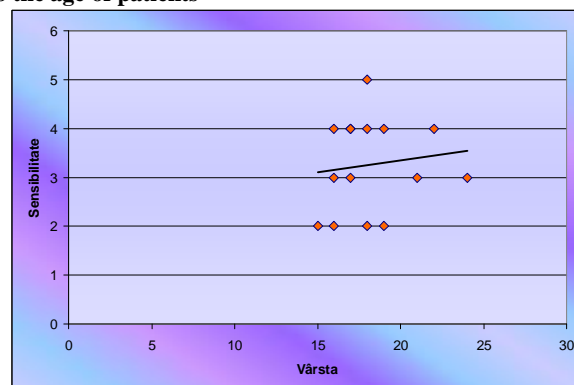
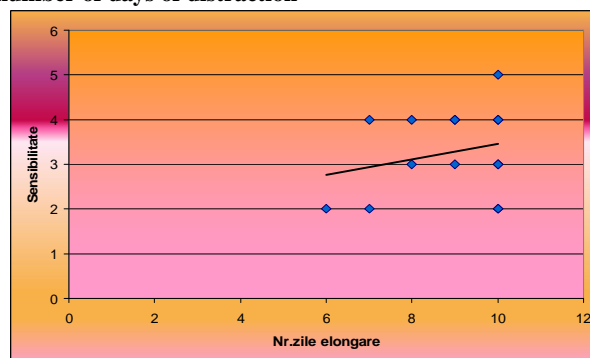


Fig.5 Variation of sensibility to distraction according to the number of days of distraction



Theresults are confirmed by a Spearman's correlation coefficient of 0.18 between sensibility and age ($p=0.15$) and a Spearman's correlation coefficient of 0.53 between sensibility and the number of days of active distraction ($p=0.60$).

There were no statistically relevant data regarding the differences of age, sensibility and treatment days between the patients in groups A and B, as shown in Table 1

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Tabel no.1 Data regarding the differences of age, sensibility and treatment days between the patients in groups A and B, as shown in

	Grup	N	Average	Standard deviation	P
Age	Lot A	8	17.88	1.96	0.77
	Lot B	7	18.57	3.10	
No. Of distraction days	Lot A	8	9.25	1.04	0.36
	Lot B	7	8.43	1.62	
Sensibility	Lot A	8	3.38	1.06	0.67
	Lot B	7	3.14	0.90	

Due to a good tolerance of patients to distraction we didn't consider reducing the daily distraction rate, in order to avoid the danger of premature ossification in case of an insufficient distraction rate. A higher sensibility to distraction in some of the patients was managed by small doses of usual analgesics.

Contention was maintained in all cases for another 120 days after distraction by orthodontic means to consolidate the obtained results and to avoid bone loss.

CONCLUSIONS

Translation of impacted upper canines to the dental arch through callus distraction represents a biological alternative to bone grafting techniques

Callus distraction lacks the disadvantages of grafting, by not needing a donor site, thus a second operation site for harvesting the graft, with its morbidity.

Distraction can be successfully used in cases of orthodontic treatment failure due to dental-alveolar ankylosis or improper root conformation

Callus distraction allows transporting dentulous segments of the maxilla and preserving the tooth in normal position on the dental arch, with proper vascularization and innervation of the transported teeth.

Callus distraction allows recovering impacted teeth that cannot be treated by vital transplantation or orthodontic methods, gaining optimal morphological and functional results.

There is a moderate sensibility associated to distraction, which does not vary statistically significant with the number of daily rates, the age of patients or the total length of distraction

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