Journal of Dental Research

RESEARCH ABSTRACTS:

Selective Alveolar Decortication

1) Hajji SS, Ferguson DJ, Miley DD, WM Wilcko WM, Wilcko MT: The influence of accelerated osteogenic response on mandibular decrowding. J Dent Res 80:180, 2001.

2) Ferguson DJ, Al-Harbi MS, Wilcko WM, Wilcko MT: Lower dental arch de-crowding comparing non-extraction, accelerated osteogenesis and distraction techniques. J Dent Res 80:181, 2001.

3) Fulk LA, Ferguson DJ, Wilcko WM, Wilcko MT: Lower arch de-crowding comparing corticotomy-facilitated, midline distraction and conventional orthodontic techniques, J Dent Res 80:483, 2002.

4) Machado I, Ferguson DJ, Wilcko WM, Wilcko MT, AlKahadra T: Root resorption following orthodontics with and without alveolar corticotomy, J Dent Res 80:301, 2002.

5) Twaddle BA, Ferguson DJ, Wilcko WM, Wilcko MT: Dento-alveolar bone density changes following accelerated orthodontics. J Dent Res 80:301, 2002.

6) Nazarov AD, Ferguson DJ, Wilcko WM, Wilcko MT: Improved retention following corticotomy using BO Objective Grading System, J Dent Res 83:2644, 2004.

7) Skountrianos HS, Ferguson DJ, Wilcko WM, Wilcko MT: Maxillary arch decrowding and stability with and without corticotomy-facilitated orthodontics. J Dent Res 83:2643, 2004.

8) Kacewicz MJ, Ferguson DJ, Wilcko WM, Wilcko MT: Characterization of mandibular tooth movement in corticotomy-facilitated, non-extraction orthodontics. J Dent Res 83:1289, 2004.

9) Ferguson DJ, Alvi A, Wilcko MT, Wilcko WM: Stability of alveolar grafting in corticotomy-facilitated orthodontics. J Dent Res 2005.

10) Al-Qabandi SM, Ferguson DJ, Carvalho RS, Wilcko MT, Wilcko WM: Demineralization of trabecular bone following alveolar corticotomy in rats. J Dent Res 2005.

11) Kacewicz MJ, Ferguson DJ, Wilcko WM, Wilcko MT: Grafting effectiveness following alveolar corticotomy and augmentation grafting during orthodontics. J Dent Res 2005.

12) Kelson CL, Ferguson DJ, Wilcko WM, Wilcko MT: Characterization of maxillary tooth movement in corticotomy-facilitated orthodontics. J Dent Res 2005.

13) Ahlawat A, Ferguson DJ, Rajaei, O, Wilcko WM, Wilcko MT: Influence of DI on orthodontic outcome following selective aveolar decortication. J Dent Res (accepted 2006)

14) Dosanjh MSK, Ferguson DJ, Rajaei O, Wilcko WM, Wilcko MT: Orthodontic outcome changes during retention following selective alveolar decortication. J Dent Res (accepted 2006)

15) Ferguson DJ , Sebaoun JD, Turner JW, Kantarci A, Carvalho RS, Van Dyke TE, Prasad H: Anabolic modeling of trabecular bone following selective alveolar decortication. J Dent Res (accepted 2006)

16) Kelson CL, Ferguson DJ, Wilcko WM, Wilcko MT: Anabolic modeling of the lamina dura following selective alveolar decortication. J Dent Res (accepted 2006)

17) Oliveira K, Ferguson DJ, Wilcko WM, Wilcko MT: Orthodontic stability of advanced lower incisors following selective alveolar decortication. J Dent Res (accepted 2006)

18) Sebaoun JD, Ferguson DJ, Kantarci A, Carvalho RS, Van Dyke TE: Trabecular Bone Modeling and RAP Following Selective Alveolar Decortication. J Dent Res (accepted 2006)

19) Walker ED, Ferguson DJ, Wilcko WM, Wilcko MT: Orthodontic treatment and retention outcomes following selective alveolar decortication. J Dent Res (accepted 2006)

Journal of Dental Research 80:180, 2001

The Influence of Accelerated Osteogenic Response on Mandibular Decrowding

SS HAJJI[1], DJ FERGUSON[1]*, DD MILEY[1], WM WILCKO[2], MT WILCKO[2] ([1]Saint Louis University, CADE, St. Louis, MO and [2] Erie, PA)

Regional Acceleratory Phenomena (RAP) has been described following surgical intervention as resulting in increase bone turnover and decrease bone density. As such, this concept has potential for accelerating tooth movement and reducing the treatment time frame for both the patient and orthodontist. A study was conducted to investigate the efficacy of a technique combining orthodontic with alveolar corticotomy + grafting (n=20) as an effective treatment for Class I and II malocclusions in comparison with conventional, non-surgical orthodontic non-extraction (n=34) and extraction (n=30) therapies. Lateral cephalograms and study casts were assessed pre- (T1) and post treatments (T2). Paired t-tests demonstrated a significant ($p<.01$) increases in SNB, B-N/Me and B-N/Po from T1 to T2 in the corticotomy + grafting group, while B-N/Me and B-N/Po significantly decreased in the extraction group. One-way ANOVA testing demonstrated no differences ($p>.05$) between the corticotomy group and non-extraction group in any of the variables at T2. Orthodontics combined with corticotomy + grafting resulted in increased labial-lingual alveolar width, had cephalometric results similar to non-surgery, non-extraction therapy and was up to four times faster than conventional orthodontic treatment.

Journal of Dental Research 80:181, 2001.

Lower Dental Arch De-crowding Comparing Non-extraction, Accelerated Osteogenesis and Distraction Techniques

DJ FERGUSON[1], **MS AL-HARBI[1]**, WM WILCKO[2], MT WILCKO[2]
[1]Saint Louis Univ., CADE, St. Louis, MO and [2]Erie, PA

Dental arch crowding is the most common form of malocclusion. The two conventional orthodontic treatment strategies used to resolve dental arch crowding are extraction and non-extraction. Two alveolar surgery techniques have recently been introduced aimed at resolving dental arch crowding: mandibular midline widening by distraction and accelerated osteogenesis (a localized corticotomy technique). The aim of this study was to examine the lower dental arch and incisor position for treatment technique differences among three techniques. Sixty nine subjects were treated orthodontically non-extraction and grouped according to the technique used to resolve lower dental arch crowding: 33 conventional orthodontics (CO), 16 lower midline distraction subjects (LD), and 20 accelerated osteogenesis (AO). Lateral cephalograms and mandibular study casts were analyzed at pre-treatment (T1) and post orthodontics (T2). One-way ANOVA testing for inter group differences revealed homogeneity at T1 except LD was larger than CO for L1-MPmm ($p=.002$), CO was larger than AO for 3-3 ($p=.04$), and LD was smaller for 6-6 than CO ($p=.004$) and AO ($p=.002$). At T2, variable 3-3 was significantly larger ($p<.001$) for LD than for CO and AO, and arch depth was greater for LD than CO ($p=.02$). Orthodontic treatment time was four times more rapid with AO and resulted in greatest arch dimension change with LD. Treatment results using the accelerated osteogenic orthodontic technique was the same as conventional orthodontics.

Journal of Dental Research 80:483, 2002

Lower Arch De-crowding Comparing Corticotomy-Facilitated, Midline Distraction, and Conventional Orthodontic Techniques

L. FULK[1], **D.J. FERGUSON**[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1] Saint Louis University, USA, [2] USA

Objectives: To compare the efficacy of mandibular de-crowding in three non-extraction orthodontic techniques: lower midline distraction (LMD, n=16), corticotomy plus graft facilitated (CORF, n=24), and conventional (CONV, n=29). Methods: Arch dimensions and lower incisor position were assessed from study casts and lateral cephalograms at pre- (T1) and post treatment (T2) as well as retention (T3). Results: One-way ANOVA testing demonstrated T1 age for CORF (23.3 yrs) was greater than CONV (14.6, p=.000) but not LMD (19.5, p>.05). Treatment time for CORF (6.6 mths, p=.000) was significantly more rapid than CONV (20.7) and LMD (26.4). At T1, the groups were homogeneous for 10 of 12 variables but not for Arch Depth and L1-MPmm. At T2, only intermolar width was greater for LMD (34.5mm) than CORF (32.2, p=.03) and CONV (31.8, p=.005). At T3, intercuspid width was greater for LMD (21.2mm) than CONV (19.0, p=.000) and CORF (18.5, p=.000), and intermolar width was greater for LMD (34.2mm) than CORF (32.2, p=.05). One-way analysis of variable mean change showed greater treatment increases (p=.000) for LMD in Inter-canine and Inter-molar widths while CORF angle L1-NB increased more than in LDM (p=.01). Paired t-testing showed that for LMD and CONV, the same variables were significantly changed by treatment (9 of 12) and during retention (6 of 12). For CORF, 8 of 12 variables changed T1 to T2 and 5 of 12 relapsed from T2 to T3. Irregularity Index and SNB remained stable for CORF but relapsed in CONV and LMD (p=.002). Conclusions: Corticotomy facilitated orthodontics was 3.1 times faster than conventional orthodontics while lower midline distraction therapy resulted in dramatic, long term increases in lower arch width.

Journal of Dental Research 80:301, 2002

Root Resorption Following Orthodontics With and Without Alveolar Corticotomy

I. MACHADO[1], D.J. FERGUSON[1], M.T. WILCKO[2], W.M. WILCKO[2],
and **T. ALKAHADRA**[1], [1] Saint Louis University, USA, [2] USA

Literature evidence suggests that root resorption, an adverse side effect of orthodontic therapy, may be decreased under conditions of alveolar osteopenia, a condition characterized by diminished bone density and created secondary to alveolar corticotomy surgery. Objectives: To compare root resorption of the upper central incisors following non-extraction orthodontic treatment with and without alveolar corticotomy surgery. Methods: The sample consisted of two groups as follows: corticotomy facilitated orthodontics (CORF) with 26 subjects and 51 central incisors, and conventional non-extraction orthodontics (CONV) with 27 subjects and 52 incisors. All periapical radiographs were taken using the paralleling technique. Total length of right and left central incisors were measured by projecting and enlarging the periapical radiographs exactly 10X. Results: Independent t-testing revealed a significant decease in treatment time (T1 to T2) with CORF therapy (6.3 months vs 17.4, p<.000). T1 to T3 for CORF was greater than T1 to T2 for CONV (25.9 months vs 17.4, p=.000). Pre-treatment (T1) root lengths were not significantly different (p=.11) but CONV had significantly shorter roots at post treatment (T2) when compared to CORF at T2 (p=.02) and also when compared with the CORF retention (T3, p=.003) data. Paired t-testing revealed that orthodontic treatment resulted in significant mean root shortening in both CORF (0.23mm, p=.007) and CONV (.52mm, p=.000). Conclusions: T-testing showed root resorption was significantly greater in CONV than in CORF (p=.048), In this study, corticotomy facilitated non-extraction orthodontic therapy resulted in half as much resorption at debanding and at long term retention than in conventional non-extraction orthodontics at debanding.

Journal of Dental Research 80:301, 2002

Dento-Alveolar Bone Density Changes Following Corticotomy Facilitated Orthodontics

B.A. TWADDLE[1], D.J. FERGUSON[2], W.M. WILCKO[1], T.M. WILCKO[1], and **C.Y. LIN**[2], USA, [2] Saint Louis University, USA

Corticotomy-facilitated orthodontics provides a means for rapidly moving teeth purportedly with little damaging effects to the periodontium and with greatly reduced treatment time. Objectives: To analyze the dento-alveolar effects of rapid tooth movement in the anterior mandible of subjects treated orthodontically for moderate to severe crowding following labial-lingual corticotomy. Methods: A sample of 10 subjects who underwent orthodontic therapy following labial-lingual corticotomy and an alveolar augmentation procedure was compared to four subjects treated with orthodontics alone without corticotomy. Pre-treatment (T1), post-treatment (T2), and two-year post-treatment (T3) CT scans were analyzed using SIM/Plant software for tested for differences in alveolar bone width, bone density, and incisor angulation. The investigation site was a sagittal cut through the lower left central incisor. Results: Paired and independent t-testing (α=.05) revealed no bone density differences between or within either study group (p>.05). Pre-to post treatment flaring of the lower centrals was significant (115.8^{o} vs. 125.0^{o}, p=..003) which remained stable at T3 (122.8^{o}, p=.21). Alveolar sagittal width increased in the area labial to the tooth apex (T1 to T2, p=.003) but the increase did not remain significant (T1 to T3, p=.07). Overall width of the alveolus at the level of the incisor apex increased T1 to T2 (p=.006) and remained stable at T3 (T1 to T3, p=.02). Conclusions: Orthodontic therapy facilitated with corticotomy surgery and grafting improved alveolar bony support and resulted in permanent alveolar process width increase.

Journal of Dental Research 83:2644, 2004.

Improved Orthodontic Retention Following Corticotomy Using ABO Objective Grading System

A.D. NAZAROV[1], **D.J. FERGUSON**[2], W.M. WILCKO[3], and M.T. WILCKO[3], [1] Saint Louis University, St. Louis, MO, USA, [2] Boston University, MA, USA, [3] Private Practice, Erie, PA, USA

Objectives: To compare immediate post treatment and retention outcomes in Class I, non-extraction orthodontic patients treated with (n=28) and without alveolar corticotomy (n=28) to resolve crowding. Methods: All patients were treated with fixed, edgewise orthodontic therapy and were requested to wear removable Hawley retainers for 6 months full time then night time thereafter. Study casts and panoramic radiographs were evaluated using the ABO Objective Grading System and scoring instrument for 8 criteria plus total score at immediate post orthodontic treatment and at least one year retention. Results: Wilcoxon Signed Rank testing demonstrated significant ($p<.05$) improvements during the retention phase in 5 of 9 grading criteria for the group with corticotomy and 3 of 9 criteria without corticotomy. Mann-Whitney U testing showed that the two groups were statistically homogeneous ($p>.05$) at post treatment, but at retention, the corticotomy-facilitated group was significantly better for alignment (1.7 vs 3.8, p=.001), marginal ridges (3.3 vs 4.9, p=.018) and total score (22.1 vs 27.2, p=.01). Mann-Whitney U testing for effect sizes demonstrated the total score dropped precipitously (improved) during retention in the group that had undergone alveolar corticotomy compared to group without corticotomy (7.6 vs 3.7, p=.0.18). Conclusions: Alveolar corticotomy-facilitated orthodontic treatment resulted in significantly greater improvements during the orthodontic retention period and a better retention outcome as judged using the ABO Objective Grading System.

Journal of Dental Research 83:2643, 2004.

Maxillary Arch De-Crowding and Stability With and Without Corticotomy-Facilitated Orthodontics

H.S. SKOUNTRIANOS[1], D.J. FERGUSON[2], W.M. WILCKO[3], and M.T. WILCKO[3], [1] Boston University, Saint Louis University, MA, USA, [2] Boston University, MA, [3] Private Practice, Erie, PA, USA

Objectives: To compare the efficacy of maxillary de-crowding and stability in non-extraction orthodontic treatment with and without alveolar corticotomy. Methods: Lateral cephalograms and study casts taken at pre-treatment (T1), post treatment (T2) and at least one year retention (T3) were evaluated on patients who were treated by non-extraction orthodontics with alveolar corticotomy surgery plus augmentation grafting (n=30) and without surgery (n=27). Five study cast and 7 cephalometric variables were measured to assess upper dental arch status and incisor position. Results: Corticotomy-facilitated orthodontic treatment was 66% more rapid than without surgery. Paired t-tests revealed significant changes during treatment (T1-T2) in 7 variables for the group with corticotomy and 3 variables without surgery; there were 3 intra-group changes with corticotomy during retention (T2-T3) and 6 significant changes without corticotomy. One-way ANOVA with Tukey post hoc testing demonstrated no significant inter-group differences at pre-treatment (T1); inter-cuspid width was significantly smaller at post treatment (T2) with corticotomy (22.7mm) than without (24.5mm, p=.017) and this condition persisted into retention (22.6 vs 24.4mm, p=.013). Inter-molar width was smaller at retention (T3) with corticotomy than without (33.1 vs 35.8mm, p=.037). Independent t-testing for effect size differences showed a significant relapse during retention without corticotomy versus with corticotomy in inter-molar width (0.57 vs -0.1mm, p=.000) and Irregularity Index (1.19 vs 0.33, p=.009). Conclusion: Corticotomy-facilitated, non-extraction orthodontic treatment resulted in nearly the same post treatment outcome in 1/3rd the treatment time, and the outcome was more stable during retention.

Journal of Dental Research 83:1289, 2004.

Characterization of Mandibular Tooth Movement in Corticotomy-Facilitated, Non-Extraction Orthodontics

M.J. KACEWICZ[1], D.J. FERGUSON[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1] Boston University, MA, USA, [2] Private Practice, Erie, PA, USA

Objectives: To characterize how mandibular teeth move following non-extraction orthodontics facilitated by alveolar corticotomy. Methods: CT scans at pre-treatment (T1), post treatment (T2) and retention (T3) were evaluated on 12 patients who underwent corticotomy-facilitated, non-extraction orthodontics plus alveolar augmentation grafting in order to resolve lower incisor crowding. SimPlant 3dimensional software (version 8) was utilized to measure transverse dental arch widths from root tip to root tip and from cusp tip to cusp tip on all posterior contralateral teeth. Dental arch depth was measured from each lower incisor to a reference line constructed from 1st and 2nd lower molar interproximal contact points bilaterally. Results: Paired t-testing demonstrated that during treatment (T1-T2), lower second molar roots constricted 1.3mm, second crowns expanded 1.2mm and lower second premolar crowns expanded 1.8mm ($p<.05$); these variables were stable ($p>.05$) during retention (T2-T3). Arch depth, as measured from incisal edges to reference line, increased about 3mm during orthodontic treatment for each incisor ($p<.001$) and decreased approximately 1.5mm during retention for each incisor ($p<.05$). Conclusions: Root movements were clearly delineated using the SimPlant 3-D software for mandibular CT scan images. Non-extraction, corticotomy-facilitated orthodontics resulted in incisor crown flaring with incisor crown up-righting during retention.

Paper #64955

Journal of Dental Research 2005

Stability of Alveolar Grafting in Corticotomy-Facilitated Orthodontics

D.J. FERGUSON[1], A. ALVI[2], M.T. WILCKO[2], and W.M. WILCKO[2], [1] Boston University, MA, USA, [2] Private practice, USA

Stability of orthodontic treatment outcome is related to tissue turnover and the ability of the periodontium to regenerate, reorganize and adapt to the new position. Surgical wounding increases turnover of tissues adjacent to the surgical site (regional acceleratory phenomena), but the effects of increasing alveolar volume with grafting on stability post orthodontics is unknown. Objectives: To assess post-treatment stability of infradentale in non-extraction orthodontic outcomes after alveolar corticotomy and grafting. Methods: Seven lateral cephalometric variables were used to assess stability of cephalometric points A and B in non-extraction orthodontic samples with (n=24) and without (n=27) alveolar corticotomy and augmentation grafting. Results: Paired t-testing showed significant increases pre-treatment (T1) to post treatment (T2) in angles SNA and ANB and linear S-XA ($p<.01$) with corticotomy and grafting. Angles SNA and ANB and linear Xa-Xb relapsed significantly T2 to retention (T3) in the grafting group ($p<.05$). There were no significant intra-group changes in the non-grafted group between any two study intervals, and no inter-group differences at any study interval. Active treatment time was significantly more rapid with corticotomy-facilitation (7.0 v 21.2 months, $p<.001$). Conclusions: Using cephalometric technique as the assessment method, infradentale alveolar prominence significantly increased following orthodontics facilitated with corticotomy and grafting, but the change did not persist into retention. Lateral cephalometrics limits the assessment of alveolar augmnentation grafting to bone mid-saggital profiles only.

Paper #64862

Journal of Dental Research 2005

Demineralization of Trabecular Bone Following Alveolar Corticotomy in Rats

S.M. AL-QABANDI[1], D.J. FERGUSON[1], R.S. CARVALHO[1], M.T. WILCKO[2], and W.M. WILCKO[2], [1] Boston University, MA, USA, [2] Private practice, Erie, PA, USA

It has been demonstrated that the rate of tooth movement is influenced by bone turnover when bone density changes are pharmacologically induced in rats. Rapid tooth movement following alveolar corticotomy is purported to result from extensive decalcification of alveolar trabecular bone adjacent to the corticotomy site but this regional acceleratory phenomena has not been clearly demonstrated. Objective: To characterize the influence of alveolar corticotomy on medullary bone turnover adjacent to the surgery site in rats. Methods: Six adult Sprague Dawley rats were climatized and provided rat chow and water ad libitum. Four of 6 rats underwent lingual alveolar corticotomy surgery adjacent to the upper right first molar following full thickness periodontal flap elevation; 2 of 6 rats underwent neither flap elevation nor surgery. Post surgery, two groups of 3 rats each were formed, with and without calcein fluorescent bone label added to the drinking water. All rats were sacrificed at 25 days post-op, and the right hemi-maxillas were prepared histologically either as decalcified or calcified sections. Results: Calcein staining of calcified tissues as well as H&E staining of decalcified tissues demonstrated extensive medullary bone turnover. Little bone turnover was evident in the controls. Conclusion: Alveolar corticotomy resulted in extensive demineralization of alveolar spongiosa adjacent to the surgery site during the fourth week of healing.

Paper #64710

Journal of Dental Research 2005

Grafting Effectiveness Following Alveolar Corticotomy and Augmentation Grafting During Orthodontics

M. KACEWICZ[1], D.J. FERGUSON[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1] Boston University, MA, USA, [2] Private practice, Erie, PA, USA

Objectives: To assess the effectiveness of augmentation grafting of the mandibular alveolus at posttreatment and retention following corticotomy-facilitated orthodontics. Methods: CT scans at pre-treatment (T1), post treatment (T2) and a minimum of 1-year retention (T3) were evaluated on 13 patients who underwent corticotomy-facilitated orthodontics plus alveolar augmentation grafting in order to resolve lower dental arch crowding. The augmentation mixture was a 50-50% mix of bovine and demineralized freeze-dried (DMFD) bone. SimPlant 3-dimensional software (version 8) was utilized to measure the thickness of the alveolar arch at the level of the root tips in seven locations along the dental arch mesial to the first molars. Alveolar thickness was evaluated at intervals of 22.5 degrees on both sides of the arch from midline to an inter-first molar reference line constant. Results: Paired t-testing demonstrated significant increases in alveolar thickness at the end of active treatment (T1-T2) ranging from 1.8mm at the midline to .8mm at the 67.5 degree section on the left side of the arch ($p<.01$). No significant changes ($p>.05$) were observed during retention (T2-T3). Conclusions: The width of the alveolar arch was significantly widened at the apical level with a bovine and DMFD bone augmentation graft placed during the surgery in corticotomy-facilitated orthodontics. Moreover, the width increase remained stable at retention demonstrating the long-term effectiveness of the augmentation grafting procedure.

Paper #64929

Journal of Dental Research 2005

Characterization of Maxillary Tooth Movement in Corticotomy-Facilitated Orthodontics

C.L. KELSON[1], D.J. FERGUSON[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1] Boston University Goldman School of Dental Medicine, MA, USA, [2] Private practice, Erie, PA, USA

Objectives: To characterize how maxillary teeth move following non-extraction orthodontics facilitated by alveolar corticotomy and augmentation bone grafting. Methods: CT scans at pre-treatment (T1), post treatment (T2) and retention (T3) were evaluated on 6 patients who underwent corticotomy-facilitated, non-extraction orthodontics plus alveolar augmentation grafting in order to resolve maxillary dental arch crowding. SimPlant 3-dimensional software (version 8) was utilized to measure transverse dental arch widths from root tip to root tip and from cusp tip to cusp tip on all posterior contra-lateral teeth. Dental arch depth was measured from each upper incisor root tip and incisal edge to the mid-point of a reference line constructed from 1st and 2nd upper molar interproximal contact points bilaterally. Results: Wilcoxson Signed Ranks testing demonstrated that during orthodontic treatment (T1-T2), upper first premolar roots constricted 1.3mm ($p=.046$). Arch depth, as measured from mid-incisal edge to the reference line midpoint, increased .8mm ($p=.046$) during active orthodontic treatment for the upper left central incisor crown; arch depth from upper right and left lateral incisor crowns increased 1.7mm and 2.2mm respectively ($p=.028$). The study variables that changed during treatment remained stable ($p>.05$) during retention (T2-T3). Conclusions: Root tip movements for maxillary CT scan images were clearly delineated using the SimPlant 3-D software. Non-extraction, corticotomy-facilitated orthodontics resulted in upper incisor crown flaring.

Paper #74937

Journal of Dental Research 2006

Influence of DI on Orthodontic Outcomes Following Selective Alveolar Decortication

A. AHLAWAT[1], D.J. FERGUSON[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1]Boston University, Boston, MA, USA, [2]Private Practice, Erie, PA, USA

Discrepancy Index (DI) was released by the ABO as a measure of pre-treatment malocclusion severity. It is expected that orthodontic treatment outcome and retention success is related to severity of initial malocclusion. Objectives: To evaluate post treatment and retention outcomes relative to pre-treatment malocclusion severity in a population of patients treated with orthodontic therapy facilitated by selective alveolar decortication. Methods: DI scores were derived from pre-treatment study casts and radiographs for 77 patients and grouped into 4 groups according to total DI score or severity: 1=0-9, 2=10-19, 3=20-29, and 4=30+. Seventeen ABO Objective Grading System (OGS) criteria were used to score orthodontic outcomes at immediate post treatment or T1 (n=77), at least 1 year retention or T2 (n=56) and at least 2 years retention or T3 (n=23). Results: Non-parametric Kruskal Walls H-testing revealed statistical differences between DI severity group 3 and the following DI severity groups: groups 1 and 2 (7.6 vs 1.7 and 2.2, p=.001) for T1 occlusion relationship; group 1 (7.9 vs .04, p=.000) and group 2 (7.9 vs 2.3, p=.003) for T2 occlusal relationship; group 1 (6.1 vs 2.2, p=.02) for T2 overjet; and group 1 (31.7 vs 15.2, p=.03) for T2 OGS total score. Conclusions: In the sample studied, treatment of malocclusions with DI severity scores between 20 and 29 resulted in higher OGS scores for occlusion relationship at T1 and T2 and for overjet and OGS total scores at T2.

Paper #74973

Journal of Dental Research 2006

Orthodontic Outcome Changes during Retention Following Selective Alveolar Decortication

M.S. DOSANJH[1], D.J. FERGUSON[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1]Boston University, Boston, MA, USA, [2]Private Practice, Erie, PA, USA

Surgical scarring of alveolar bone induces an increase in hard and soft tissue turnover, a process collectively known as Regional Acceleratory Phenomena. If the purpose of orthodontic retention is to hold the treatment result until the periodontium reorganizes (turns-over), then enhanced alveolar turnover should reduce relapse of treatment outcome. Objectives: To assess post orthodontic treatment changes during retention following selective alveolar decortication and augmentation grafting. Methods: The study cast and panoramic records of 51 selective alveolar decortication patients were scored using the ABO Objective Grading System (OGS) at immediate post treatment (T1), at least 1 year retention (T2) and at least 2 years retention (T3). Results: Wilcoxon signed-rank non-parametric testing revealed 5 of 17 study variables improved ($p<.05$) from T1 to T2 ($n=51$) as follows: Mn posterior alignment (1.5 v .5, $p=.000$), Mx B-L inclinations (2.0 v 1.5, $p=.048$), Mx marginal ridges (1.0 v .6, $p=.01$), Mn marginal ridges (1.3 v .8, $p=.01$) and Mn interproximal contact (.3 v .02, $p=.01$). From T2 to T3 ($n=24$), Mn B-L inclinations improved (3.7 v 2.6, $p=.01$). Conclusion: Orthodontic treatment combined with selective alveolar decortication and grafting resulted in improved orthodontic treatment outcome during the retention period; relapse was absent.

Paper #76338

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Anabolic Modeling of Trabecular Bone Following Selective Alveolar Decortication

D.J. FERGUSON, J-D. SEBAOUN, J.W. TURNER, A. KANTARCI, R.S. CARVALHO, and T.E. VAN DYKE, Boston University, MA, USA

When orthodontic clinical treatment is combined with selective alveolar decortication, it has been demonstrated that clinical treatment time is 60 to 70% more rapid. However, the biological rationale for rapid tooth movement after alveolar decortication remains obscure. Corticotomy was performed by Bogoch, et al. on the rabbit tibia condyle, the rabbits were feed calcein ad libitum in the drinking water post-op, and 5X turnover of trabecular bone was demonstrated adjacent to the boney incision at post-op day 28. In contrast, little is known about the anabolic hard tissue response to alveolar bone injury. Objectives: The objective was to evaluate anabolic modeling of alveolar trabecular bone as a function of time and location following selective alveolar decortication. Methods: Five rats underwent selective buccal-lingual alveolar decortication adjacent to the left maxillary first molar; the contra lateral side acted as the control in the split mouth design. The animals were feed vital bone stain calcein ad libitum in the drinking water post-op and sacrificed at 3 weeks (n=3) or 7 weeks (n=2). Maxillas were removed, stripped, and prepared for non-decalified fluorescent stain histology. Pixel counts were made in the transverse sections of trabecular bone in the first molar and third molar areas that were analyzed independently using a 100 x 100 pixel square grid (10,000 pixels). Results: Percent of new bone apposition in the 1st molar area was significantly greater ($p<.03$) in the post decortication group (5968 pixels) at 3 weeks compared to the 3 week 1st molar control (2446) and the 3 week 3rd molar control (2290) and surgery (1778). Conclusion: Anabolic modeling of alveolar trabecular bone adjacent to the decortication site increased by about 1.5 times at 3 weeks; this increase represented a 2.6 to 3.4 fold greater anabolic modeling activity as compared to the 3rd molar area.

Paper #76409

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Anabolic Modeling of the Lamina Dura Following Selective Alveolar Decortication

C.L. KELSON, J.-D. SEBAOUN, D.J. FERGUSON, A. KANTARCI, R.S. CARVALHO, and T.E. VAN DYKE, Boston University, MA, USA

It has been clinically demonstrated that orthodontic treatment time is reduced 60% to 70% following selective alveolar decortication. Decortication injury is followed by an increase in tissue turnover. Objective: The aim of this study was to analyze bone apposition pattern following selective alveolar decortication. Methods: Six rats underwent unilateral selective alveolar decortication buccal and lingual to the upper left first molar with the right side serving as control; animals were divided into 2 groups. In group 1, vital bone stains were injected sub-peritoneal at 1 week intervals beginning 1 week post-op starting with calcein, then tetracycline, and lastly alizarin red. The same series of injections were made in group 2 starting at post-op week 4. Group 1 animals were killed at post-op week 4 and group 2 was killed at post-op week 7. Maxillary halves were harvested and processed for un-decalcified fluorescent stain histology. Multiple systematic measurements (80 to 294 values per specimen) of bone apposition surrounding the 5 roots of the first molar were made using Olympus MicroSuite FIVE analysis software and expressed as total 3-week apposition width as well as apposition length as percent of overall root perimeter. Results: One-way ANOVA with Tukey post hoc testing demonstrated that apposition width was significantly greater (p=.000) following surgery at 4 weeks post decortication (.051mm) compared with the 4 week control (.037mm), and the 7 week surgery (.037mm) and control (.032mm). No differences were observed in apposition length as a percentage of root perimeters. Conclusion: Apposition of the lamina dura (anabolic modeling) increased 46% at the 4-weeks stage following selective alveolar decortication in the rat.

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Orthodontic Stability of Advanced Lower Incisors Following Selective Alveolar Decortication

K. OLIVEIRA[1], D.J. FERGUSON[2], W.M. WILCKO[3], and M.T. WILCKO[3], [1]Tufts University, Boston, MA, USA, [2]Boston University, Boston, MA, USA, [3]Private Practice, Erie, PA, USA

Re-crowding of lower incisors following labial positioning is consistently cited in orthodontic retention literature. The tendency for incisors to return toward pre-treatment positions is due, in part, to periodontal tissue memory. Selective alveolar decortication plus alveolar grafting (AOOtm) when combined with orthodontic treatment results in greater post treatment and retention stability. This finding is likely due to enhanced tissue turnover and loss of periodontal tissue memory. Objectives: To assess the effects of labial advancement of lower incisors of at least 3mm on stability with and without AOOtm. Methods: The orthodontic study cast records of 75 patients were examined at pre-tx (T1), post treatment (T2) and retention (T3) and grouped as follows: L1 advanced >3mm with AOOtm (n=8), L1 advanced <3mm with AOOtm (n=16), L1 advanced >3mm without AOOtm (n=25), and L1 advanced <3mm without AOOtm (n=26). Irregularity Index (NDX) and inter-canine distance (3-3) were measured at the 3 time intervals. Results: For the L1 advanced >3mm without AOOtm group, T3 NDX was greater (p<002) than all other groups and magnitude of NDX change from T2 to T3 was greater (p<001) than both groups with AOOtm; both non-AOOtm groups relapsed T2 to T3. No differences were observed in 3-3 width treatment changes (T1-T2), but 3-3 width relapsed during retention more in the L1 advanced >3mm without AOOtm group than the L1 advanced <3mm without AOOtm group. Conclusions: Advancement of the lower incisors greater than 3mm did not result in significant re-crowding when selective alveolar decortication plus grafting (AAOtm) was combined with orthodontic treatment; relapse was absent.

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Catabolic Modeling of Trabecular Bone Following Selective Alveolar Decortication

J.-D. SEBAOUN, D.J. FERGUSON, A. KANTARCI, R.S. CARVALHO, and T.E. VAN DYKE, Boston University, Boston, MA, USA

Significant hard and soft tissue turnover increases are reported following bone injury but little is known about the effect of alveolar injury. Clinical orthodontics is 60 to 70% more rapid following selective labial-lingual alveolar decortication but the biological rationale for rapid tooth movement remains obscure. Objective: The objectives were to evaluate bone modeling in 1) trabecular bone, 2) PDL and 3) 1st versus 3rd molars as a function of time and proximity following decortication. Methods: Nine rats underwent selective buccal-lingual alveolar decortication adjacent to the left maxillary first molar in a split mouth design. The animals were sacrificed in groups of three at 3, 7, and 11 weeks, and maxillas were removed, stripped, and prepared for decalified histology using TRAP or H&E stains. Bone modeling dynamics was histomorphometrically examined for osteoclast and/or precursor count (OC) within the geometric center defined by the 4 most distal 1st molar roots, the 2 mesial roots of the 3rd molar, and within the 1st molar PDL. Results: Kruskal-Wallis testing showed that trabecular bone OC at 3 weeks post decortication (56.3) was significantly greater ($p<.02$) than control (26.3) and 7 week surgery (29.7). At 3 weeks post decortication, one-way ANOVA testing demonstrated bone surface volume (4.4mm2) was significantly less ($p<.05$) than control (7.5mm2) and 7 week surgery (6.2mm2) and all other groups; PDL surface volume was greater (7.2mm2) than 3 week control (3.1mm2) and 7 week surgery (5.3mm2). Moreover, Regional Acceleratory Phenomena (RAP) was shown as PDL OC for 3-week surgery was greater than all other groups, and the 1st molar 3-week surgery group had significantly greater OC than the 3rd molar and all other groups. Conclusion: Selective alveolar decortication in the rat resulted in approximately a 50% increase in catabolic modeling of alveolar trabecular bone adjacent to the surgery and RAP was demonstrated.

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Orthodontic Treatment and Retention Outcomes Following Selective Alveolar Decortication

E.D. WALKER[1], D.J. FERGUSON[1], W.M. WILCKO[2], and M.T. WILCKO[2], [1]Boston University, MA, USA, [2]Private Practice, Erie, PA, USA

Success in orthodontically treating malocclusion is somewhat dependent upon the severity of the initial malocclusion. The American Board of Orthodontics developed the Discrepancy Index (DI) as a measure of pre-treatment malocclusion severity and the Objective Grading System (OGS) to assess orthodontic treatment outcomes. Objectives: To compare non-extraction orthodontic treatment and retention outcomes with and without selective alveolar decortication plus grafting (AOOtm) for pre-treatment malocclusion with DI scores greater than 10. Methods: Pre-treatment patient records were screened for DI scores greater than 10 and grouped for treatment with (n=26) and without (n=28) AOOtm. Study casts and panoramic x-rays for non-extraction, straight-wire therapy were scored at post treatment (T1) and retention (T2) using the OGS for 8 criteria plus total OGS score. Results: For the AOOtm group, total post treatment (T1) OGS score (21.7) was significantly lower (p<.001) than the group without surgery (30.6), as were buccal-lingual inclinations (4.6 v 6.6, p=.04), marginal ridge relationships (2.7 v 5.9, p<.001) and interproximal contacts (.3 v 1.1, p=.03). At retention (T2), the AOOtm group had significantly lower scores for alignment (1.3 v 3.8, p<.001) and marginal ridge relationships (1.4 v 4.9, p<.001) as well for effect sizes.. Conclusions: Orthodontics combined with selective alveolar decortication plus grafting (AOOtm) to resolve malocclusions with pre-treatment Discrepancy Index scores greater than 10 produced better orthodontic and retention outcomes in non-extraction, straight wire therapy cases.