ARTICLE SUMMARY

AcceleDent® aura

CYCLIC LOADING (VIBRATION) ACCELERATES TOOTH MOVEMENT IN ORTHODONTIC PATIENTS: A DOUBLE-BLIND, RANDOMIZED CONTROLLED TRIAL

Dubravko Pavlin DMD, MSD, Ph.D., Ravikumar Anthony MSD, Vishnu Raj DDS, MS, Peter T. Gakunga DDS, Ph.D.

Semin Orthod, http://dx.doi.org/10.1053/j.sodo.2015.06.005

PURPOSE

- To assess the effect of a defined low-level cyclic loading on the rate of orthodontic tooth movement.

METHODS

- Parallel, double-blind, prospective, randomized, controlled trial.
- Enrolled 45 orthodontic patients (age range 12-40 yrs) with fixed appliances and randomized into two groups.
  - AcceleDent® Group (N=22)
  - Sham Control Group (N=23)
- Patients underwent extraction of maxillary first premolars with maximum maxillary posterior anchorage and at least 3mm of extraction space after initial alignment.
- Cyclic loading was applied to the vibration group for 20min/day using the AcceleDent device, which delivered a force of 0.25N (25g) at a frequency of 30Hz.
- Control group was assigned to the same protocol, but the device could not be activated to vibrate.
- Separate canine retraction was performed on a 0.018 in stainless steel archwire and enmasse retraction with a 0.019 x 0.025 SS archwire.
- Average monthly rate of maxillary canine retraction into an extraction space was analyzed.

RESULTS

- The mean rate of movement was significantly higher for the AcceleDent Group versus the Sham Control Group (Figure 1).
  - 1.16 mm/month vs 0.79mm/month (p=0.05)
- Study outcomes indicated that AcceleDent is safe and convenient for patients' daily use.

AUTHOR CONCLUSIONS

- These results showed that low-level cyclic loading of 0.25N at 30Hz increases the rate of tooth movement when applied as an adjunct to orthodontic treatment.

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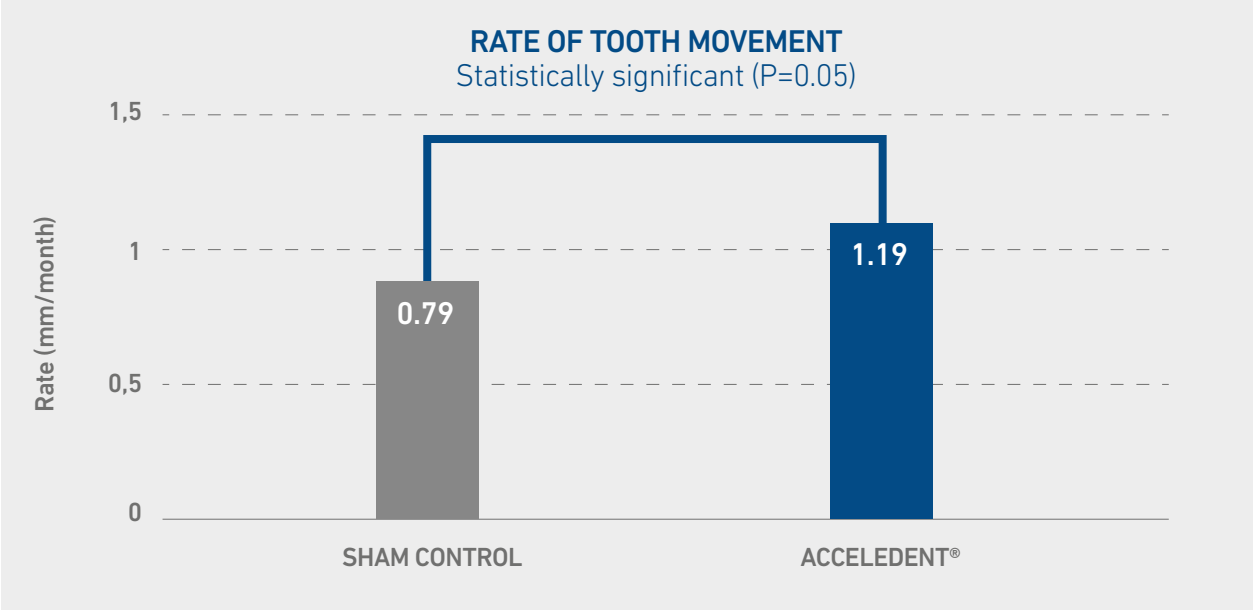
01
SERIES

ARTICLE SUMMARY

ACCELERATED TOOTH MOVEMENT

CYCLIC LOADING (VIBRATION) ACCELERATES TOOTH MOVEMENT IN ORTHODONTIC PATIENTS: A DOUBLE-BLIND, RANDOMIZED CONTROLLED TRIAL



☑ KEY POINT

This peer-reviewed randomized controlled trial demonstrates that AcceleDent accelerates the rate of tooth movement during orthodontic treatment.

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OA-L49025. 07/15

ARTICLE SUMMARY

THE EFFECT OF VIBRATION ON THE RATE OF LEVELING AND ALIGNMENT

Bowman SJ. *J Clin Orthod. 48:11 (2014): 678-688.*

PURPOSE

- To evaluate the effects of vibration with AcceleDent® on the speed of orthodontic leveling and alignment.

METHODS

- Retrospective evaluation of the effects of vibration on the time required for mandibular leveling and alignment.
- Enrolled 117 consecutively treated Class II non-extraction patients (40% male) who underwent maxillary molar distalization and concurrent mandibular leveling and alignment.
  - AcceleDent vibration (AD) group (N=30, 13.1 ± 1.3 yrs) .
  - Study control (SC) group (N=37, 12.8 ± 1.0 yrs).
  - Pre-AD (PAD) control group of Class II patients (N=50, 14.3 ± 4.2 yrs).
- Patients presented a half-to-full-step Class II molar relationship and mild-to-moderate crowding.
- Alignment defined as the sufficient resolution of dental irregularities to permit complete seating of a rectangular archwire with a minimum dimension of .017" × .025" stainless steel or superelastic alloy into .022" × .028" brackets.
- Leveling defined as the sufficient resolution of vertical dental discrepancies to allow complete seating of a rectangular archwire with a minimum dimension of .019" × .025" stainless steel into the bracket slots.

RESULTS

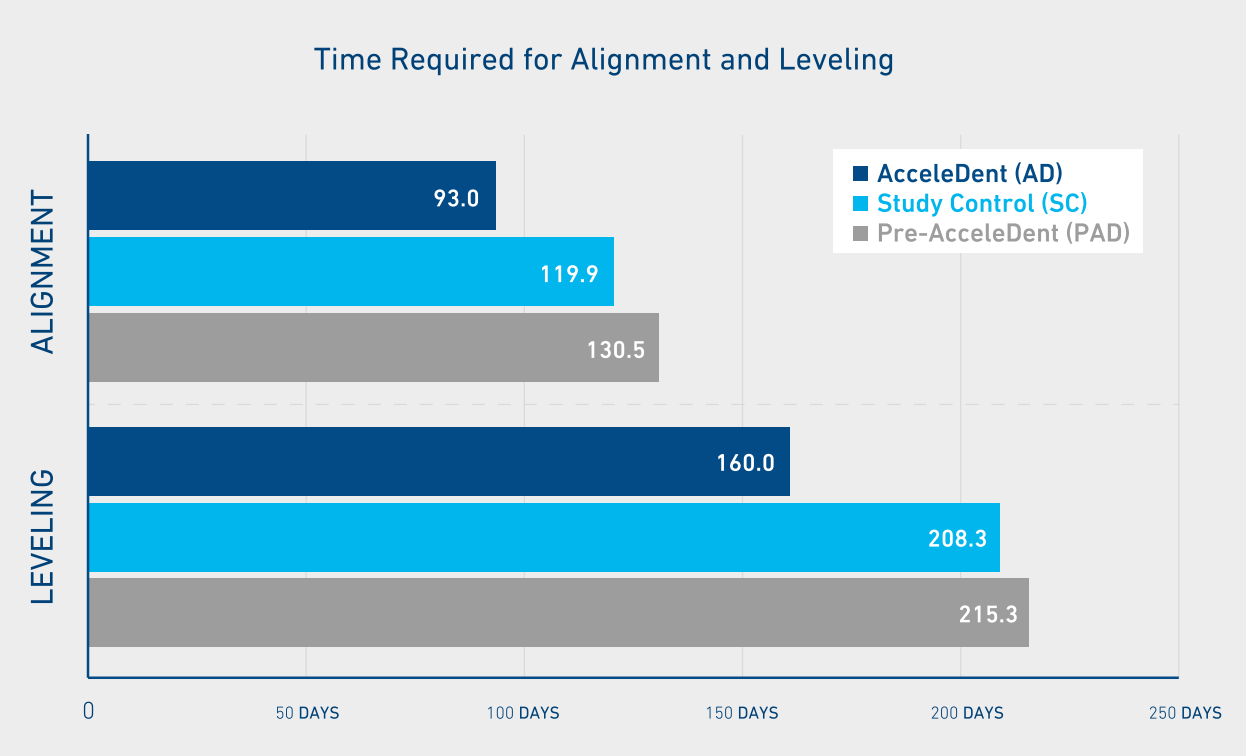
- No statistically significant differences in age or gender amongst the three groups.
- Average time to alignment was shorter in the AD group than either the SC group or the PAD control group *(Figure 1).*
- .017" × .025" archwire was placed in AD patients 27 days earlier (29% faster) on average than the SC patients and 38 days earlier (40% faster) than in the PAD subjects.
- Average time to leveling in the AD group was 48 days less than the SC patients (30% faster, $p<0.05$) and 55 days less than the PAD patients (35% faster, $p<0.05$).

AUTHOR CONCLUSIONS

- Amount of time required to achieve both dental alignment and leveling in Class II non-extraction treatment was reduced by using an AcceleDent device to apply vibration.
- Investigator found a clinically beneficial and statistically significant 30% increase in the rate of tooth movement during orthodontic leveling of the mandibular dentition.

ACCELERATED TOOTH MOVEMENT

THE EFFECT OF VIBRATION ON THE RATE OF LEVELING AND ALIGNMENT *(Continued)*



☑ KEY POINT

This peer-reviewed clinical study provides initial data on how AcceleDent may accelerate time to alignment and leveling in Class II non-extraction patients.

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OA-A24028. March 2015.

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AcceleDent® aura

ACCELERATE YOUR PRACTICE: EFFECTIVE SELF-LIGATION TECHNIQUES

Graham J. *Webinar presented on orthoaccellearning.com (Dec 2014).*

In this webinar, Dr. John Graham describes his wire sequence and patient management protocol when using AcceleDent with passive self-ligation appliances.

WIRE SEQUENCE

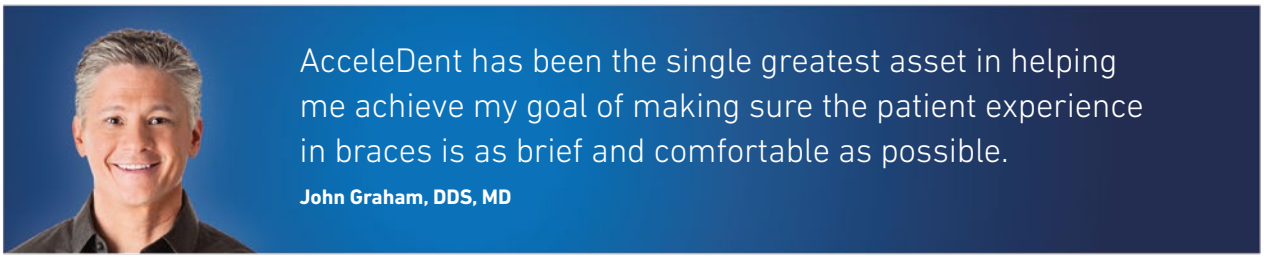
- Leveling/Alignment
  – 0.014" round wires 90% of the time
- Working
  – 0.014" X 0.025" rectangular wire
- Transition
  – 0.018" X 0.025" rectangular wire
- Finishing
  – 0.019" X 0.025" rectangular wire TMA/SS (Upper) and 0.017" X 0.025"/0.016" X 0.025" TMA/SS (Lower)
- Advocates early use of elastics with PSL

VISIT INTERVALS

- Reduce visit intervals by up to 2 weeks which can result in 2-3 saved visits

TREATMENT TIME

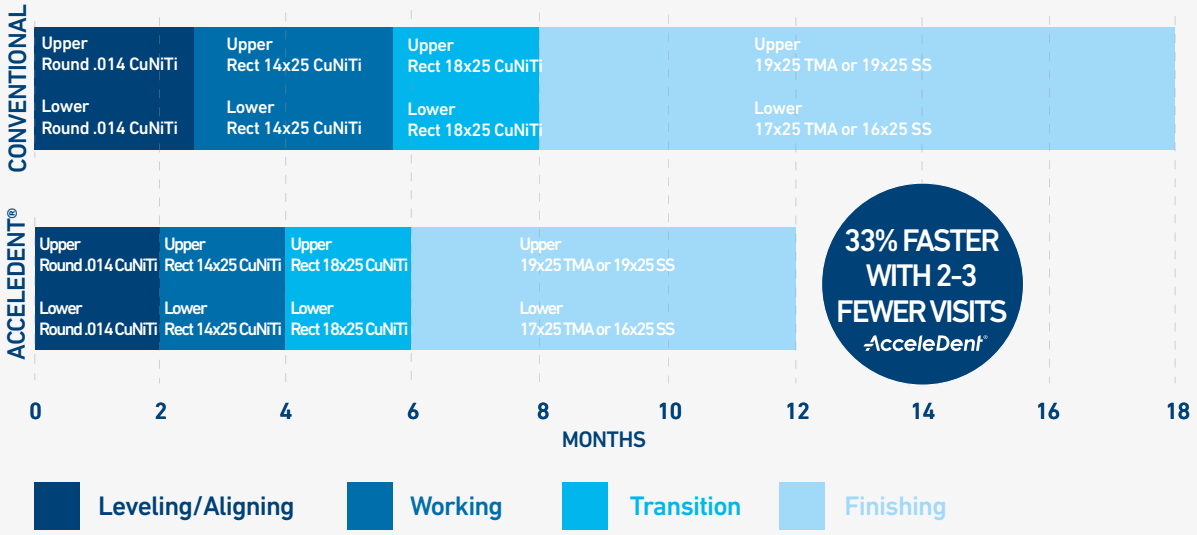
- Up to 33% faster treatment can be achieved with AcceleDent and passive self-ligation



TREATMENT EFFICIENCY

ACCELERATE YOUR PRACTICE: EFFECTIVE SELF-LIGATION TECHNIQUES *(Continued)*

AVERAGE TREATMENT TIME / PROTOCOL (PSL APPLIANCES)



Based on an average 18 month treatment plan with Damon PSL system as reported by Dr. John Graham, Sugarhouse Orthodontics, Salt Lake City, UT.

☑ KEY POINT

AcceleDent may accelerate treatment by 33% with 2-3 fewer visits in patients using passive self-ligation mechanics.

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OA-A24029. March 2015.

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EFFECT OF MECHANICAL VIBRATION ON RESISTANCE TO SLIDING IN THE FIXED ORTHODONTIC APPLIANCE

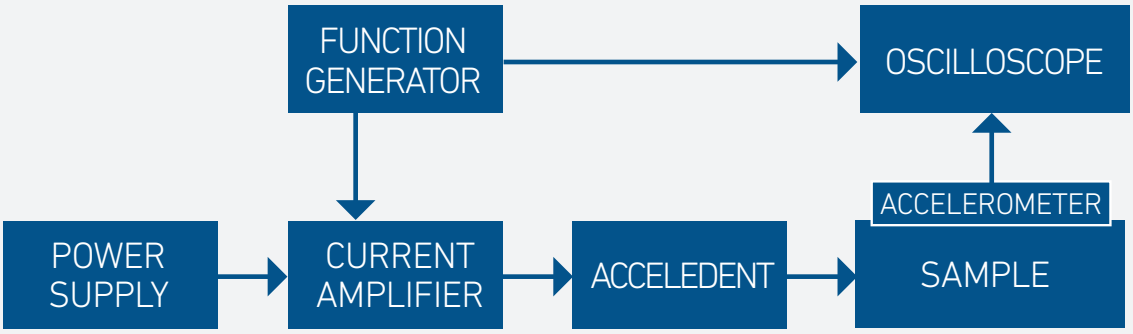
Kennedy D, Liu D. *Electronic poster session presented at: 2014 Annual Session of the American Association of Orthodontists; 2014 Apr 25-29; New Orleans, LA.*

PURPOSE

- To test the effect of vibration on the sliding resistance (i.e. friction and binding) of a fixed orthodontic appliance system.

METHODS

- Engineering bench test setup that simulated tooth structure with PDL layer
- Measured static and dynamic friction between 0.022" x 0.028" SS bracket and 0.016" x 0.025" NiTi wire with and without AcceleDent
  - Pulled wire at 5 mm/min for 7 mm



RESULTS

- With AcceleDent, static and dynamic friction between orthodontic wire and brackets in a fixed appliance system were reduced by 8.5% and 22.3% ($p<0.05$), respectively.
- Range of dynamic friction at 5 mm:
  - Control: 267-478g
  - AcceleDent: 210-345g

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TREATMENT EFFICIENCY

EFFECT OF MECHANICAL VIBRATION ON RESISTANCE TO SLIDING IN THE FIXED ORTHODONTIC APPLIANCE

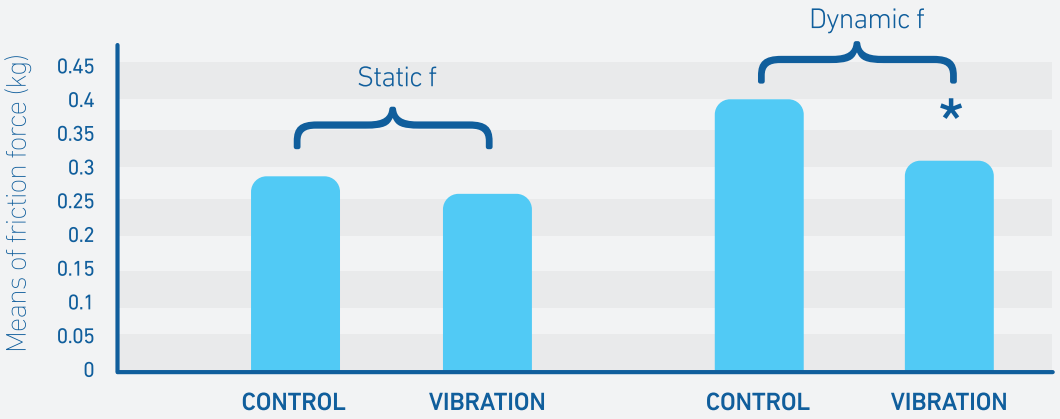
(Continued)

AUTHOR CONCLUSIONS

- Our data show that vibration (AcceleDent) reduces static and dynamic frictions between orthodontic wire and brackets in fixed appliance system by about 8.5% and 22.26%, respectively.

ACCELEDENT® AND EFFICIENCY OF FIXED APPLIANCES

AcceleDent may enhance efficiency of fixed mechanics by reducing friction



With AcceleDent, static and dynamic friction between orthodontic wire and brackets in a fixed appliance system were reduced by 8.5% and 22.3% ($p<0.05$), respectively.*

*Liu D, Kennedy D. Effect of Mechanical Vibration on Resistance to Sliding in the Fixed Orthodontic Appliance. Electronic poster session presented at: 2014 Annual Session of the American Association of Orthodontists; 2014 Apr 25-29; New Orleans, LA.

☑ KEY POINT

AcceleDent may enhance the efficiency of fixed mechanics by reducing friction.

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02 SERIES

TREATMENT EFFICIENCY

ARTICLE SUMMARY

AcceleDent® aura

CLINICAL EXPERIENCE WITH THE USE OF PULSATILE FORCES TO ACCELERATE TREATMENT

***Orton-Gibbs S**, Kim NY. J Clin Orthod. 2015 Sep;49(9):557-73.*

PURPOSE

- To report the first extensive single-center experience with a new pulsatile force (PF) delivery device: AcceleDent®, a noninvasive accessory designed to accelerate orthodontic tooth movement.

METHODS

- 117 patients (mean age 31 yrs, 64% female) opted to use AcceleDent as an adjunct to their treatment between November 2009 and May 2014.
- The following factors were recorded for each patient:
  - Appliance type
  - Acceptance rates for all patients offered AcceleDent
  - Preferred place of AcceleDent use
  - Reduction in treatment time
- The expected treatment time was estimated by the clinician, based on more than 25 years of clinical experience, and before knowing whether or not the patient opted to use AcceleDent.
- The accuracy of predicted treatment time in fixed-appliance patients without AcceleDent was verified by comparing actual against predicted treatment time in a consecutively treated control group matched to the AcceleDent group of patients, which was also consecutively treated.

RESULTS

- Predicted treatment times were estimated in the first 14 consecutively treated fixed-appliance cases with AcceleDent and 14 cases without AcceleDent.
  - Predicted treatment times were between 18 and 24 months with no significant difference in predicted treatment time between the AcceleDent and control patients.
  - In the control group, the predicted treatment time was accurate to within an average 1.6 months (7%).
  - After adjusting for prediction error, the AcceleDent group finished 33.5% faster than predicted, saving an average 6.23 months of treatment time.

PREDICTED AND ACTUAL TREATMENT TIME IN FIXED-APPLIANCE PATIENTS

	No. Patients	Predicted Treatment Time	Actual Treatment Time	p
Control	14	22.29 months	20.71 months	0.24
AcceleDent	14	20.04 months	12.39 months	<0.0001

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TREATMENT EFFICIENCY

CLINICAL EXPERIENCE WITH THE USE OF PULSATILE FORCES TO ACCELERATE TREATMENT

(Continued)

WIRE SEQUENCING PROTOCOL

- In fixed-appliance cases, the faster tooth movement achieved with AcceleDent® will shorten the interval between visits for leveling and alignment, as well as in the detailing phase.
- During space closure, appointments can be maintained at normal intervals but with two fewer visits as the mechanics continue to be active.

TYPICAL NON-EXTRACTION TREATMENT MODEL

	APPOINTMENT INTERVAL	
Archwire Sequence	**Without AcceleDent**	**With AcceleDent**
.013"superelastic	8 weeks	6 weeks
.018"superelastic	8 weeks	6 weeks
.018" x .025" superelastic	8 weeks	6 weeks
018" x .025" stainless steel	6 weeks	4 weeks
Detailing/settling	6 weeks x 4 visits	4 weeks x 4 visits
Total (including debonding)	**54 weeks (9 visits)**	**38 weeks (9 visits)**

TYPICAL MID-ARCH EXTRACTION TREATMENT MODEL

	APPOINTMENT INTERVAL	
Archwire Sequence	**Without AcceleDent**	**With AcceleDent**
.013"superelastic	8 weeks	6 weeks
.018"superelastic	8 weeks	6 weeks
.018" x .025" superelastic	8 weeks	6 weeks
018" x .025" stainless steel with space closure	8 weeks x 6 visits	8 weeks x 4 visits
Detailing/settling	6 weeks x 2 visits	4 weeks x 2 visits
Total (including debonding)	**84 weeks (12 visits)**	**58 weeks (10 visits)**

AUTHOR CONCLUSION

This article demonstrates that the successful incorporation of AcceleDent into an orthodontic practice can significantly reduce treatment time, making it an attractive adjunct for both patients and clinicians.

☑ KEY POINT

This real-world clinical evaluation demonstrates that AcceleDent accelerates orthodontic treatment in patients with fixed appliances.

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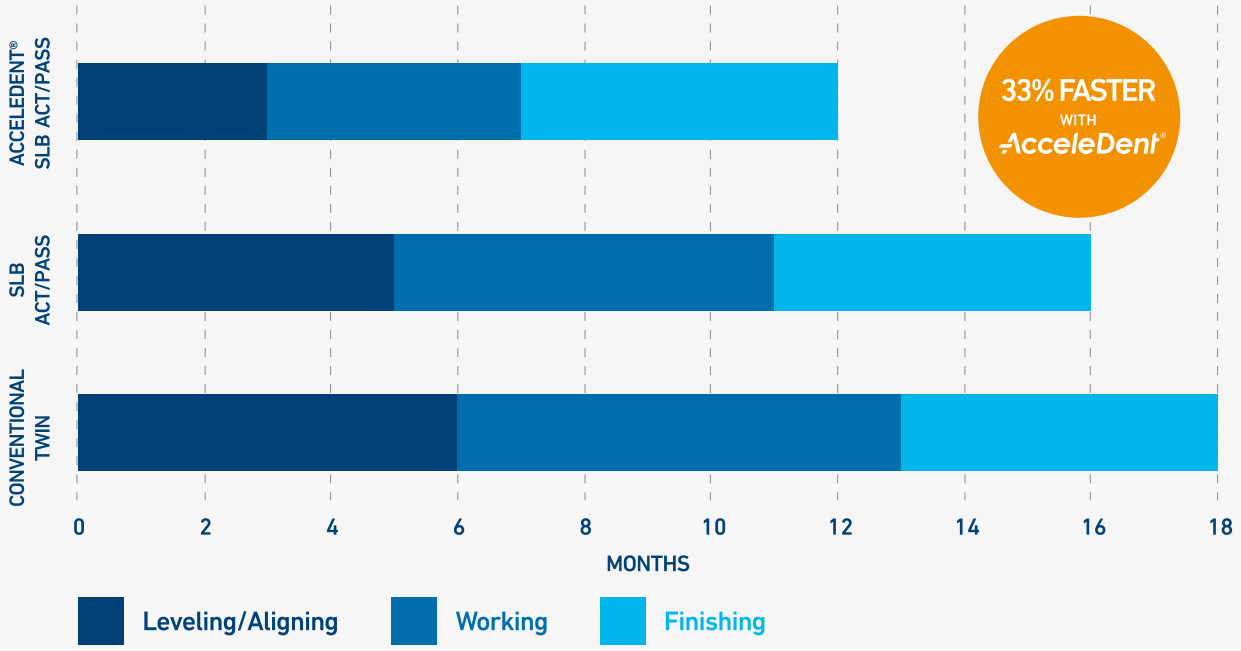
WIRE SEQUENCE PROTOCOL FOR NON-EXTRACTION AND EXTRACTION CASES

AVERAGE TREATMENT TIME PROTOCOL NON-EXTRACTION



Girardot, RA Editor, Goal Directed Orthodontics, Section 2 "The Goal Directed Approach to Diagnosis and Treatment and Its Effect on Treatment Excellence and Efficiency", Dr. Straty Righellis 2013. Working treatment time variables include but not limited to severity of over bite and anchorage requirements. Based on an average 18 month treatment plan with conventional twin system as reported by Dr. Straty Righellis, Righellis Orthodontics, Oakland, CA.

WIRE SEQUENCE

- **Leveling/Alignment**
  - .016 BioStarter
  - .020 sq BioTorque

  Reset brackets as needed and bonding 7's
  - .0195 x .025 BioTorque
- **Working**
  - .0195 x .025 SS
- **Transition**
  - .018 X .025 rectangular wire
- **Finishing**

  Reset brackets
  - .0195 x .025 BioTorque
  - .0195 x .025 SS
  - .0195 x .025 Multi-Stranded Wires

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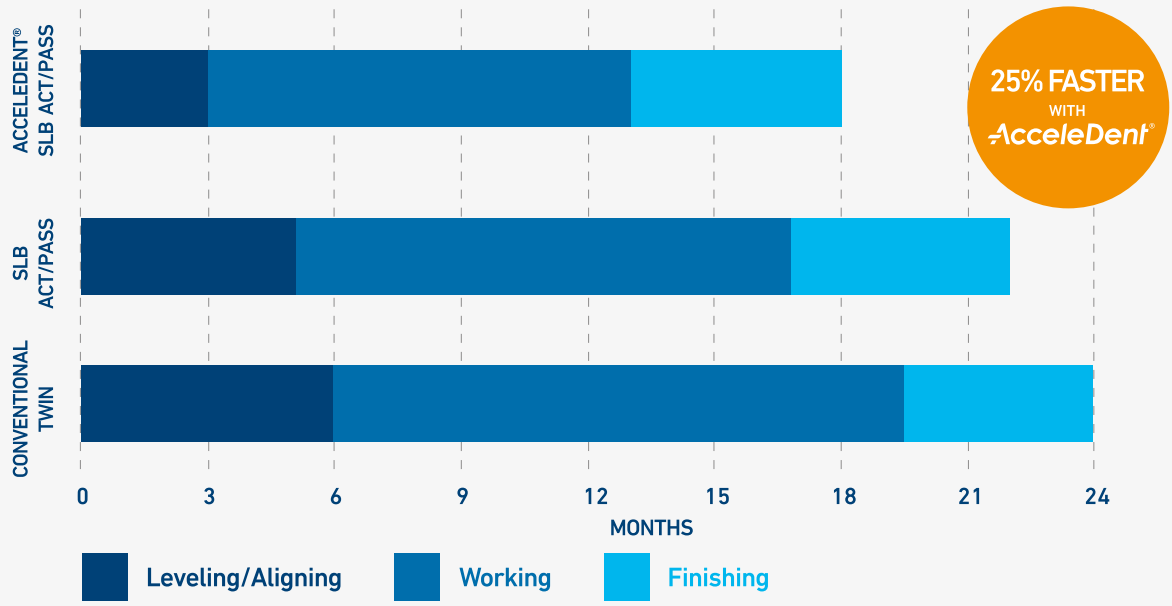
TREATMENT EFFICIENCY

WIRE SEQUENCE PROTOCOL FOR EXTRACTION AND NON-EXTRACTION CASES *(Continued)*

AVERAGE TREATMENT TIME PROTOCOL EXTRACTION



Girardot, RA Editor, Goal Directed Orthodontics, Section 2 "The Goal Directed Approach to Diagnosis and Treatment and Its Effect on Treatment Excellence and Efficiency", Dr. Straty Righellis 2013. Working treatment time variables include but not limited to severity of over bite and anchorage requirements. Based on an average 24 month treatment plan with conventional twin system as reported by Dr. Straty Righellis, Righellis Orthodontics, Oakland, CA.

WIRE SEQUENCE

- **Leveling/Alignment**
  - .016 BioStarter
  - .020 sq BioTorque

  Reset brackets as needed and bonding 7's
  - .0195 x .025 BioTorque
- **Working**
  - .0195 x .025 SS
  - .0195 x .025 SS (Working)

  U: Double KH Loops or Posted hooks with NiTi springs

  L: Chains or Posted hooks with NiTi springs
- **Finishing**

  Reset brackets
  - .0195 x .025 BioTorque
  - .0195 x .025 SS
  - .0195 x .025 Multi-Stranded Wires

☑ KEY POINT

- 33% faster treatment can be achieved with AcceleDent and non-extraction wire sequencing protocol
- 25% faster treatment can be achieved with AcceleDent and extraction wire sequencing protocol

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OA-P49045. 12/15

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INCREASING ORTHODONTIC AND ORTHOGNATHIC SURGERY TREATMENT EFFICIENCY WITH A MODIFIED SURGERY-FIRST APPROACH

Uribe F, Agarwal S, Shafer D, Nanda R. *Am J Orthod Dentofacial Orthop 2015;148:838-48.*

SUMMARY

In this case report, Uribe et al. reviews how the total treatment time can be reduced with a modified surgery-first approach. A 33-year-old white man was diagnosed with skeletal Class III and dental Class II subdivision malocclusion caused by a retrognathic maxilla, maxillary and mandibular crowding, a highly placed maxillary left canine, and a bilateral posterior crossbite.

The authors detail a presurgical orthodontic protocol prior to surgery, which resulted in an enhancement of the efficiency during the orthodontic and orthognathic surgery phases of treatment. To expedite tooth movement prior to the surgical phase, the patient was prescribed the use of AcceleDent.

With AcceleDent, the authors specifically noted significant enhancement of the speed of canine retraction at approximately 1 mm/week, which is more than 3x the rate (1.19 mm/month) reported by Pavlin et al. of a similar canine movement in a separate AcceleDent randomized controlled trial.[1]

As a result of the modified surgery-first approach, the patient completed treatment in 12 months with a fully functional occlusion and an attractive esthetic finish.

☑ KEY POINTS

- This peer-reviewed published case report illustrates how AcceleDent can be incorporated to expedite tooth movement to accelerate treatment in a combined orthodontic/orthognathic surgery protocol, which can last at least 2 years. This case was treated in 12 months.

[1]*Pavlin D et al. Cyclic loading (vibration) accelerates tooth movement in orthodontic patients: A double-blind, randomized controlled trial. Seminars in Orthodontics, Volume 21, Issue 3, 187 – 194.*

POSTER PRESENTATION

TRANSMISSION OF ACCELEDENT MICROPULSES TO ORAL STRUCTURES

Transmission of Mechanical Vibration from AcceleDent to Dentition and Skull

[1]Liu D, [2]Dai Z, [2]Royston TJ.

[1]Department of Developmental Sciences/Orthodontics, Marquette University School of Dentistry, Milwaukee, WI, USA;

[2]Department of Mechanical and Industrial Engineering, University of Illinois at Chicago, IL, USA.

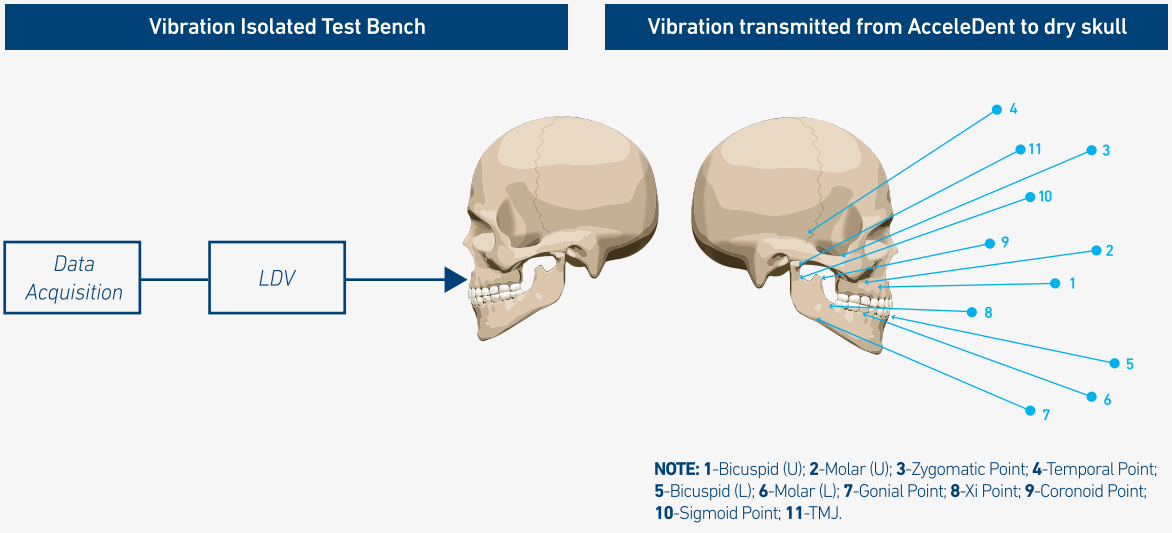
Presented at the IADR/AADR/CADR 91st General Session.

PURPOSE

- To measure the transmission of vibration to oral structures using AcceleDent.

METHODS

- To study the transmission of vibration on dentition and skull, the AcceleDent device was placed between the upper and lower dentitions of a dry skull.
- Surface vibrations were measured at various representative anatomical locations on the dentition (e.g. incisor, cuspid and molar) and the skull by a Laser Doppler Vibrometer (LDV).



NOTE: **1**-Bicuspid (U); **2**-Molar (U); **3**-Zygomatic Point; **4**-Temporal Point; **5**-Bicuspid (L); **6**-Molar (L); **7**-Gonial Point; **8**-Xi Point; **9**-Coronoid Point; **10**-Sigmoid Point; **11**-TMJ.

- AcceleDent was also inserted into a human mouth, and the surface vibrations under three different levels (low, medium, high) of biting forces were recorded at the corresponding spots on the skin of face.
- Magnitudes of vibration at various locations were compared to the original magnitude of the device.

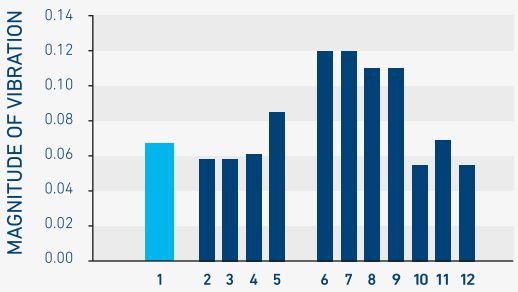
ACCELEDENT® SCIENCE

TRANSMISSION OF ACCELEDENT MICROPULSES TO ORAL STRUCTURES

(Continued)

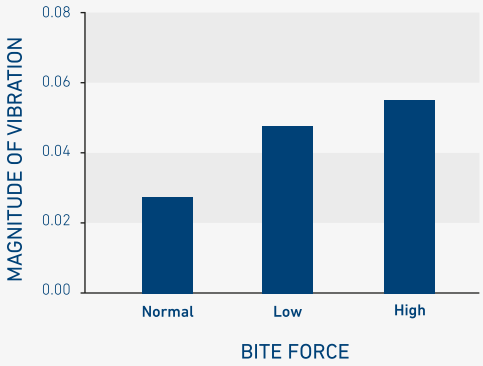
RESULTS

Vibration Transmission (Dry Skull)



NOTE: 1-Device; **2**-Bicuspid (U); **3**-Molar (U); **4**-Zygomatic Point; **5**-Temporal Point; **6**-Bicuspid (L); **7**-Molar (L); **8**-Gonial Point; **9**-Xi Point; **10**-Coronoid Point; **11**-Sigmoid Point; **12**-TMJ.

Vibration Transmission (Human Face)



SUMMARY

- All teeth in the mouth receive nearly the same amount of vibration regardless of whether they touch the mouthpiece.
  - Vibration is transmitted from AcceleDent through the entire skull but varies in magnitude.
  - Most locations receive reduced levels of vibration, except for the mandibular molar, "Xi" point and gonial angle areas.
- Vibration is transmitted from the dental vibrator to human face, reaching as far as the TMJ area.
  - Biting forces drastically influence the vibration's transmission.

AUTHOR CONCLUSIONS

- The transmission of vibration from AcceleDent is highly transmissible but variable.

☑ KEY POINT

AcceleDent micropulses may be transmitted throughout the entire dentition even when there is not complete contact of the Mouthpiece.

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OA-P49039. 10/15

ARTICLE SUMMARY

AcceleDent®

PAIN CONTROL IN ORTHODONTICS USING A MICROPULSE VIBRATION DEVICE: A RANDOMIZED CLINICAL TRIAL

Lobre WD, Callegari BJ, Gardner G, Marsh CM, Bush AC, Dunn WJ.

Angle Orthod. http://dx.doi.org/10.2319/072115-492.1

PURPOSE

- To investigate the relationship between a micropulse vibration device (AcceleDent®) and pain perception during orthodontic treatment.

METHODS

- Parallel, prospective, randomized, controlled trial.
- Enrolled 58 orthodontic patients (>10 years old) with fixed appliances and randomized into 2 groups.
  - AcceleDent® Group (N=29)
  - Control Group (N=29)
- During a 4-month period:
  - Adjustments and wire changes were made at the beginning of each month.
  - Incidence and severity of pain from a visual analog scale (VAS) were recorded by the patient after the separator or archwire placement appointment daily for the first 7 days and then weekly for the remainder of the month.
- Patients recorded the perceived severity of pain in two categories: chewing/biting and overall pain.
- AcceleDent patients were instructed to use the device for 20 minutes daily and mark the pain scales within 1 hour after using the device.
- Patients were directed not to take any pain medication or analgesics, including over-the counter (OTC) medications and topical ointments.
- Univariate analysis of variance (ANOVA) of between-subject effects were used to detect differences between the AcceleDent and Control groups (α=0.05).

RESULTS

- Repeated-measures ANOVA detected that VAS Pain scores were significantly lower for the AcceleDent group versus the Control group for overall pain (P=0.002) and for biting pain (P=0.003).
- No harms or unintended effects were noticed in either study group.
- All participants in the AcceleDent group reported that they were in less pain when using the device.

AUTHOR CONCLUSION

- The micropulse vibration device significantly lowered the pain scores for overall pain and biting pain during the 4-month study period.

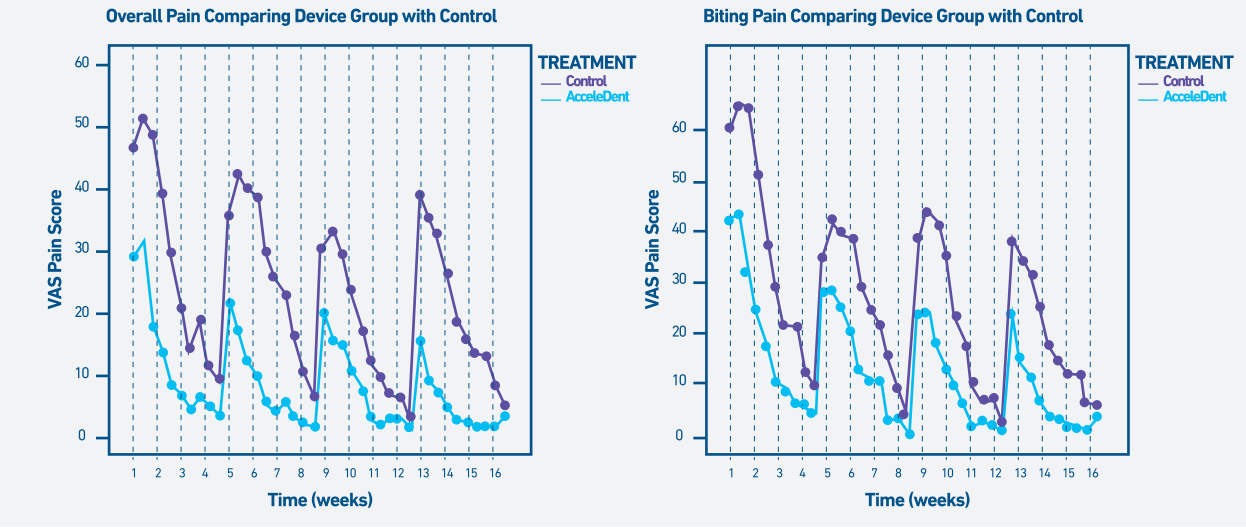
PATIENT COMFORT

PAIN CONTROL IN ORTHODONTICS USING A MICROPULSE VIBRATION DEVICE: A RANDOMIZED CLINICAL TRIAL

(Continued)

Table 1. Mean VAS Pain Scores

	OVERALL PAIN				BITING PAIN			
Month	AcceleDent	Control	% Reduction in AcceleDent Group	P-value	AcceleDent	Control	% Reduction in AcceleDent Group	P-value
1	8.78	17.2	**49%**	0.039	14.28	23.65	**40%**	0.068
2	4.62	13.11	**65%**	0.005	8.33	17.01	**51%**	0.016
3	3.83	9.22	**58%**	0.012	5.83	12.37	**53%**	0.008
4	2.54	8.8	**71%**	0.003	4.45	13.22	**66%**	0.001



☑ KEY POINT

This peer-reviewed randomized controlled trial demonstrates that AcceleDent reduces pain and discomfort associated with orthodontic treatment.