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Choice of Initial Alignment Archwires in Moderate to Severe Crowding in Patients Treated with Damon and MBT Systems: A Retrospective Study

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Abstract

Initial arch wires are the firsts arch wires to be inserted into the fixed appliance at the beginning of orthodontic treatment and are used mainly for the alignment of teeth by correcting crowding and rotations. With a number of different types of orthodontic arch wires available for initial tooth alignment, it is important to understand which wire is most efficient. The purpose of this study was to evaluate the choice of initial alignment archwires in treating patients with moderate to severe crowding with the MBT and Damon appliances. Sample included 50 patients aged 18 years and above,selected from the pretreatment records of the patients reported to the Department of Orthodontics,Saveetha Dental College,Chennai.Results of the study was obtained by evaluating the initial archwires used in case of MBT and Damon appliances. This study revealed that 85.7% out of the 35 MBT cases used 0.014 NiTi as the initial archwire and all of the Damon cases started with 0.013 CuNiTi.The collected data were entered into an Excel sheet(Microsoft Excel 2007) and statistical analysis done. The association between gender and initial alignment archwires in moderate to severe crowding cases was found using Chi-square association test in IBM SPSS software, which showed a statistically not significant difference (p -value >0.05) , hence there is no gender difference in the choice of initial alignment archwires in moderate to severe crowding patients.

Keywords:- *Damon system, Conventional MBT system, moderate to severe crowding, Orthodontic therapy,initial archwire.*

Introduction

Initial archwires are the first arch wires to be used in the fixed appliance for the alignment of teeth by correcting crowding and rotations.With a number of different types of orthodontic archwires available for initial tooth alignment,it is important to understand which wire is most efficient,as well as which wire cause the least amount of root resorption and pain during initial aligning stage of treatment[1]. Over recent years a number of new materials ,various metal alloys,or mixtures of nickel and titanium(NiTi) have been developed which show a range of different properties in the laboratory and which manufacturers claim offer benefits in terms of tooth alignment. Fixed orthodontic appliance treatment uses archwires to exert force upon teeth.Treatment is carried out in stages and selection of appropriate arch wires contribute to the treatment success.There is no arch wire ideal for all stages of fixed appliance treatment. The purpose of this study was to evaluate the choice of initial alignment archwires in moderate to severe crowding cases in patients treated with Damon and conventional MBT(McLaughlin Bennett Trevisi) systems.

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Materials and Methods

Digital records from the pretreatment records of the patients who reported to the Department of Orthodontics, Saveetha Dental College were screened for patients having Moderate to severe crowding . The selection criteria included Arch perimeter - tooth material discrepancy of over 4mm. Patients above the age of 12 years with a Angles Class I or Class II malocclusion were included in the study. Patients with a history of periodontal conditions and patients undergoing retreatment were excluded.Out of 500 patient records screened from a time period of 6 months (September 2019 to February 2020) 50 case records were chosen for data analysis. Patient records were divided into Two groups - Group A undergoing treatment with the MBT appliance and Group B undergoing treatment with Damon Self ligating appliances. The data on initial arch wires used were retrieved from the pretreatment records and tabulated.

Statistical Analysis

The collected data were entered into an Excel sheet(Microsoft Excel 2007) and statistical analysis done. The association between gender and initial alignment archwires in moderate to severe crowding cases was found using Chi-square association test in IBM SPSS software version 23.0. P value was found to be 0.731, which represents an insignificant association.

Results and Discussion

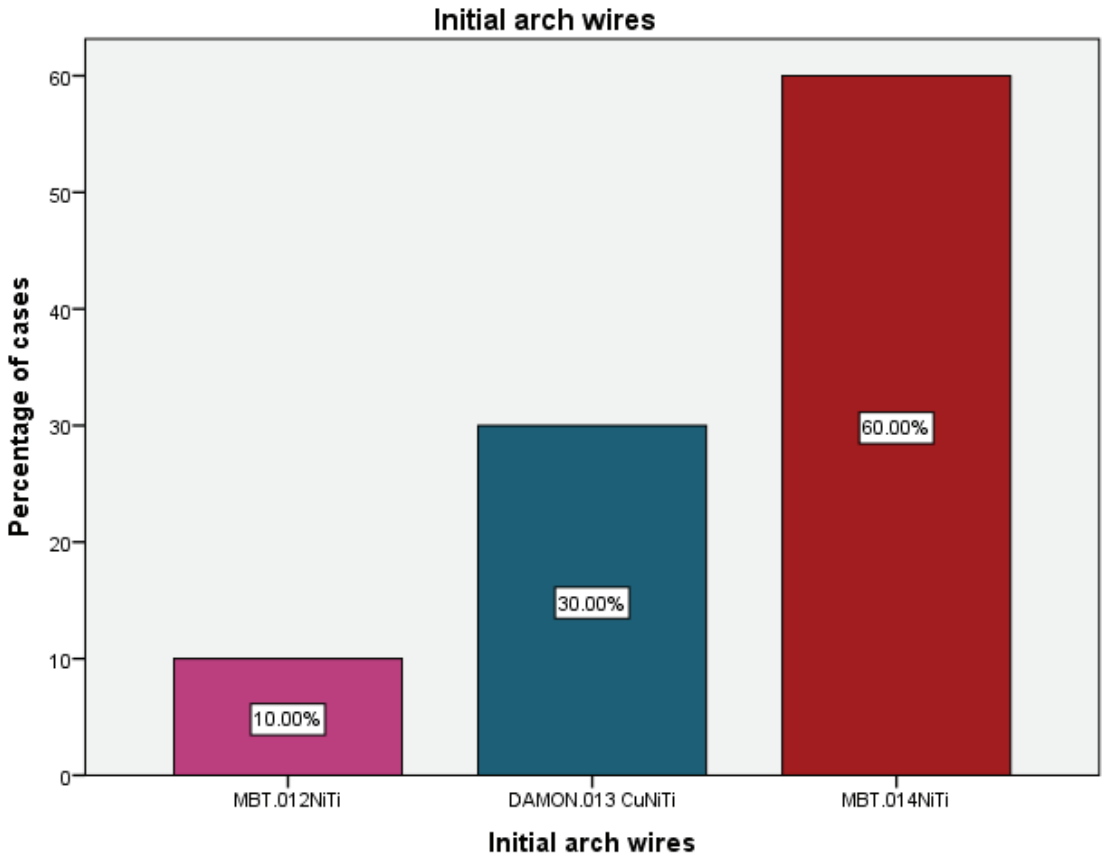

Figure 1: Bar Graph represents the choice of initial alignment archwires in moderate to severe crowding cases. X axis represents initial alignment arch wires and Y axis represents the percentage of cases. Out of the 50 moderate to severe crowding cases, 60 % used MBT0.014 NiTi (red)as the initial archwire and the rest used MBT0.012 NiTi(pink) as initial archwire. All of the Damon cases, that is, 30% of the total crowding cases used Damon0.013 CuNiTi(blue) as initial alignment arch wire. It can be inferred from the above result that MBT 0.014 NiTi was the preferred choice of initial alignment archwire in most of the crowding cases.

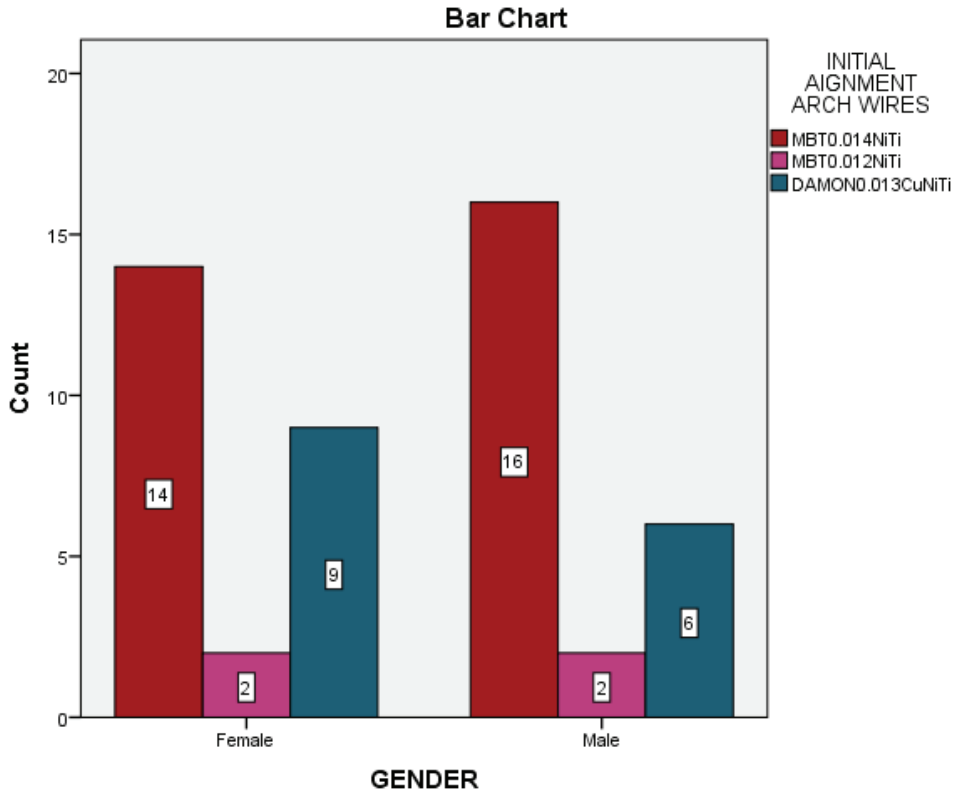

Figure 2. Cluster bar graph represents association between gender and initial alignment archwires in moderate to severe crowding cases.X axis represents gender and Y axis represents initial alignment arch wires. According to the graph among the females, 14 of them were treated with MBT 0.014 NiTi(red), 9 with Damon 0.013 CuNiTi(blue) and among males,16 were treated with MBT 0.014 NiTi(red), 6 with Damon 0.013 CuNiTi(red). A slight predominance of MBT 0.014 NiTi is found in males than in females. However, there is no significant difference found statistically. (Chi-square value- 0.713; df-2; p value=0.700).

Evaluation of the two groups showed most of the moderate to severe crowding cases treated under conventional MBT used 0.014 NiTi as initial archwire and all Damon cases used 0.013 CuNiTi.

Out of the 50 moderate to severe crowding cases; 60 % used 0.014 NiTi as the initial archwire and the rest used 0.012 NiTi as initial arch wire. All of the Damon cases, that is, 30% of the total crowding cases used 0.013 CuNiTi as initial alignment arch wire (fig 1). Association between gender and initial alignment archwires in moderate to severe crowding cases showed a statistically insignificant difference (p value=0.700). A slight predominance of MBT 0.014 NiTi is found in males than in females(fig 2). According to Proffit and Bennett and Mc Laughlin[2] the first phase of treatment deals with leveling and alignment and also correction of vertical and horizontal discrepancies by leveling out the arches, and the initial aligning wires should apply light continuous force. Conventionally,round wires are used for alignment because tightly fitting resilient rectangular arch wires produce back and forth movement of the root apices as the teeth move into alignment[3].To utilize the superelastic property of the NiTi wires,they should be deformed beyond a certain bending angle [4,5].

Results of this study shows that most of the MBT treated cases used 0.014 NiTi as the initial alignment wire; whereas all of the Damon cases used 0.013 CuNiTi as the starting arch wire.Pandis et al[6], found no difference in alleviation of mandibular anterior crowding with copper-nickel-titanium and superelastic NiTi wires.They substantiated that this may be due to differences in loading between laboratory conditions and the oral cavity resulting from free play between archwire and bracket slot. West et al[7] reported better

alignment efficiency with superelastic NiTi in the lower anterior region; which is statistically significant.Jones et al[8] found greater mean improvement in incisal alignment with superelastic NiTi.

The attempts to deform the superelastic wire to attain the superelastic plateau by selecting severe lower anterior crowding cases have led to many occasions of difficulty in engaging the single-stranded superelastic NiTi and of partial ligation with steel ties. Thus superelastic coaxial wires offer the advantage of engaging a relatively large archwire during the initial phase of the treatment with low force delivery. So a greater degree of uprighting, leveling, and rotational control is achieved than with NiTi wires other initial wires.

For the purpose of comparison on alignment and leveling, 0.013 inch NiTi arch wire used throughout the aligning phase of Damon[9]. Miles et al[10] postulated that presence of 'play' between the smaller arch wire dimension and the slot when inch archwire was fitted within 0.028 inch slot depth Damon 2 bracket would allow 8.5 degree of rotational play compared to fully engaged archwire in conventional twin brackets. Scott et al found no difference in initial alignment between Damon 3 and conventional brackets with respect to discomfort.

Previously our team had conducted numerous clinical trials [11–17] and lab animal studies [18–22] and in-vitro students [23–25] over the past 5 years. Now we are focussing on epidemiological surveys. The idea for this survey stemmed from the current interest in self ligating brackets and the rise in their usage in many practises.

Conclusion

This survey evaluated the choice of initial alignment archwires in treating patients with moderate to severe crowding with the MBT and Damon appliances The results of this study showed that the MBT appliance used 0.014 NiTi as initial alignment archwire. All the Damon appliances used 0.013 CuNiTi as the initial alignment archwire. The association between gender and initial alignment archwires in moderate to severe crowding cases was also found to have no significant difference.

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Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

References

1. Jian F, Lai W, Furness S, McIntyre GT, Millett DT, Hickman J, et al. Initial arch wires for tooth alignment during orthodontic treatment with fixed appliances [Internet]. Cochrane Database of Systematic Reviews. 2013. Available from: http://dx.doi.org/10.1002/14651858.cd007859.pub3
2. McLaughlin RP, Bennett JC. Evolution of treatment mechanics and contemporary appliance design in orthodontics: A 40-year perspective. Am J Orthod Dentofacial Orthop. 2015 Jun;147(6):654–62.
3. Proffit WR, Fields HW, Sarver DM. Contemporary Orthodontics. Mosby; 2007. 751 p.
4. Meling TR, Ødegaard J. Short-term temperature changes influence the force exerted by superelastic nickel-titanium archwires activated in orthodontic bending [Internet]. Vol. 114, American Journal of Orthodontics and Dentofacial Orthopedics. 1998. p. 503–9. Available from: http://dx.doi.org/10.1016/s0889-5406(98)70169-6
5. Bourauel C, Nolte LP, Drescher D. Numerische Untersuchung kieferorthopädischer Behandlungselemente aus pseudoelastischen NiTi-Legierungen - Numerical Analysis of Pseudoelastic Orthodontic Devices [Internet]. Vol. 37, Biomedizinische Technik/ Biomedical Engineering. 1992. p. 46–53. Available from: http://dx.doi.org/10.1515/bmte.1992.37.3.46
6. Pandis N, Polychronopoulou A, Eliades T. Alleviation of mandibular anterior crowding with copper-nickel-titanium vs nickel-titanium wires: A double-blind randomized control trial [Internet].

Vol. 136, American Journal of Orthodontics and Dentofacial Orthopedics. 2009. p. 152.e1–152.e7. Available from: http://dx.doi.org/10.1016/j.ajodo.2008.08.022

7. West AE, Jones ML, Newcombe RG. Multiflex versus superelastic: A randomized clinical trial of the tooth alignment ability of initial arch wires [Internet]. Vol. 108, American Journal of Orthodontics and Dentofacial Orthopedics. 1995. p. 464–71. Available from: http://dx.doi.org/10.1016/s0889-5406(95)70046-3
8. Dickson JAS, Jones SP, Davies EH. A Comparison of the Frictional Characteristics of Five Initial Alignment Wires and Stainless Steel Brackets at Three Bracket to Wire Angulations—an in Vitro Study [Internet]. Vol. 21, British Journal of Orthodontics. 1994. p. 15–22. Available from: http://dx.doi.org/10.1179/bjo.21.1.15
9. Wahab RMA, Megat Abdul Wahab R, Idris H, Yacob H, Zainal Ariffin SH. Comparison of self- and conventional-ligating brackets in the alignment stage [Internet]. Vol. 34, The European Journal of Orthodontics. 2012. p. 176–81. Available from: http://dx.doi.org/10.1093/ejo/cjq179
10. Miles P, Fisher E. Assessment of the changes in arch perimeter and irregularity in the mandibular arch during initial alignment with the AcceleDent Aura appliance vs no appliance in adolescents: A single-blind randomized clinical trial [Internet]. Vol. 150, American Journal of Orthodontics and Dentofacial Orthopedics. 2016. p. 928–36. Available from: http://dx.doi.org/10.1016/j.ajodo.2016.07.016
11. Sivamurthy G, Sundari S. Stress distribution patterns at mini-implant site during retraction and intrusion--a three-dimensional finite element study. Prog Orthod. 2016 Jan 18;17:4.
12. Samantha C, Sundari S, Chandrasekhar S, Sivamurty G, Dinesh S. Comparative Evaluation of Two Bis-GMA Based Orthodontic Bonding Adhesives - A Randomized Clinical Trial. J Clin Diagn Res. 2017 Apr;11(4):ZC40–4.
13. Krishnan S, Pandian S, Kumar S A. Effect of bisphosphonates on orthodontic tooth movement-an update. J Clin Diagn Res. 2015 Apr;9(4):ZE01–5.
14. Vikram NR, Prabhakar R, Kumar SA, Karthikeyan MK, Saravanan R. Ball Headed Mini Implant. J Clin Diagn Res. 2017 Jan;11(1):ZL02–3.
15. Kamisetty SK. SBS vs Inhouse Recycling Methods-An Invitro Evaluation [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2015. Available from: http://dx.doi.org/10.7860/jcdr/2015/13865.6432
16. Viswanath A, Ramamurthy J, Dinesh SPS, Srinivas A. Obstructive sleep apnea: awakening the hidden truth. Niger J Clin Pract. 2015 Jan;18(1):1–7.
17. Felicita AS. Quantification of intrusive/retraction force and moment generated during en-masse retraction of maxillary anterior teeth using mini-implants: A conceptual approach. Dental Press J Orthod. 2017 Sep;22(5):47–55.
18. Rubika J, Sumathi Felicita A, Sivambiga V. Gonial Angle as an Indicator for the Prediction of Growth Pattern [Internet]. Vol. 6, World Journal of Dentistry. 2015. p. 161–3. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1334
19. Jain RK, Kumar SP, Manjula WS. Comparison of intrusion effects on maxillary incisors among mini implant anchorage, j-hook headgear and utility arch. J Clin Diagn Res. 2014 Jul;8(7):ZC21–4.
20. Pandian KS, Krishnan S, Kumar SA. Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. Indian J Dent Res. 2018 Mar;29(2):137–43.
21. Ramesh Kumar KR, Shanta Sundari KK, Venkatesan A, Chandrasekar S. Depth of resin penetration into enamel with 3 types of enamel conditioning methods: a confocal microscopic study. Am J Orthod Dentofacial Orthop. 2011 Oct;140(4):479–85.
22. Felicita AS. Orthodontic management of a dilacerated central incisor and partially impacted canine with unilateral extraction - A case report. Saudi Dent J. 2017 Oct;29(4):185–93.
23. Felicita AS, Chandrasekar S, Shanthasundari KK. Determination of craniofacial relation among the subethnic Indian population: a modified approach - (Sagittal relation). Indian J Dent Res. 2012 May;23(3):305–12.
24. Dinesh SPS, Arun AV, Sundari KKS, Samantha C, Ambika K. An indigenously designed apparatus for measuring orthodontic force. J Clin Diagn Res. 2013 Nov;7(11):2623–6.
25. Felicita AS. Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor - The sling shot method. Saudi Dent J. 2018 Jul;30(3):265–9.