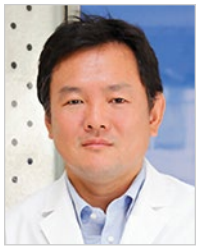
3M℠ Health Care Academy

An orthodontic system optimal for passive self-ligating brackets – “JETsystem.”



Dr. Shinichi Narita

Dr. Shinichi Narita graduated from the Tokyo Medical and Dental University in 1991, and received his Doctor Degree in Orthodontics in 1998. He started his private practice, the Jiyugaoka Orthodontic Clinic, in 1999. He is a Fellow of the World Federation of Orthodontists, a Certified Doctor by the Japanese Orthodontic Society, and a Member of the American Association of Orthodontists, the Japanese Society for Jaw Deformity, the Japanese Academy of Facial Studies, and the Tokyo Orthodontic Society. Dr. Narita is the President of the JETsystem Study Group.

Introduction

Since an encounter with a patient in 2006, I have been engaged in development of a system realizing marked reduction in duration of orthodontic treatment. Because I had doubts about the necessity of leveling, I expected that canine distal movement achieved at an early stage of orthodontic treatment would lead to reduction in treatment duration.

Performing canine distal movement at the beginning of the treatment process requires passive self-ligating brackets (PSL brackets) in place of conventional ligating brackets. When a 0.014-inch Heat Activated NiTi archwire is used as the main archwire on placement of conventional ligating brackets, the frictional force generated by ligation (approximately 100 gf) hinders proper movement of teeth. To enable canine distal movement immediately after placement of the orthodontic appliance, combined use of PSL brackets and superelastic NiTi closed coils yielding a frictional force not greater than 50 gf is needed.

In recent years, many articles investigating the difference in treatment duration between PSL brackets and conventional ligating brackets have been published in the *American Journal of Orthodontics and Dentofacial Orthopedics* (AJO-DO), and the majority of these articles concluded that no statistically significant difference in treatment duration was observed between these two brackets. However, it should be noted that these results do not mean there is no clinical difference between use of PSL brackets and conventional ligating brackets.

As we carefully read articles reporting no difference in treatment duration between these two brackets, we noted that such articles did not describe the treatment procedures in detail and contained a brief statement that the treatment was performed "according to the conventional procedures." An orthodontic treatment system used according to the conventional procedures cannot make full use of the strength of PSL brackets. I believed that the development of a treatment system that enables canine distal movement at the beginning of orthodontic treatment would be the key to successful reduction in treatment duration, and started investigation of such a system ... the JETsystem.

JETsystem – a treatment system optimal for PSL brackets

As of June 2016, the current JETsystem has the following 20 features. These 20 features represent theoretical backgrounds of this system. It is not too much to say that the first 10 points of pre-treatment preparation are the key determinants of successful treatment. Not exclusive to orthodontic treatment, the importance of adequate preparation in advance has been emphasized by the old saying "Perfection is eighty percent planning and twenty percent working." Without prior preparation anticipating the treatment goal, as well as the routine examination/diagnosis, no excellent treatment result can be obtained. However, the most important point is the decision to "finish within one year" with planning backward from the goal, and then think and do what should be done now.

1. Measurement in advance – No measurement, No KAIZEN

In general, the term "pre-treatment measurement" may be used to mean measurement of dental models or cephalometric analysis. Those measurements are necessary but inadequate. Producing an ideal setup representing post-treatment to measure teeth movement, the balance of the dental arch width, and the condition of post-treatment occlusion is to improve the precision of orthodontic treatment. At present, we measure plaster models and make an ideal setup from divided plaster teeth, but I believe that all such measurement processes will be digitalized in the near future. Instead of manual impression-taking with alginate or silicone material, every dental chair will be equipped with an optical scanner.

2. Passive self-ligating brackets

Many orthodontists still misunderstand an orthodontic treatment system using PSL brackets. Several years ago, many articles addressing the difference in treatment duration between PSL brackets and conventional ligating brackets were published in AJO-DO, and the majority of these articles reported that no statistically significant difference in treatment duration was observed between these two brackets. Such articles did not describe the treatment procedures in detail and contained a brief statement that the treatment was performed according to the conventional procedures.

The result of orthodontic treatment may vary depending on the treatment system used. Brackets, wires, chains, and coils used for orthodontic treatment may be considered as parts of a personal computer. The performance of the computer may be changed by upgrading the system. A recent well-known example is an upgrade from Windows® 7 to Windows 8. According to many newspaper articles, a considerable number of users who had once upgraded to Windows 8 soon downgraded to Windows 7 and are currently using Windows 7. Observing that first-hand personal computer systems using Windows 7 are still commercially available, even after the launch of Windows 10, the key importance of operating system in performance of a computer system may well be recognized. Thus, the difference in operating system changes the performance of a computer system even if the specifications of hardware components remain unchanged.

Conversely, if the operating system fails to fully utilize the difference in hardware components, there is a considerable possibility of little change in overall performance of the computer system. So much for allegory. In conclusion, a conventional system for orthodontic treatment cannot fully utilize the potential ability of PSL brackets, which results in little difference in treatment duration. If the treatment difference in PSL brackets and conventional brackets are tested with JETsystem, I believe there must be a significant difference in duration of orthodontic treatment between the two brackets. However, there is a substantial problem with this comparison: conventional brackets are apparently inferior to PSL brackets in treatment outcome. In such situation, there are ethical issues associated with clinical trials comparing PSL brackets with conventional brackets in JETsystem. While some university professors insist the importance of randomized controlled trials (RCTs), the essential prerequisite for starting such studies is clinical equipoise of the systems to be compared and this is why PSL brackets and conventional brackets used in JETsystem cannot be compared in RCTs.

Self-ligating brackets (SL brackets) were originally developed to save chair time, namely to reduce the time for ligation. Some types of SL brackets, however, enabled tooth movement by application of a force lower than ever (several dozens of gf). At present, Damon brackets are likely to be regarded as representative PSL brackets. I myself used Damon brackets about 10 years ago. However, I do not use them at present because they have several critical defects. First, because of its high profile, it is difficult to achieve torque control with Damon brackets. The greater the distance between wire and tooth surface, the more difficult to express the brackets pre-adjusted torque.

Furthermore, since the bracket width is not proportional to the tooth width, use of Damon brackets may be associated with problems in rotation control of maxillary anterior teeth. The last issue of Damon brackets is that only 0.022-inch brackets are available. Clarity™ SL Self-Ligating Brackets are devised to overcome the three defects described above. Although associated with some trouble in wire engagement and disengagement until getting used to it, Clarity SL brackets are PSL brackets that are low-profile, individually designed to have a bracket width proportional to the tooth crown width, and available for both 0.018- and 0.022-inch slots.

3. Bi-dimensional slots

For space closure utilizing the sliding mechanics, the friction force applied to brackets placed in the molar region should be desirably low. However, when using an archwire with a larger size such as a working wire (0.017×0.022 inch), as the friction becomes larger, then smooth space closure cannot be executed. On the other hand, using a smaller size archwire, the torque is lost in the anterior region and lingual inclination occurs. Is it feasible to meet these two apparently contradictory requirements at one time, providing sufficient torque in the anterior region and reducing the friction in the molar region to close the extraction space through application of a reduced force (less than 100 gf)?

The possible solution may be either to use brackets with the same slot size and wires with different sizes between anterior and posterior regions or to use both wires with brackets that have different slot sizes between anterior and posterior. At the beginning, the former approach was applied for JETsystem. However, since options for wires were limited and treatment outcome was unsatisfactory, the latter approach has been adopted since 2011. This latter approach is far superior to the former approach, because use of brackets with varying slot size in the anterior and posterior allows a wide selection of wires with many sizes made of different materials.

4. Bracket selection

To minimize the friction as much as possible, wires should preferably not be bent. That is, wires should preferably remain straight during tooth movement. This is the so-called "Straight-Wire" technique. However, elaborate wire bends may be generally produced during tooth movement in actual clinical practice. In principle, JETsystem uses NiTi wires until the extraction space is closed, without adding any bend. For this purpose, based on prior consideration of the necessary amount of torque applied to each bracket, the most appropriate bracket should be selected from products with varying torque designed for a particular site. In addition, considering the amount of pre- to post-operative change in tooth axis as well as tooth movement distance, brackets for anterior maxillary teeth are selected from high-torque or low-torque prescription. Brackets for lower anterior teeth with the same -6° torque are placed upside down as necessary in some cases involving tooth extraction to prevent excessive lingual inclination.

5. Ideal setup

To define the treatment goal accurately, preparation of an ideal setup model is essential. Preparation of an ideal setup model has two objectives: one is to examine the outlines of tooth movement distance for individual teeth and appropriateness of treatment plan; the other is to ensure accurate positioning. For this purpose, a setup model is prepared exactly according to the final treatment goal by ideally positioning individual teeth without any overcorrection in torque and other parameters. Overcorrection, if any, is incorporated in brackets to ensure standardization of treatment. Incorporating overcorrection in a setup model hinders appropriate torque setting, thereby making treatment even more difficult.

6. Straight wire positioning

In the early 1970s, SWA was developed by Dr. Lawrence F. Andrews and, as is well known, most of the current conventional methods are modifications of SWA in nature. An important dogma in orthodontic treatment applying SWA is the concept of facial axis (FA) points as the reference points for placement of brackets. However, when brackets are actually placed on FA points, cuspids are slightly shifted to the lingual side, requiring wire bends to engage into the wire slots even if SWA is used. To avoid this, a Clarity SL bracket for the upper and lower lateral incisor is positioned not exactly on but somewhat mesially to the FA point, while a Clarity SL bracket for the cuspid are positioned so that its distal wing is exactly on the FA point. Such positioning of brackets ensures straight-wire treatment without wire bends and enables space closure with NiTi wires.

7. Just-fit bite turbo

In orthodontic treatment, resolving issues related to vertical occlusion is important. Particularly in cases of deep bite involving tooth extraction, smooth closure of extraction space requires substantial effort. Establishing an appropriate vertical dimension of occlusion solely by wire adjustment is difficult even for experienced orthodontists. Use of a bite turbo is a method for anterior bite raising. A bite turbo is a metal or resin block placed on the lingual side of maxillary anterior teeth to get in contact with and intrude anterior mandibular teeth. Although an optimal vertical dimension of occlusion cannot be established by this method alone, the solution of this issue is to prepare an ideal setup model. Using the resulting ideal setup model, a bite turbo with an ideal height was prepared for maxillary anterior teeth and placement of this bite turbo at a relatively early stage of treatment enabled smooth closure of extraction space.

8. Indirect bonding

At present, there is no method for accurate intraoral placement of brackets positioned on an ideal setup model other than indirect bonding. Although some tools for bonding of brackets digitally set up may be developed in the near future, the conventional technique is more accurate at present. While a wide variety of indirect trays are currently available, those made of materials easy to process and capable of consistent application are preferable. I currently use silicone trays with their occlusal surface reinforced with resin for molars and individual resin trays for other teeth.

9. Simultaneous tooth extraction

It goes without saying that enhanced metabolism is required for efficient tooth movement. In cases involving tooth extraction, tooth movement starts immediately after tooth extraction to utilize metabolic activity in the extraction socket. This is based on a mechanism similar to stimulation of tooth movement by corticotomy.

Following tooth extraction, the conventional orthodontic treatment system requires several months till initiation of canine distal movement and about half a year for the initial step of leveling. This means that canine movement and anterior retraction are initiated after extraction socket remodeling is completed. In JETsystem, aiming at completion of movement of most teeth before completion of extraction socket remodeling, all teeth to be extracted for orthodontic treatment (except for impacted 3rd molar teeth) are extracted in one day and the orthodontic appliance is placed on the following day to initiate aggressive canine distal movement at this time point.

10. Oral myofunctional therapy (MFT)

One issue I recognized after introducing orthodontic treatment by JETsystem into my clinical practice was that abnormalities in oral muscle function caused stagnation of treatment and delayed space closure of the extraction socket. Since JETsystem utilizes minute force, tongue thrust on swallowing and pronunciation as well as weak lip closing pressure have greater effects on treatment outcome of JETsystem compared with that of conventional procedure. Stagnated space closure and failed stabilization of occlusion at the final step lead to delay in removal of the orthodontic appliance. Oral myofunctional therapy (MFT) is essential for smooth progress of treatment.

11. Measurement at every office visit

Once orthodontic treatment is initiated, detailed measurements to monitor the progression of tooth movement are seldom performed in general. While I expect that, in the future, intraoral scanning will be performed at every office visit to allow comparison with the data obtained at the last visit and prediction of time to achieve the treatment goal, there is currently no choice but to follow the conventional procedures. For patients currently on orthodontic treatment by JETsystem, the following are performed at every office visit: intraoral photographs, measurement of extraction socket, use of NiTi closed coils instead of elastometric chains to provide stable and continuous orthodontic force, and measurement of traction force applied to each intermaxillary elastic with a spring scale. These measurements enable better and more accurate understanding of treatment progress and provide information for decision-making regarding force system change, for example.

12. Stimulation of metabolism

It goes without saying that enhanced metabolism is essential for efficient tooth movement.

Aerobic exercise

I recommend aerobic exercise three times a week to college students and adults. Since tooth movement results from bone metabolism, smooth bone metabolism is imperative. To assure smooth bone metabolism, I believe that enhancement of systemic metabolism is important. I do not recommend aerobic exercise to junior and senior high school students, because their metabolic activity is high.

Sleep

During sleep, the parasympathetic nerve system is dominant in the autonomic nervous system and stimulates bone metabolism. Accordingly, in orthodontic treatment in adults, I instruct my patients to have appropriate sleeping hours.

13. Canine first

The greatest difference between conventional orthodontic treatment and JETsystem is *aggressive canine movement immediately starting from the time of placement of the orthodontic appliance.* This concept applies to all cases, regardless of need for tooth extraction.

In the conventional orthodontic treatment system, canine distal movement starts after wires of larger size are inserted following completion of leveling. In the JETsystem, in contrast, canine distal movement is initiated using 0.014-inch Heat Activated NiTi wires as initial wires. This treatment strategy is achieved by using PSL brackets. When conventional ligating brackets are used, a ligation force of approximately 100 gf is applied and an even greater force needs to be applied to accomplish canine distal movement. A textbook written by William R. Proffit states that 200 gf is required. If such a force were applied from the initial stage using 0.014-inch Heat Activated NiTi wires as main wires, the results would be obviously ineffective. Use of PSL brackets enables canine distal movement at an orthodontic force as small as 50 gf. It should be noted that the activity of the extraction socket is maintained only for three months. Achieving canine movement as much as possible while the extraction socket is still active is the key to successful reduction of overall treatment duration. The new concept "Canine first" enables reduction in duration of orthodontic treatment that has been impossible with conventional procedures.

14. Anchor screws

Traditionally, the technique used for anchorage had been thought to determine the outcome of orthodontic treatment. However, the advent of anchor screws as absolute means of anchorage greatly changed the clinical practice of orthodontics. In modern orthodontic treatment, anchor screws have been used in many systems including JETsystem. In addition, anchor screws achieved tooth movement in ways previously thought to be impossible and allowed to design three-dimensional tooth movement.

15. Variable treatment interval

To determine the optimal appointment interval is another key point in reducing total treatment duration. Since crowding is prevalent among Asians including Japanese, shorter appointment intervals facilitate smooth treatment progress at the initial stage. In cases involving tooth extraction, office visits during the first 2-3 months until engagement of working wires are scheduled at two-week intervals for wire change and bracket replacement. Even if no manipulation is necessary, MFT is preformed at every appointment. Once engagement of working wires is completed, appointments at 1-month intervals are sufficient. In the late stage of treatment involving use of robot-bended archwire, appointments are scheduled at two-week intervals again during the final adjustment period for 2-3 months.

16. Light-side force

In my opinion, there is "good" orthodontic force and "bad" orthodontic force. In JETsystem, orthodontic force causing adverse effects on periodontal tissue, inducing excessive tooth inclination and torsion or gingival recession, or root resorption is termed as "bad" force (Dark-side force), while orthodontic force facilitating efficient and painless tooth movement with normal physiological conditions maintained is termed "good" force (Light-side force).

Most orthodontists not familiar with JETsystem may be concerned about torque and distal inclination of cuspids presumably due to involvement of the unique bracket position (straight-wire positioning) mentioned above. In addition, such concern appears to be further amplified by nickel-titanium wires (NiTi wires) basically used throughout the treatment process. Based on the results of experiments on ligation force conducted in 2005 (60-83 gf), I use .017×.022 wires as main wires in actual clinical practice. In addition, inspired by Professor Gakuji Ito of Kagoshima University on the occasion of a previous graduate school lecture, that "tooth movement can occur even at an orthodontic force as small as 10 gf," I use superelastic NiTi closed coils (25 gf) for distal movement of cuspids in junior high school students, and use of PSL brackets is essential for tooth movement at such a small orthodontic force. At an orthodontic force of around 25 gf, excessive inclination and torque are prevented by restoring force. May the force be with you.

17. Friction control

Friction control means adjustment of frictional force during tooth movement, reducing it to almost zero to facilitate tooth movement and sometimes increasing it to inhibit tooth movement. The purpose of using PSL brackets is to reduce frictional force to almost zero and thereby enable friction control. The conventional orthodontic treatment system bears contradiction in that it fixes brackets and archwires with frictional force generated by ligation and simultaneously attempts to separate them by application of even greater orthodontic force. As a consequence, distal inclination and rotation occur. JETsystem aims at minimizing such unnecessary frictional force to near zero before space closure is completed. For example, a coil is ligated to the lower part of each bracket. To reduce normal force, no excessive reverse curves or 1st- 2nd- and 3rd-order bends were introduced in .017×.022 wires used as the main wires. Furthermore, frictional force is increased to inhibit tooth movement after space closure is completed.

18. Initial movement

1) Initial elastic (intermaxillary elastic)

Use of intermaxillary elastics immediately after placement of the orthodontic appliance is termed "initial elastic." When I used the "initial elastic" strategy for the first time in early 2008, I was so worried about treatment failure that I scheduled the next appointment of a patient 10 days after the first visit. Every orthodontist has likely experienced fear upon application of intermaxillary elastics with Niti round wires. The greatest difference in the use of intermaxillary elastics between conventional methods and JETsystem is the strength of force applied. Conventionally, force exceeding the ligation force (around 100 gf) was generally applied to intermaxillary elastics and an authoritative textbook, *Contemporary Orthodontics* by William R. Proffit, states that 250 gf is applied. Based on the "Light-side force" concept, 50 gf is applied in JETsystem.

2) Initial coil spring (NiTi closed coil spring)

Recognizing the importance of early approach to extraction socket, I developed a new approach called "initial coil spring" involving canine distal movement initiated immediately after placement of the orthodontic appliance using NiTi closed coil springs. Although tooth movement during the first month after placement of the orthodontic appliance is not so significant because of time-consuming remodeling of alveolar septum, subsequent movement achieved at 2-3 months after placement is remarkable. For junior and senior high school students, 25 gf and 50 gf are applied for canine distal movement and anterior retraction, respectively. For college students and adults, 50 gf and 100 gf are applied for canine distal movement and anterior retraction, respectively.

19. Leverage torque control

Leverage torque control is a technique for controlling anterior torque using hooks. Anterior torque is controlled by selection of hook length. This technique has theoretical rationales and exhibits remarkable effects if an optimal wire size is selected. Anterior brackets with .018-inch slot allows early initiation of torque control. Anterior retraction with hooks usually results in lingual inclination of retracted teeth. This is a phenomenon associated with use of shorter hooks. In contrast, use of longer (8 mm) hooks in combination with wires of almost full size enables anterior retraction with slight labial inclination. This is a useful method realizing anterior torque control without application of torque to wires.

20. Zero-step method

The Zero-step method is a concept that treatment processes conventionally divided into multiple steps and sequentially conducted are all conducted in parallel as if there were no discrete steps. Based on an idea that an orthodontic treatment system may be analogous to process management in manufacturing industry, I have learned project management from "The Goal: A Process of Ongoing Improvement" and have been investigating how to achieve total optimization.

Although conventional clinical practice in orthodontics has addressed a reduction in chair time at each appointment, this is nothing but the pursuit of sub-optimization and does not necessarily have a beneficial effect on the overall treatment outcome. The JETsystem aims at optimization (minimization) of overall treatment by process management.

Conclusion

This article has introduced JETsystem, a method for orthodontic treatment taking advantage of PSL brackets. JETsystem does not inhibit bloodstream, utilizes orthodontic force causing minimal pain (Light-side force), reduces frictional force, corrects balance of perioral muscle, takes full advantage of in vivo metabolic activity, and is constructed considering features and characteristics of various materials. As a consequence, this system has reduced treatment-related pain and treatment duration. Hereafter, I would like to continue further KAIZEN, aiming at reducing the duration of dynamic orthodontic treatment involving tooth extraction in junior and senior high school students to 6-9 months and see more smiles of my patients.

Case 1:
Class I, crowding, maxillary and mandibular right and left 1st bicuspids extracted

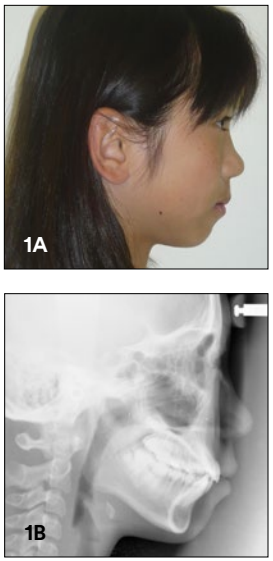


Figure 1A-B: Case 1 initial.

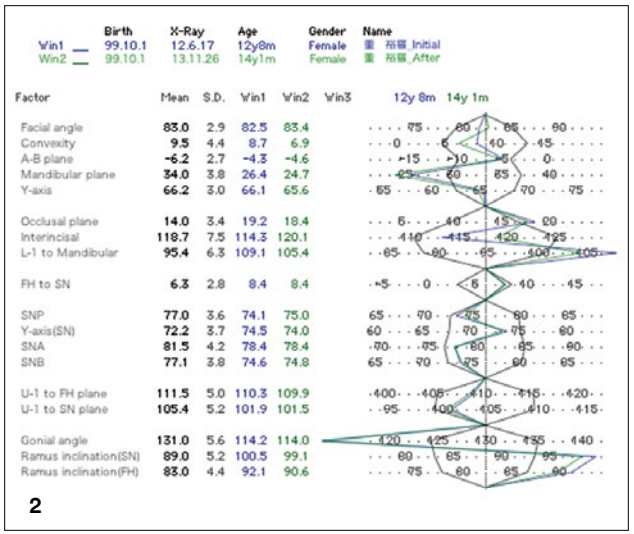


Figure 2: Case 1 cephalometric diagnosis.

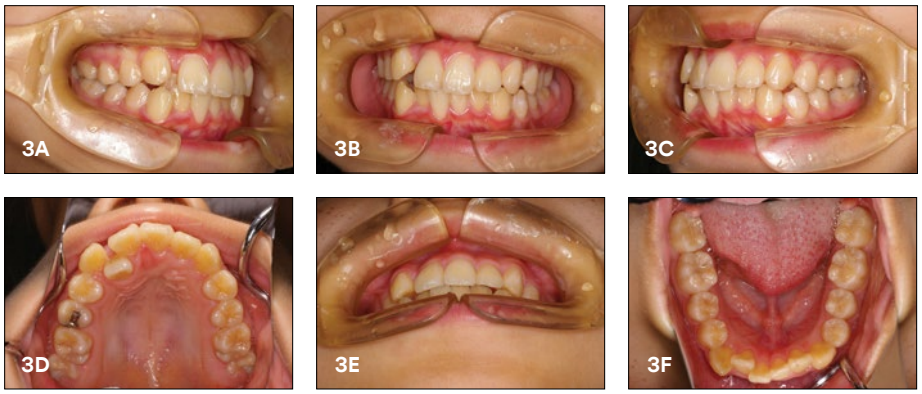


Figure 3A-F: Case 1 initial.

Pre-treatment

Figure 4A-C

Two months

Figure 5A-C

Four months

Figure 6A-C

Six months

Figure 7A-C

Ten months

Figure 8A-C

Post-treatment at 14 months

Figure 9A-C

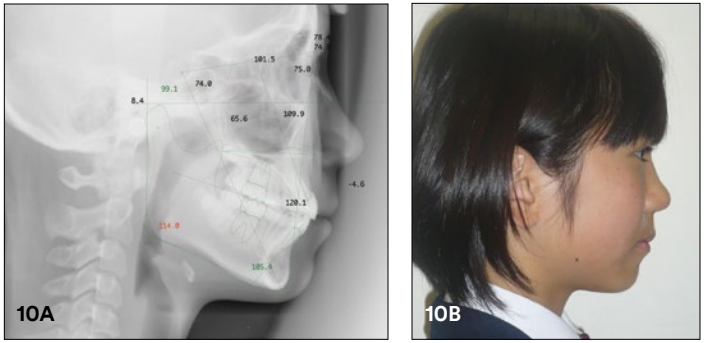


Figure 10A-B: Case 1 post-treatment.

Retention after 24 months

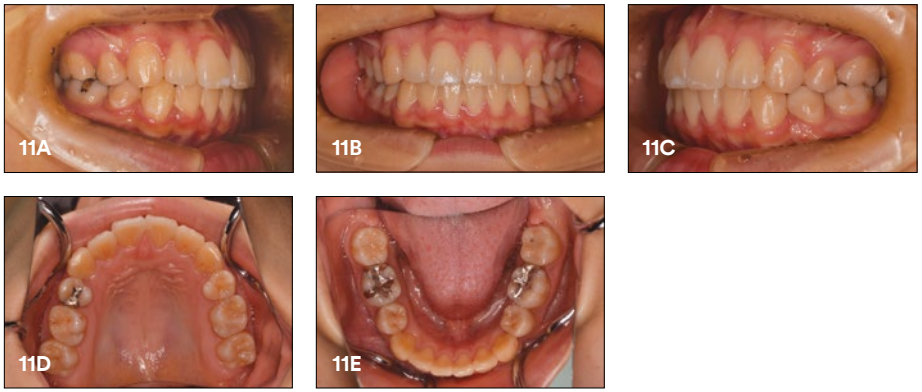


Figure 11A-E

Case 1 Narrative:
A 12-year, 8-month-old female patient presented with a concern about high canines. Her facial appearance was symmetric and her facial type was of Convex type. A slight tension was noted in the mentalis muscle. Angle Class I malocclusion was observed with overjet of 2.5 mm and overbite of 2.5 mm. The maxillary and mandibular arch length discrepancies were –8 mm and –8 mm, respectively. Lingual transposition of the maxillary right lateral incisor and mandibular anterior crowding were noted. Tooth formation of maxillary and mandibular right and left 3rd molars were observed and there was no abnormality in tooth number. Initial cephalometric analysis in the lateral view revealed the following measurements: SNA, 78.4°; SNB, 74.6°; ANB, 3.8°; FMA, 26.4°; FMIA, 44.5°; U1-FH, 110.3°; and Interincisal angle, 114.3°.

Based on these findings, a diagnosis of Angle Class I with crowding was established. Orthodontic treatment by JETsystem using passive self-ligating (PSL) brackets (Clarity™ SL and SmartClip™ Self-Ligating Brackets) of varying slot size, .018-inch slot for anterior brackets (3-3) and .022-inch slot for posterior brackets, was planned to improve lingual transposition of the maxillary lateral incisor and mandibular anterior crowding. For resolution of crowding and improvement of lip protrusion, maxillary and mandibular right and left 1st bicuspids were all extracted on the day prior to the date of placement of the orthodontic appliance.

Brackets were positioned on a plaster model in advance (straight-wire positioning) and then bonded using an indirect tray. For reinforced anchorage, a trans-palatal arch was bonded between the maxillary right and left 1st molars. Maxillary and mandibular right and left canine distal movement was initiated immediately after placement of brackets using 25 gf NiTi closed coils. In addition, application of 3/8-inch intermaxillary elastics between the maxillary canine and mandibular 1st molar was initiated to achieve tight occlusion. Almost complete resolution of crowding was achieved in 4 months after placement of brackets, indicating that active canine movement was almost completed. At this point, maxillary and mandibular anterior retraction was initiated using 50 gf NiTi closed coils. The extraction space was closed 10 months after placement of brackets, and brackets were placed on the 2nd molars.

Although torque control of the maxillary right lateral incisor took time, the total duration of treatment was 14 months. Both upper and lower lips recessed and her facial profile was improved. Postoperative panoramic radiograph identified no apparent root resorption and no problem with root parallelism. Postoperative cephalometric analysis in the lateral view demonstrated changes in FMIA (44.5° to 49.9°) and Interincisal angle (114.3° to 120.1°) that contributed to improvement of the patient's facial profile.

Case 2:
Class II Division 1, maxillary right and left 1st bicuspids extracted

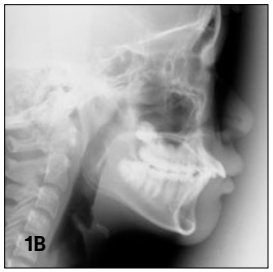


Figure 1A-B: Case 2 initial.

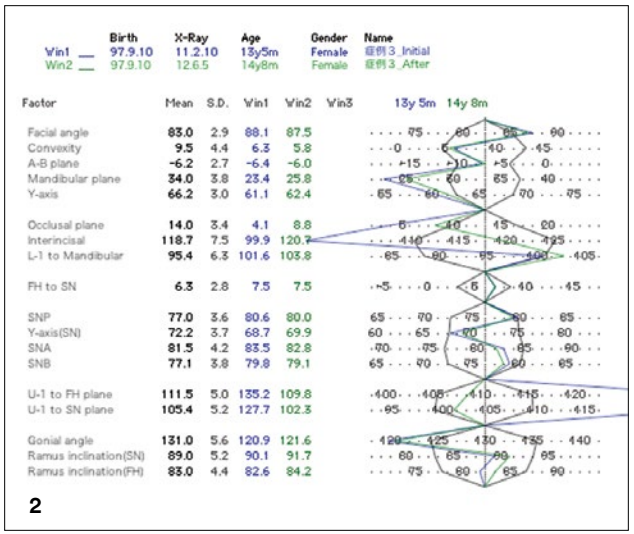


Figure 2: Case 2 cephalometric diagnosis.

Figure 3A-F: Case 2 initial.

Pre-treatment

Figure 4A-C

Two months

Figure 5A-C

Four months

Figure 6A-C

Six months

Figure 7A-C

Ten months

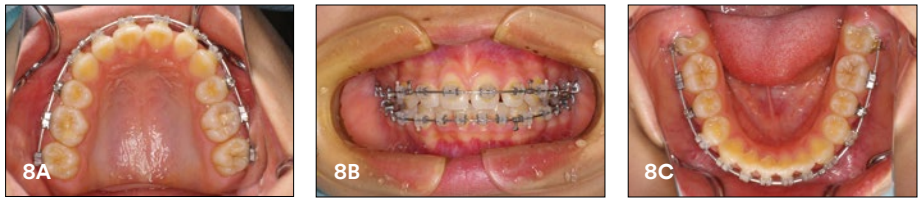


Figure 8A-C

Post-treatment at 14 months

Figure 9A-C

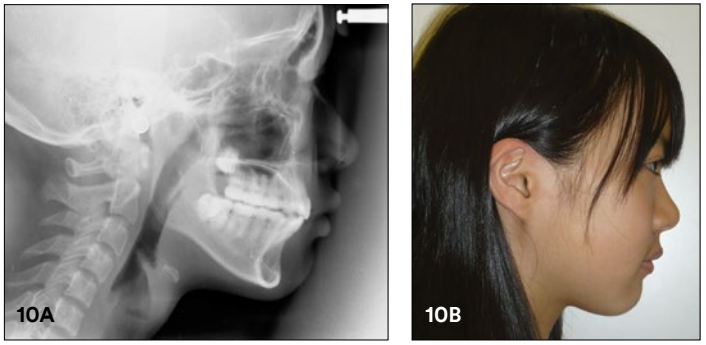


Figure 10A-B: Case 2 post-treatment.

Retention after 24 months

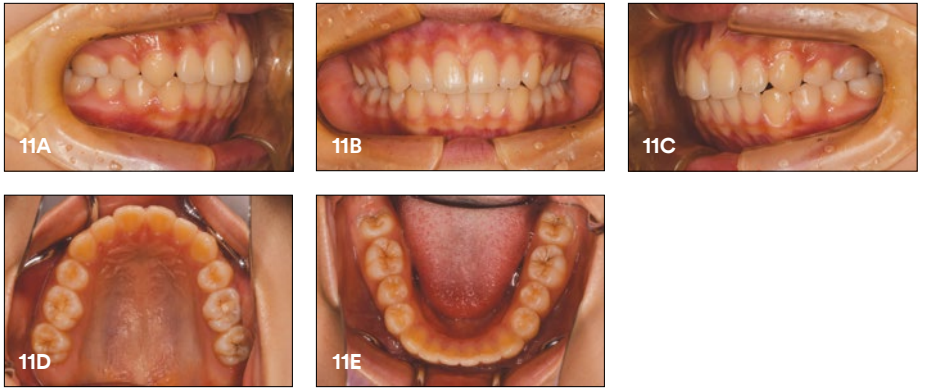


Figure 10A-E

Case 2 Narrative:
A 13-year-and 6-month-old female patient presented with main complaint of a concern with anterior teeth. Her facial appearance was symmetric and her facial type was of Convex type. A tension was noted in the mentalis muscle. Angle Class II malocclusion was observed for right and left molar occlusions with overjet of 9 mm and overbite of 4.5 mm. The maxillary and mandibular arch length discrepancies were –4 mm and –3 mm, respectively. Excessive labial inclination of the maxillary central incisors was observed. Tooth formation of maxillary and mandibular right and left 3rd molars were observed and there was no abnormality in tooth number. Initial cephalometric analysis in the lateral view revealed the following measurements: SNA, 83.5°; SNB, 79.8°; ANB, 3.7°; FMA, 23.4°; FMIA, 55°; U1-FH, 135.2°; L1-Mand., 101.9°; and Interincisal angle, 99.9°.

Based on these findings, a diagnosis of Angle Class II division 1 was established. Orthodontic treatment by JETsystem using passive self-ligating (PSL) brackets (Clarity™ SL and SmartClip™ Self-Ligating Brackets) of varying slot size, .018-inch slot for anterior brackets (3-3) and .022-inch slot for posterior brackets, was planned to improve labial inclination of the maxillary central incisors. For improvement of lip protrusion, maxillary and mandibular right and left 1st bicuspids were all extracted on the day prior to the date of placement of the orthodontic appliance.

Brackets were positioned on a plaster model in advance (straight-wire positioning) and then bonded using an indirect core. For reinforced anchorage, anchor screws were implanted into the maxillary right and left 1st molars. Maxillary and mandibular right and left canine distal movement was initiated immediately after placement of brackets using 50 gf NiTi closed coils. On the same day, application of 3/8-inch intermaxillary elastics between the maxillary canine and mandibular 1st molar was initiated to achieve tight occlusion. Furthermore, 2 months after placement of brackets, maxillary and mandibular anterior retraction was initiated using 50 gf NiTi closed coils. The extraction space was almost closed 8 months after placement of brackets. Although maxillary and mandibular arch coordination took time, the total duration of treatment was 13 months.

To address preoperative deep bite, brackets were removed leaving a shallower bite. Both upper and lower lips recessed and the patient's facial profile was improved. Postoperative panoramic radiograph identified no apparent root resorption and no problem with root parallelism. Postoperative cephalometric analysis in the lateral view demonstrated changes in U1-FH (135.2° to 109.8°) and Interincisal angle (99.9° to 120.7°) that contributed to improvement of the patient's facial profile. Following gradual bite deepening after removal of brackets, bite stabilization was achieved 2 years after initiation of orthodontic treatment.

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Case photos provided by Dr. Shinichi Narita.