

교정용 L자형 미니플레이트를 이용한 구치부 직립 : 임플란트 식립을 위한 공간 확보

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Molar uprighting using modified L type mini-plate

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Abstract

구치부에서 치아 결손 시, 빈 공간으로 인접치아가 경사이동 하는 경향이 있다. 이런 이유로, 결손 된 치아의 임플란트 치료나 보철치료를 위해서 경사된 인접치의 직립이동이 필요한 경우가 종종 있다. 구치부 직립에는 여러 방법이 제시되어 왔으나, 최근 골성 고정원의 등장으로 구치부 직립이 보다 쉽게 가능해졌다. 티타늄 미니 스크류를 이용하는 방법은 간단하고 쉽지만, 미니 스크류가 연조직에 덮여 탄성고무줄을 걸기 어려운 단점이 있다. 미니 플레이트는 이러한 단점이 없고, 구치를 여러 방향으로 이동시킬 수 있는 장점이 있다. 또한 간단한 교정장치인 버튼, 탄성 고무줄, 미니 플레이트 만으로 경사이동 된 구치를 쉽게 치료할 수 있다. 본 증례보고에서는, 변형된 L자 형태의 미니 플레이트를 이용하여, 보철치료나 임플란트 식립 전 구치부를 직립시킨 증례를 소개하고자 한다.

Key words : Tooth uprighting, Bone plate, Orthodontic anchorage, Dental implant.

1. Introduction

Molars and premolars are prone to tilt into missing teeth area. Therefore, molar uprighting is a crucial preparation step for implant placement and prosthetic treatment in missing area. There have been various orthodontic methods to upright molars. Roberts et¹ al suggested an uprighting spring and Kodod² also reported a piggyback molar uprighting spring. Tulloch³ recommended several types of methods to upright mesially tilted molars. Even though they are efficient tools to upright molars, they have inconveniences such as complicated wire bending, brackets bonding on several teeth, and a retainer as anchorage preparation. Recently, skeletal anchorage systems have been developed. Thus, Giancotti⁴ used a titanium mini-screw to treat ectopic mandibular second molar. A titanium mini-screw is a very easy and simple appliance with lingual button and elastic thread for molar control. A titanium mini-screw should be placed on retromolar area for these purposes. However, the head of a mini-screw is often embedded with soft tissue because of growth of redundant retromolar area' s mucosa as makes it difficult to engage elastic thread. Miyahira et al⁵ placed a 4-hole T-shaped titanium mini-plate on retromolar area through surgical procedure to treat a mandibular second molar impaction. They controlled the mesially impacted molar efficiently with elastic chain and a metal bracket bonded on an impacted mandibular second molar. And, a mini-

plate is a very reliable therapeutic method not to worry about covering the head of mini-plate by soft tissue overgrowth. Nonetheless, there are few designs and products of mini-plates as skeletal anchorages for molar control. So, this article introduces a modified L-type mini-plate which is designed for convenient surgical placement and easily engaging elastic chain on hook of it to control mesially tilted molars before implant placement and prosthesis.

2. Surgical procedure (Fig.1)

The surgical procedure was performed by an oral and maxillofacial surgeon and a modified L type titanium mini-plate was fixed with two 1.6 mm of diameter and 6.0 mm of length anchoring mini-screws (Orthoplate, MCT Co., South Korea). The surgical approach consisted of an incision in the alveolar buccal mucosa, 2 cm distal to the mandibular right second molar, following the external oblique line of the mandible. After the muco-periosteal flap was elevated, the mini-plate was fixed by using two screws, whereas the mini-plate' s hook part remained exposed in the oral cavity, practically under the occlusal plane in a vestibular direction. The flap was sutured with 3-0 twisted silk (Silkam, B. Brown Co. Ltd., Germany). The patient took medical medicines with Talniflumate 370mg(Talos) 1 tablet two times a day for 5 days, and Cefuroxime axetil 250mg(Cefurotil) 1 tablet for 5 days. Mouth rinsing with



Fig.1 Surgical placement procedure of modified L type mini-plate

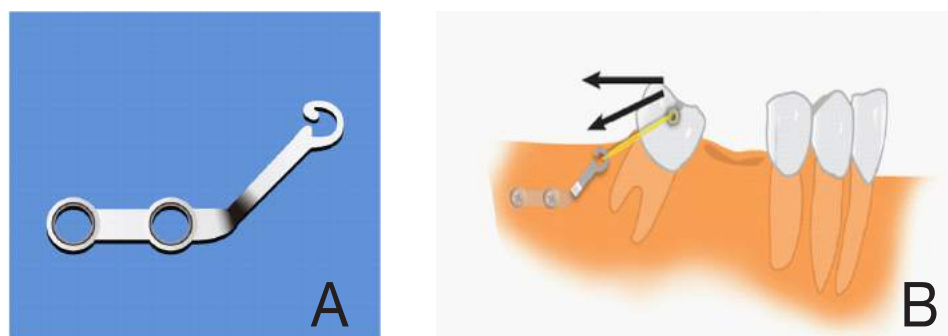


Fig.2 Schematic illustrations and biomechanics of modified L type mini-plate



Fig.3 Intraoral photos using modified L type mini-plate for molar uprighting

Chlorhexidine 0.1% gargle solution (Hexamedine) 100ml was prescribed.

Case 1

A 26 year-old man visited Department of Oral and Maxillofacial surgery in our hospital to take implant prosthesis on right and left first molar area. He had no specific medical history. Right and left second molars were mesially tilted on missing area for long missing period (Fig.4). The angles between molars' long axis and vertical line parallel to outline of panoramic view were measured. The right molar showed 50° and the left molar showed 40° . So, it was needed to upright second molars for proper prosthesis. Fig.2A

shows schematic illustrations of modified L type mini-plate and action mechanism of uprighting molars (Fig.2B). Modified L type mini-plate was installed in the mandibular ramus to improve and facilitate mechanical uprighting of the teeth. A lingual buttons were bonded on the mesial surface of the mesially tilted molars (Fig.3). Application of orthodontic force with elastic chain was applied between lingual button and hook of mini-plate at one week after placing the mini-plate. Fig.5 shows the intraoral photos and panoramic view after orthodontic treatment. Lower second molars were in proper upright position to place prosthesis. The angle improvement was about 20° through orthodontic treatment on both sides. Final implant and prosthesis were placed on lower first molar areas. Total orthodontic treatment period was about 6 months.

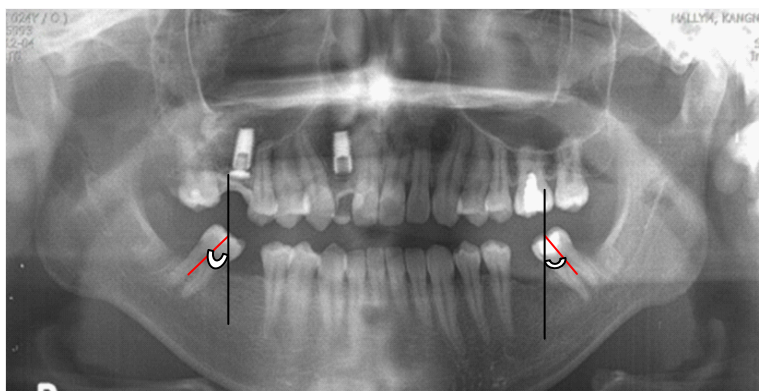


Fig.4 Initial intraoral photos and panoramic view

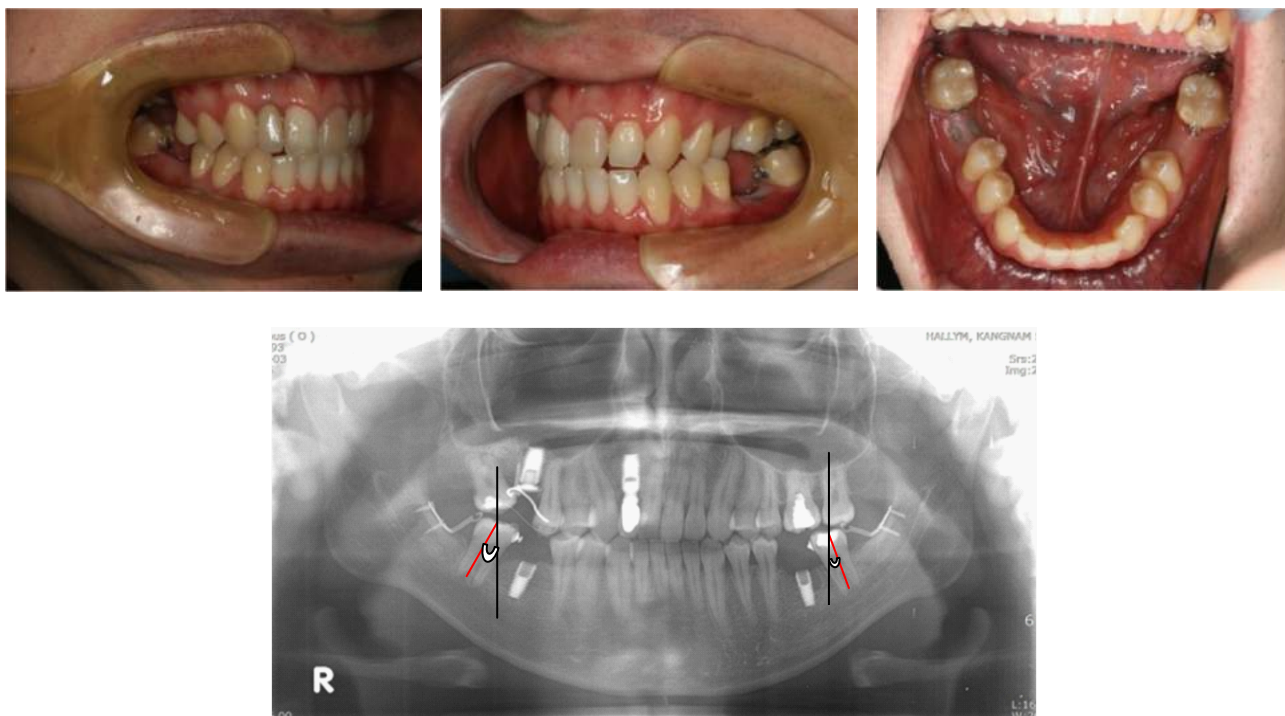


Fig.5 Intraoral photos and panoramic view after orthodontic treatment.

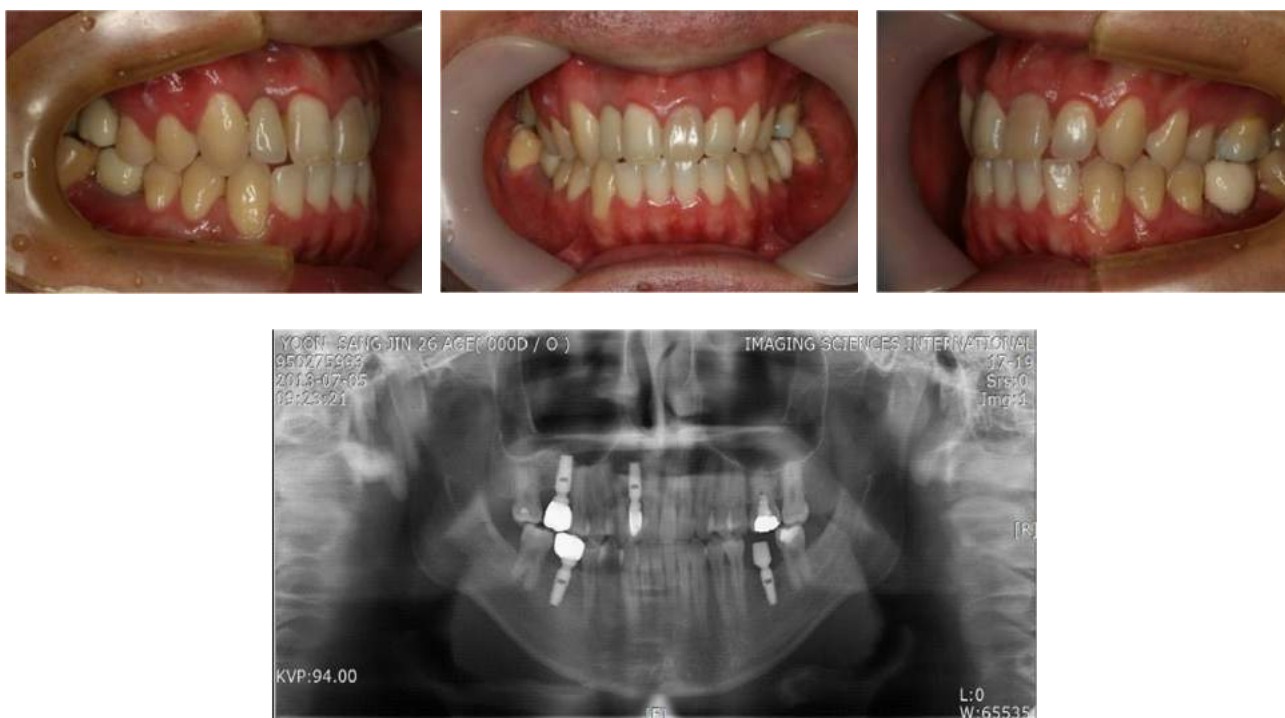


Fig.6 Intraoral photos after implant placement and prosthetic treatment

Case 2

A 22 year-old girl wanted to receive implant prosthesis on lower left first molar. Fig.7 shows initial intraoral condition and the position of lower left second molar on panoramic view. Lower second molar was moderately tilted in mesial direction. The angulation relative to

vertical line parallel to the outline of panoramic view was 40° . And, the patient wanted to take orthodontic treatment on other teeth. So, modified L type mini-plate was placed on the retromolar area with same methods and procedures of case 1. One modified L type mini-plate and two anchoring mini-screws with 1.6 mm of diameter and 6.0 mm of length were used

for molar control. A lingual button was bonded on mesial surface of lower left second molar (Fig.8). Elastic chain was used to upright molar and elastic chain was changed at every other week to load continuous light force. Brackets were bonded on other teeth to correct alignment. However, no bracket and wire were used on

lower left second molar to be uprighted. The angulation of the molar was improved up to 25° . Intraoral photo and panoramic view shows temporary crown of lower second molar and implant placement after orthodontic treatment (Fig.9). Total orthodontic treatment period was 7 months.

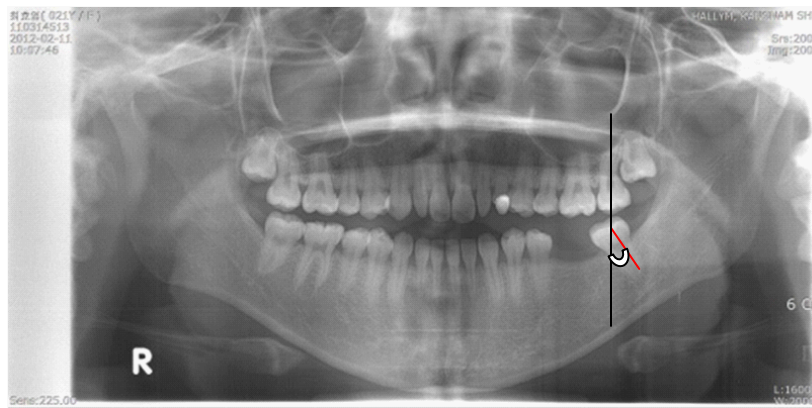


Fig.7 Initial intraoral photo of lower arch and panoramic view

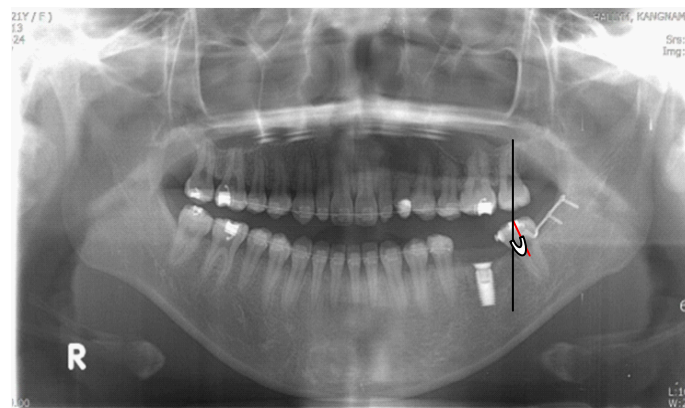


Fig.8 Intraoral photos and panoramic view during orthodontic treatment



Fig.9 Intraoral photo and panoramic x-ray after implant placement and temporary prosthesis

3. Discussion

Two cases in this article were introduced to show the procedure treating mesially tilted mandibular second molar orthodontically with modified L type mini-plate. When a posterior molar is lost, the adjacent teeth usually tip, drift and rotate. As molars tip and migrate mesially, several problems can occur⁶. I.e., mesial gingival tissue becomes folded and distorted, forming pseudo-pocket. According to Page and Schroeder⁷, the accumulation of bacterial plaque on pseudo-pocket area can cause direct damage the periodontium through the elaboration of potentially toxic and antigenic bacterial substances. And, Zander and Polson⁸ reported periodontal destruction may occur as a result of misdirected occlusal forces. Therefore, uprighting tilted molars is the most important procedure for fixed prosthesis or implant prosthesis without destruction of adjacent periodontium and attachment apparatus.

Case 1 showed two mesially tilted lower right and second molars. The angulation of tilted lower right molar is about 50° relative to vertical line parallel to vertical outline of panoramic view and the angulation of lower left molar is about 40° relative to same line (Fig.4). As a result of orthodontic treatment, the angulations were 30° and 20° respectively, improved by 20° on both sides (Fig.5). Case 2 showed 15° improvement through 7 months orthodontic treatment. The mesio-distal width of lower left first molar area in case 2 became wider than that of normal first molar.

The design of modified L type mini-plate consists of two components (Fig.2A). One is a retentive part, and the other is an elastic engaging part. Two anchoring

mini-screw were placed on a retentive part keeping it on mandibular ramus area. Usually, there are two advantages using this mini-plate. First, an elastic engaging part was totally separated from oral mucosa so that it could not be embedded in oral mucosa. The micro-implant anchorage suggested by Park et al⁹ has same concept of these cases. However, sometimes the head of mini-screw can be covered by overgrowth of oral mucosa or flabby tissue. In that case, it is very difficult to engage elastic chain on the head of micro-implant. Surgical excision with laser or blade is needed to engage elastics.

Another advantage is the capability to control the vector of molar movement (Fig.2B). Numerous methods³ such as molar uprighting spring, T spring, and open coil spring are accompanied by molar extrusion. Kojima et al¹⁰ carried out mechanical analyses of uprighting spring and demonstrated the movement of tilted molar. So, occlusal equilibration is needed to prevent premature contact with opposing teeth. However, this mini-plate can retract molars in backward and downward direction so that the possibility of occlusal premature contact can be minimized or zero.

In these cases, lingual button, elastic chain, and modified L type mini-plate are the only appliances to control tilted molars. Lingual button can be bonded on mesial side of molars and elastic chain is engaged between lingual button and the hook of modified L type mini-plate. In severely tilted molar case, lingual button can be bonded on both buccal and lingual surface of the molar and molar retraction should be performed on both surfaces to prevent rotation of the molar.

Ren et al¹¹ recommended that the optimum force to retract a molar using elastic chain is 100-150g. In these cases, about 150g of force was used and elastic chains were changed at every other week to give continuous force to molars.

The most inconvenient procedure using this method is removal of mini-plate after orthodontic treatment. Flap was elevated through same procedure used for placement of it under local anesthesia. And, two anchoring mini-screws were removed by unscrewing them in the opposite direction. After that, 2 or 3 stitches were sutured to close elevated flap.

4. Conclusion

Modified L type mini-plate can be an efficient and easy appliance to upright mesially tilted molars without occlusal adjustment before implant placement and prosthetic treatment is performed.

References

1. William WR III, Frederic MC, Charles JB. A segmental approach to mandibular molar uprighting. *Am J Orthod* 1982;81:177-184.
2. Melvin K, Harold SK. Molar uprighting with the piggyback buccal sectional arch wire technique. *Am J Orthod Dentofac Orthop* 1991;99:276-80.
3. JF Camilla T. Uprighting molars as an adjunct to restorative and periodontal treatment of adults. *Br J Orthod* 1982;9:122-128.
4. Aldo G, Claudio A, Alberto B. Treatment of ectopic mandibular second molar with titanium miniscrews. *Am J Orthod Dentofacial Orthop* 2004;126:113-7.
5. Yasushi IM, Liliana ÁM, Danilo FS, Rafi R. Miniplates as skeletal anchorage for treating mandibular second molar impactions. *Am J Orthod Dentofacial Orthop* 2008;134:145-8.
6. I Stephen B. The effect of orthodontic therapy on certain types of periodontal defects. *JPeriodontol* 1973;44:742-756.
7. Page RC, Schroeder HE. Pathogenesis of inflammatory periodontal disease. A summary of current work. *Laboratory investigation* 1976;34:235-249.
8. Zander HA, Polson AM. Present status of occlusion and occlusal therapy in periodontics. *J Periodontol* 1977;48:540-544.
9. Hyosang P, Heemoon K, Jaehyun S. A simple ethod of molar uprighting with micro-implant anchorage. *J Clin Orthod* 2002;36:592-596.
10. Yukio K, Toshihiro M, Hisao F. A numerical simulation of tooth movement produced bymolar uprighting spring. *Am J Orthod Dentofacial Orthop* 2007;132:630-8.
11. Yijin R, Jaap CM, Anne Marie KJ. Optimum force magnitude for orthodontic tooth movement: a systematic literature review. *Angle Orthod*. 2003;73:86-92.