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Orthodontic Traction of Impacted Tooth

Kyung-Ho Kim[1] · Kwang-Chul Choy[2] · Ji-Yeon Lee[3] · Chang-Soo Kang[4]

Tooth impaction may lead to malocclusion, root resorption, cyst or aberrant changes in adjacent teeth. Clinical and radiographic examinations are used to locate the impaction, and appropriate treatment plans must be made to relocate the impacted tooth.

When surgically exposing the impacted tooth, periodontal considerations to conserve maximum amount of soft and hard tissue are used. Oral hygiene instructions are emphasized to maintain sound periodontal health.

Securing enough space for the impacted tooth and proper anchorage is important. Proper use of force and mechanics is crucial to prevent such complications as root resorption. Various patterns of orthodontic traction may be employed as situation permits.

Most impaction cases can be managed with orthodontic traction to restore function and esthetics, provided that early detection and proper diagnosis and treatment planning are made.

Key Words : Impaction, Orthodontic traction, Periodontal consideration

Tooth impaction is usually without symptom and frequently found incidentally during routine examination. Any tooth can be impacted, but the most frequently impacted teeth are lower 3rd molar, upper canine, upper 3rd molar, upper and lower 2nd premolars and upper central incisor, in that order[17]. Such impaction may lead to malocclusion or cause disorders such as root resorption or cyst. Appropriate diagnosis and prompt management therefore are important.

Upper canine is the most frequently impacted tooth other than the 3rd molars. It is found in 2% of all orthodontic patients. The frequency of palatal impaction is twice as frequent as labial impaction[15]. Causes of canine impaction are either systemic or local in origin. Systemic causes include abnormal muscle tension, fever, endocrine diseases and vitamin deficiency. Local causes include arch length discrepancy, retained deciduous tooth, premature loss of deciduous canine, presence of alveolar cleft, aberrant position of tooth bud, cyst and idiopathic[12].

Lower 2nd premolar impaction may be caused by idiopathic rotation of tooth bud. For lower 2nd molar, the impaction may occur in relation to the 3rd molar or independently, with less than 1% in frequency[15].

Impaction of upper central incisor usually occurs labially, and supernumerary tooth, dilaceration and arrested root development are known as some of the causes[2].

For diagnosis of impaction, clinical and radiographic analysis are used to pinpoint the location. The radiograph may reveal whether the impaction is palatal

[1] *Assistant Professor, Department of Orthodontics, College of Dentistry, Yonsei University*
[2] *Assistant Professor, Department of Orthodontics, College of Dentistry, Yonsei University*
[3] *Resident, Department of Orthodontics, College of Dentistry, Yonsei University*
[4] *Resident, Department of Orthodontics, College of Dentistry, Yonsei University*

or labial, and may provide clues related to spatial relationship of impacted tooth to adjacent teeth or structures, root resorption or ankylosis of adjacent teeth[1].

Radiographic examination includes periapical, occlusal and extraoral views. In most cases, periapical and occlusal radiographs are sufficient to locate the impacted tooth[10]. CT scan is also available to provide accurate 3-dimensional imaging[9]. With two periapical X-rays, Clark's rule or buccal object rule can be used to confirm labiopalatal position[5].(As shown in figure 1, two periapical X-rays are needed. To employ Clark's rule, different horizontal angulation is given and for buccal object rule, different vertical angulation of about 20 degrees is given.)

As for the treatment of impacted tooth, orthodontic traction[11,14,15,16], autotransplantation[20], and extraction are among the options. In most cases, surgical exposure followed by orthodontic positioning of impacted tooth is used. Recent studies also employed orthodontic traction using magnets.

Prior to applying orthodontic traction force, it is vital to secure sufficient space for the impacted tooth within the arch as well as anchorage. Using appropriate amount of orthodontic force and mechanic is important to prevent complications such as root resorption. Traction may not be possible if the removal of bone around the crown of the impacted tooth is insufficient or if the impacted tooth is ankylosed. Therefore careful follow up is necessary[15].

Surgical exposure of impacted tooth involves such procedures as gingivectomy, apically positioned flap or flap/closed eruption technique[23], depending upon the vertical position of the impacted tooth and the amount of attached gingiva. Especially in labial impaction, securing sufficient amount of attached gingiva is important to prevent gingival recession later on[6,7]. Lan and Loe report that healthy gingiva requires more than 2mm of attached gingiva, while Miyassato[18] insists that less than 2mm of attached gingiva does not necessarily mean more periodontal breakdown. It is reasonable to assume that even in situations with minimal attached gingiva, orthodontic traction is possible if meticulous plaque control can be practiced[8].

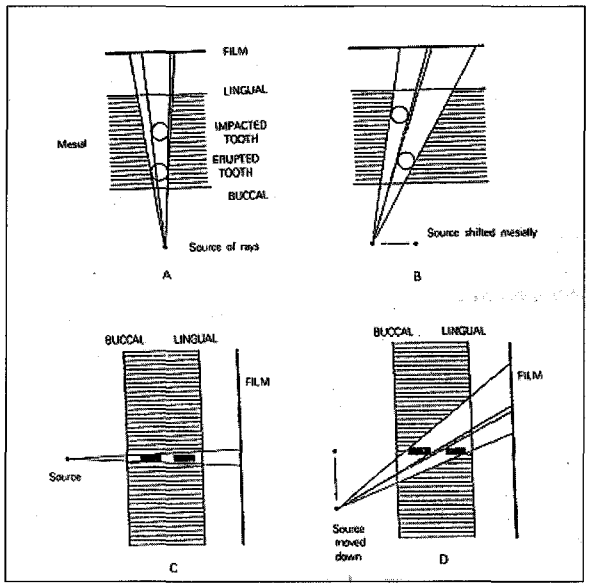

Fig. 1. Clark's rule (A, B) and buccal object rule (C, D) for locationing of impacted tooth (form Am J Orthod 1976 : 69 : 371-87)

Practically however, surgical insults, irritations from attachments, brackets and wires as well as the large traction distance are conductive to plaque accumulation, threatening periodontal health[3]. It is helpful, therefore, if sufficient amount of attached gingiva is available prior to orthodontic traction and special considerations for periodontal tissue are made.

Besides the damages to soft tissue, it is also important to limit the amount of bone removal. Kohavi reports that a light exposure of impacted crown without exposing CEJ results in better bone support later on as compared to a heavy exposure with complete removal of follicular sac[3]. The pattern of tooth movement also affects the bone support, and bone support is expected to be compromised if axial changes have to be made during the root movement[14].

Patient instruction following the surgery is also important. Plaque control is a crucial factor for the success of the treatment and for the retention of the repositioned tooth[19]. Periodontal status is checked at the end of the orthodontic therapy, and secondary periodontal procedures such as gingivoplasty or gingivectomy may be used to enhance esthetics after

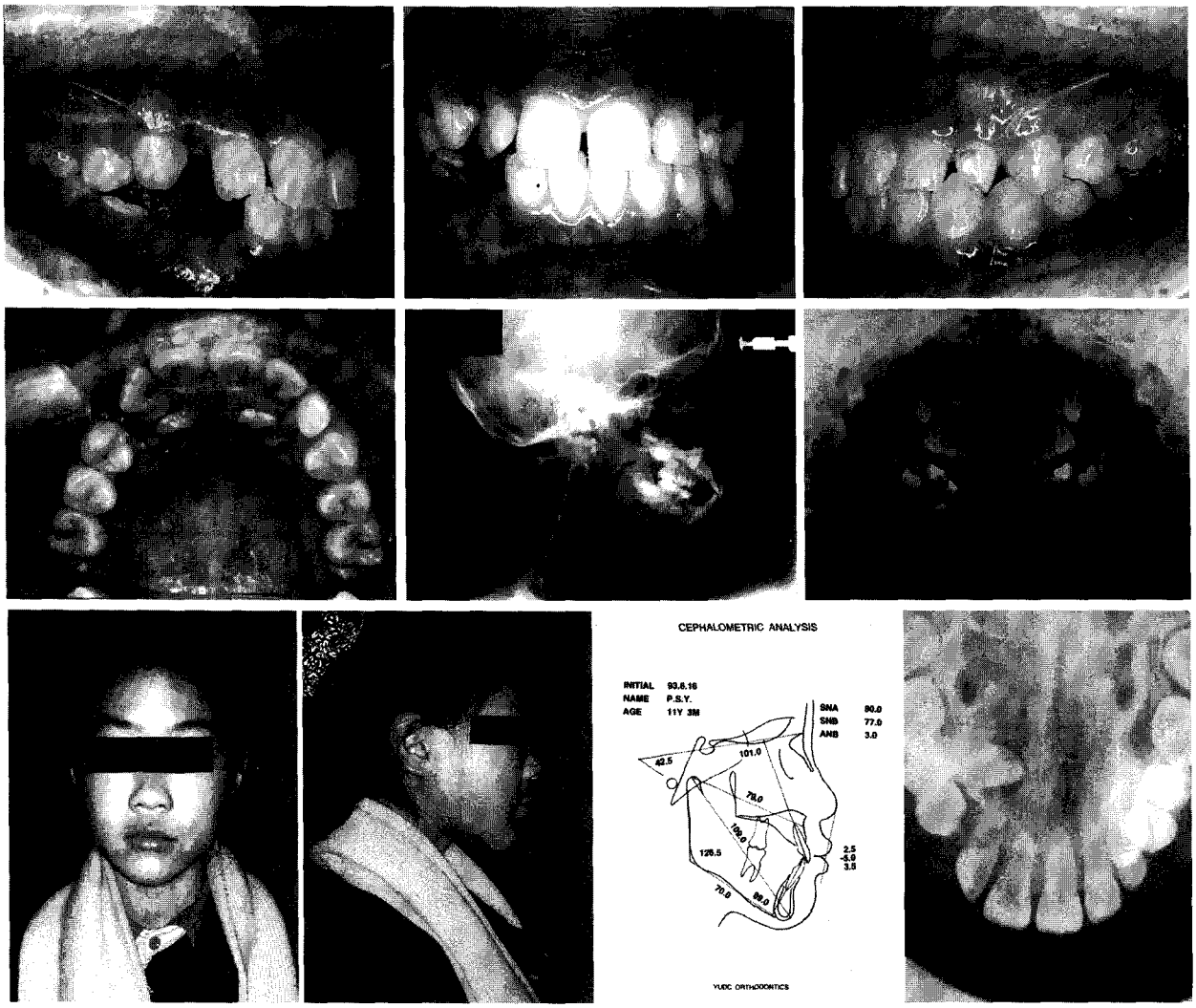

Fig. 2. Case 1. Initial intraoral photos, facial photos, lateral cephalogram, orthopantomogram, occlusal X-ray, and cephalometric tracing

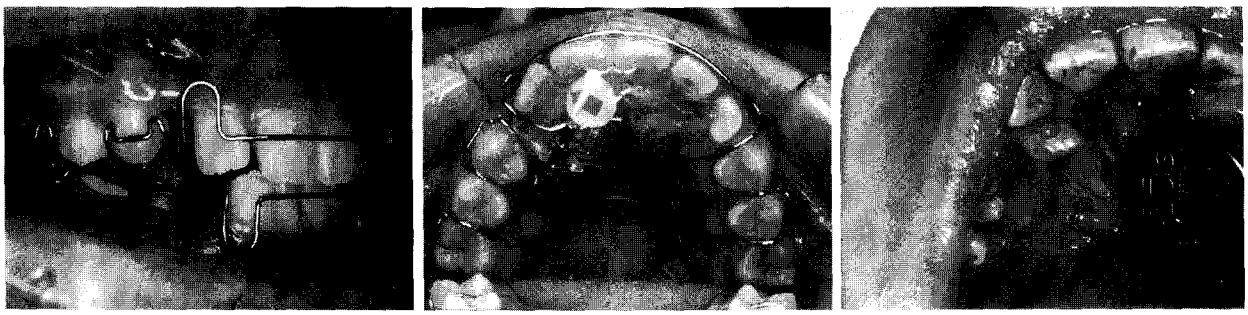

Fig. 3. case 1. Intraoral photos during treatment (Continued)

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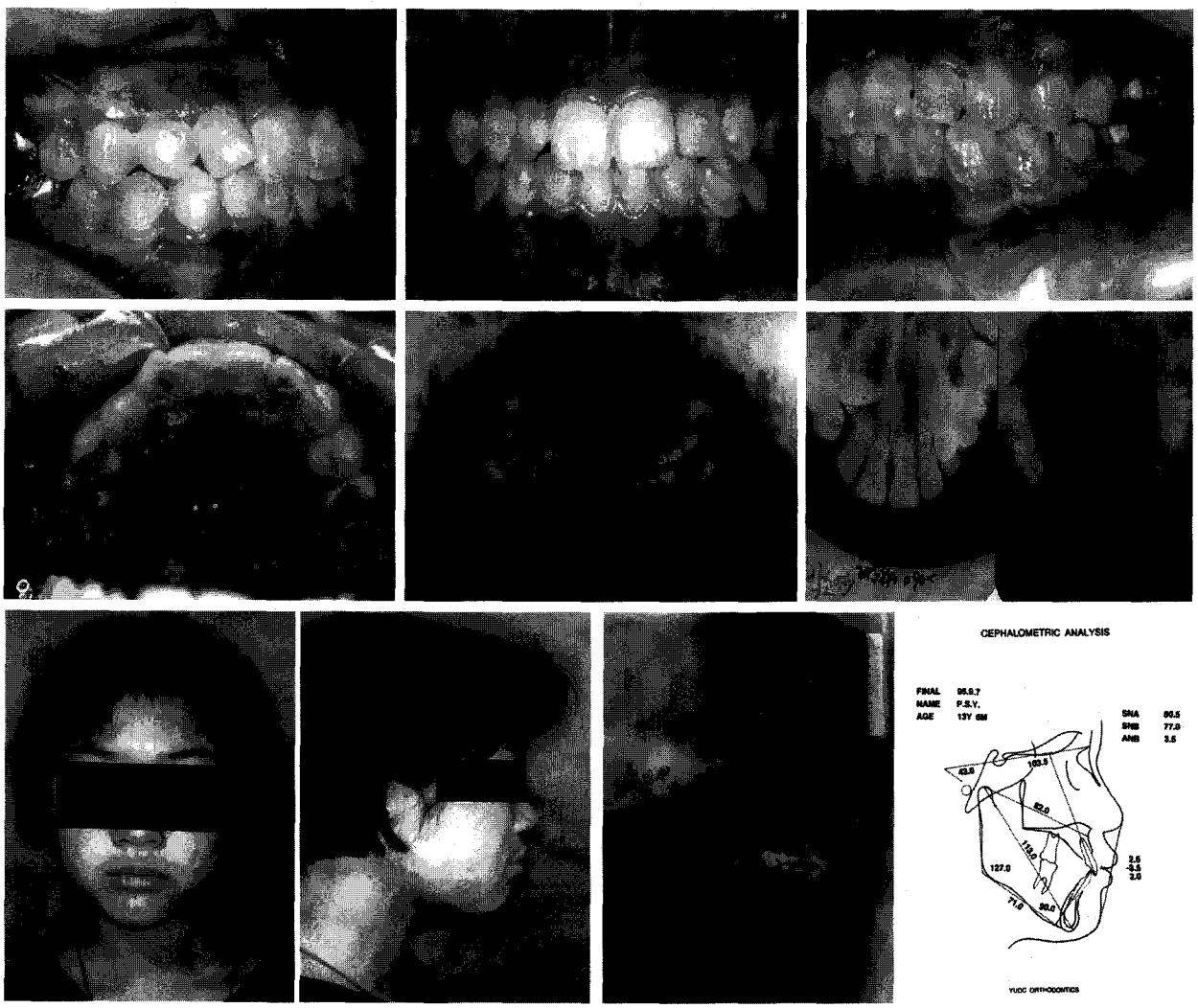

Fig. 4. Case 1. Final intraoral photos, facial photos, lateral cephalogram, orthopantomogram, occlusal X-ray, and cephalometric tracing

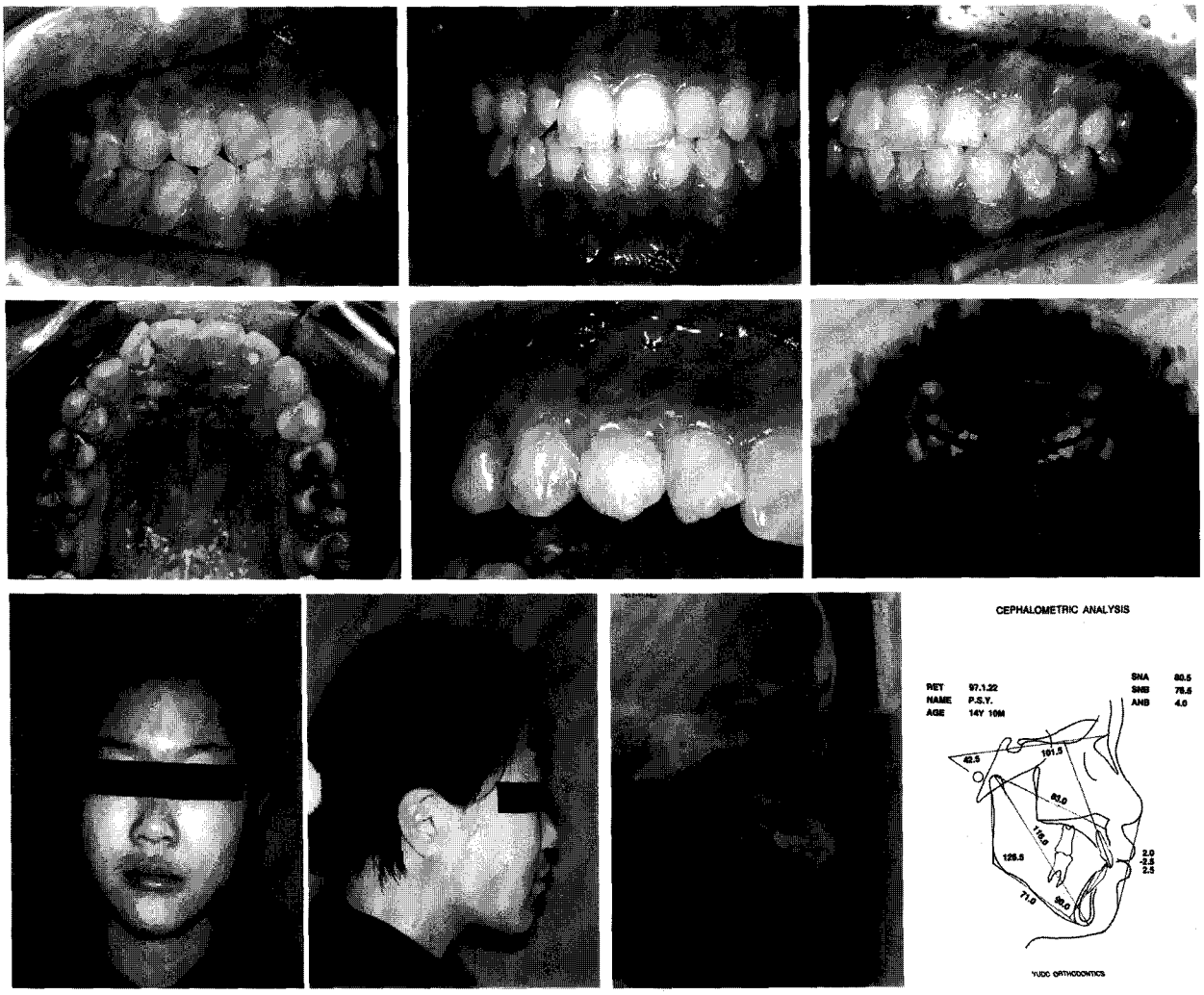

Fig. 5. Case 1. Intraoral photos, facial photos, and X-rays at 1.5 year retention period

orthodontic treatment.

Following cases illustrate successful orthodontic traction of impacted tooth with all due periodontal considerations.

Case 1

1. Patient : 11Y 3M, Female
2. Chief complaint : Impaction on $\underline{3}|$
3. Intraoral findings
   The upper right and left canines have not yet erupted. The upper right canine space is insufficient, and the upper right lateral incisor is rotated (Fig. 2, A-D).
4. Extraoral findings
   A normal profile is shown(Fig. 2, G-H).
5. Cephalometric analysis

SNA	80.0	SN to MP	42.5
SNB	77.0	$\underline{1}$ to SN	101.0
ANB	3.0	IMPA	89.0
Wits	-5.0	Rickett's esthetic line	
		upper lip	2.5
		lower lip	3.5

6. Diagnosis
   Skeletal Class I with impaction of upper right canine
7. Treatment plan and results

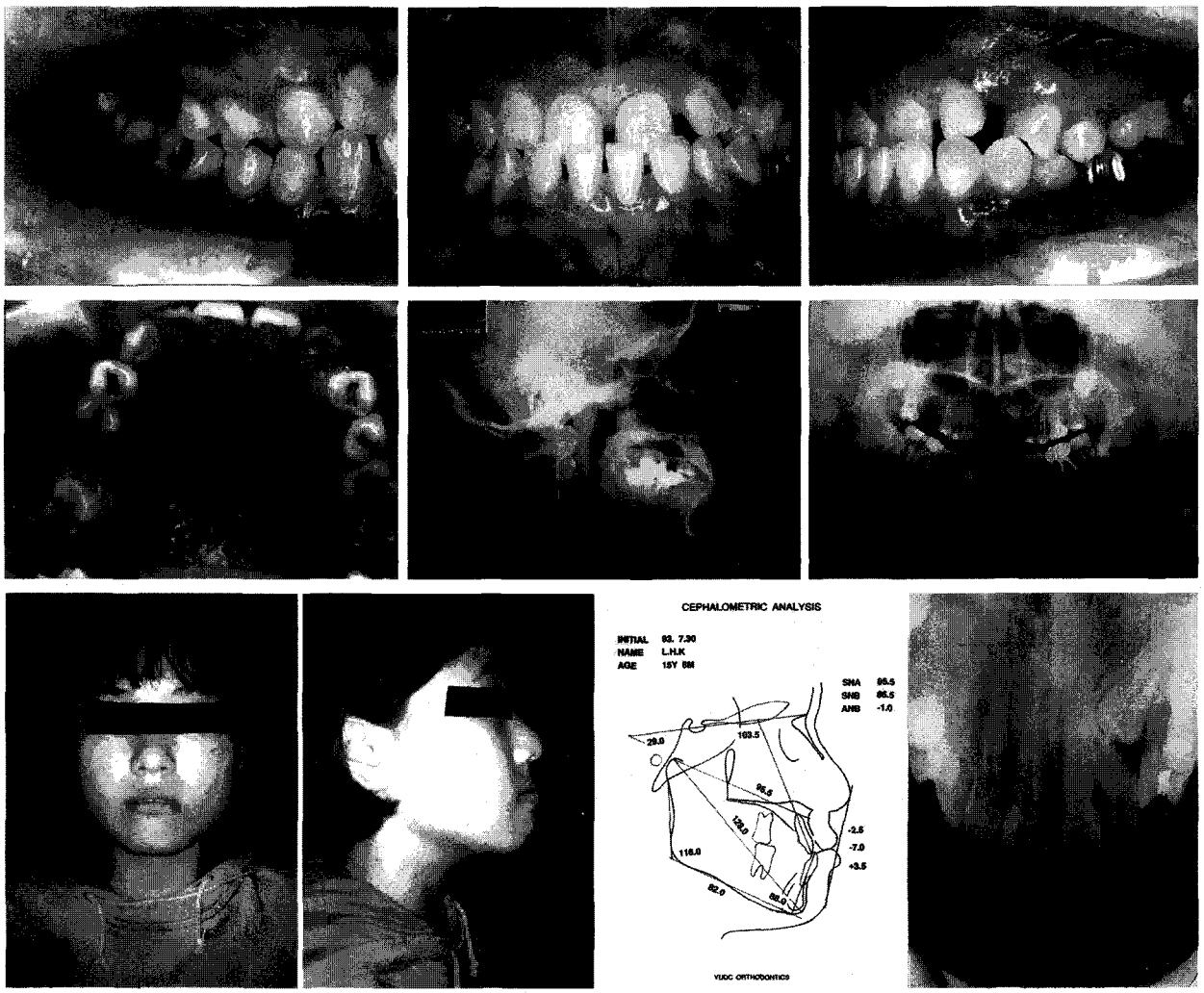

Fig. 6. Case 2. Initial intraoral photos, facial photos, lateral cephalogram, orthopantomogram, occlusal view, and cephalometric tracing

We planned to regain the space in the upper and lower right molar region with removable appliances. After space regaining, surgical opening of maxillary impacted canine following orthodontic traction was planned (Fig. 3). Because the patient and her parents did not want full bonding, and her posterior occlusal intercuspation was favorable, we decided to pull on the impacted right canine with the cantilever spring. No further active treatment was considered (Fig. 3, 4).

8. Post-treatment cephalometric analysis

SNA	80.5	SN to MP	43.0
SNB	77.0	1 to SN	103.5
ANB	3.5	IMPA	90.0
Wits	-3.5	Rickett's esthetic line	
		upper lip	2.5
		lower lip	2.0

9. Retention

After 1.5 years, good retention was obtained and the periodontal state of the upper right canine was favorable (Fig. 5).

Case 2

1. Patient : 15Y 9M, Female

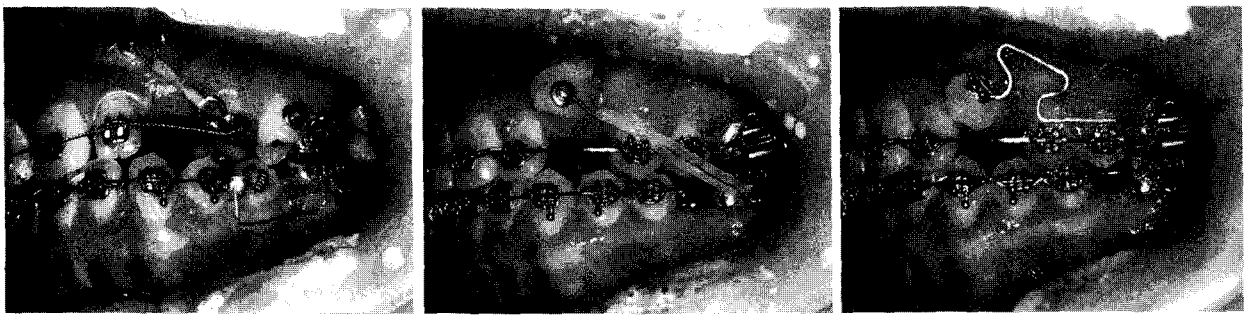

Fig. 7. Case 2. Intraoral photos during treatment

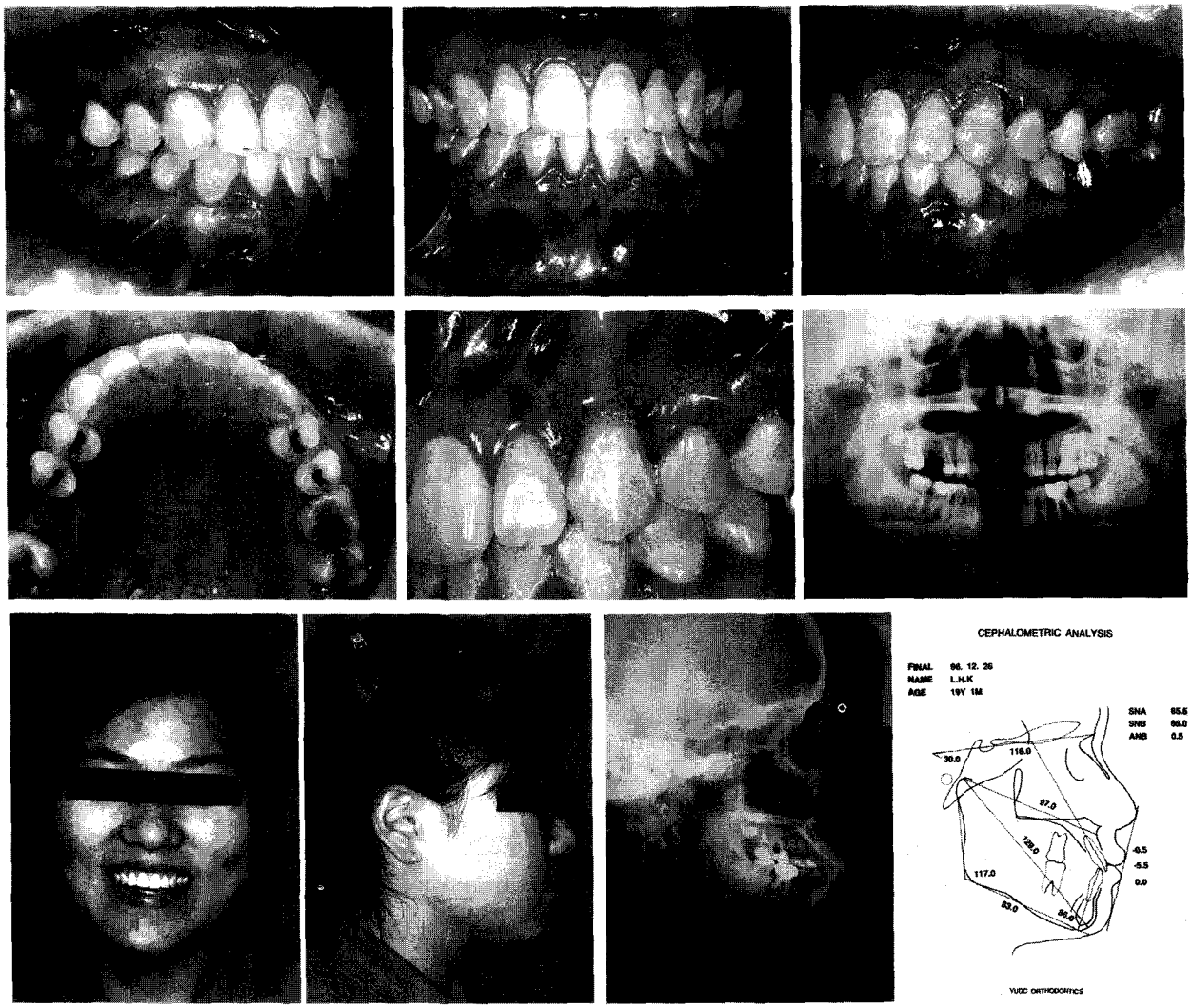

Fig. 8. Case 2. Final intraoral photos, facial photos, lateral cephalogram, orthopantomogram, and cephalometric tracing

2. Chief complaint : Crossbite on $\frac{2}{3}+\frac{1}{2}$

3. Intraoral findings

The examination showed anterior crossbite, missing of the upper right 1st molar, rotation of the upper left 1st and 2nd premolars, and spacing on upper & lower anterior teeth. A faulty axis was present on the upper left lateral incisor (Fig. 6, A-D).

4. Extraoral findings

A concave profile and prognathic mandible is shown (Fig. 6, G-H).

5. Cephalometric analysis

SNA	85.5	SN to MP	29.0
SNB	86.5	$\underline{1}$ to SN	103.5
ANB	-1.0	IMPA	88.0
Wits	-7.0	Rickett's esthetic line	
		upper lip	-2.5
		lower lip	3.5

6. Diagnosis

Skeletal Class III with full impaction of upper left canine and missing of upper right 1st molar.

7. Treatment plan and results

Although the patient's chief complaint was anterior crossbite, we found the impacted upper left canine which could be retracted after surgical opening. The labio-lingual appliance and facemask were used to correct the anterior crossbite and to reinforce anchorage. After correcting the anterior crossbite, fixed appliance was used and the space of the missing upper right 1st molar maintained for the prosthetic treatment. After the total treatment, the periodontal state was favorable on the upper left canine region (Fig. 7, 8).

8. Post-treatment cephalometric analysis

SNA	85.5	SN to MP	30.0
SNB	85.0	$\underline{1}$ to SN	116.0
ANB	0.5	IMPA	86.0
Wits	-5.5	Rickett's esthetic line	
		upper lip	-0.5
		lower lip	0.0

SUMMARY

Tooth impaction may lead to malocclusion, root resorption, cyst of aberrant changes in adjacent teeth. Clinical and radiographic examinations are used to locate the impaction, and appropriate treatment plans must be made to relocate the impacted tooth.

When surgically exposing the impacted tooth, periodontal considerations to conserve maximum amount of soft and hard tissue are used. Oral hygiene instructions are emphasized to maintain sound periodontal health.

Securing enough space for the impacted tooth and proper anchorage is important. Proper use of force and mechanics is crucial to prevent such complications as root resorption. Various pattern of orthodontic traction may be employed as situation permits.

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국문초록

매복된 치아의 교정적 견인을 통한 치험예

연세대학교 치과대학 교정학 교실 (영동 세브란스 병원)

김 경 호 · 최 광 철 · 이 지 연 · 강 창 수

매복된 치아는 부정교합과 인접치아의 치근 흡수, 낭종 등의 병적 변화를 유발할 수 있으므로 임상적 검사와 방사선학적 검사를 통해 정확한 위치를 확인하도록 하고, 적절한 치료계획을 통해 제 위치를 찾아주어야 한다.

외과적 수술시 치주적 문제점들을 고려하여 연조직과 골조직의 보존을 최대화할 수 있어야 하며 환자의 구강 위생상태에 대한 철저한 교육을 통해 좋은 구강 위생상태를 유지할 수 있도록 해야 한다.

교정적 견인시에는 매복치를 배열할 공간의 확보와 고정원에 대한 고려가 선행되어야 하며, 교정적 견인시 적절한 힘과 mechanics의 구사로 치근의 흡수 등의 부작용이 일어나지 않도록 해야 하고 상태에 따라 다양한 방법을 이용한 교정적 견인을 시도할 수 있다.

매복된 치아는 병적 변화를 일으킨 경우나 반드시 발치를 해야 하는 경우만 아니라면 교정적 견인을 통해 기능과 심미성을 회복시켜 줄 수 있으므로 조기 발견과 발견시의 올바른 진단과 치료 계획을 수립하는 것이 중요하다.

주요 단어 : 매복치, 교정적 견인, 치주적 고려 사항