Camouflage treatment of Severe Skeletal Class II and Gummy Smile Patient with 3D Simulation, Mini-Screws, and Botulinum Toxin: A case report after 1-year follow-up.

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Introduction
The most common reason to approach an orthodontist is esthetic concern which is compromised by malocclusion [1]. Skeletal Class II malocclusion has always been a challenge and often needs the assistance of surgical orthodontics in orthodontics, especially when it is combined with a gummy smile. However, if patients can't afford orthognathic surgery treatment, non-surgical orthodontic treatment is a viable option. The skeletal anchorage system has now widened the spectrum of orthodontics and is also very well accepted by patients [2-3]. Besides, botulinum toxin is a good option after orthodontic treatment for treating gummy smiles [4-5].

Case report
Diagnosis and etiology
The patient was a 29-year-old woman with the chief complaint of deep bite, retruded maxillary incisors, retruded mandibular incisors, and excessive overjet. Extraorally, she had a convex profile with a normal nasolabial angle, a gummy smile 5mm on both sides, and incompetent lips. The symptom of temporomandibular disorders was a painful joint on both sides. (Figure 1b)
Intraorally, the patient had a Class II molar and canine relationship on both sides. In the lower arch, she had mild crowding and a deep Curve of Spee. The small upper lateral incisors created Bolton tooth size discrepancy 3-3. The lower midline was coincident with the facial midline, but the upper midline was deviated 1 mm to the left. The gingival biotype is thin-scalloped. (Figure 1a)
The lateral cephalometric analysis showed a skeletal Class II jaw relationship with the normal maxilla and retruded mandible (SNA, 82.4°; SNB, 75°; ANB, 7.4°), and normal lower facial height (FMA, 25°). The maxillary incisors were retroclined and the mandibular incisors were proclined (U1-SN, 89.8°; L1-MP, 89.5°). Both the upper and lower lips were in front of the E-line. The panoramic radiograph showed all the teeth were present. (Figure 1c,1d)

Treatment plan
1st Stage: Orthodontic treatment
After making the individual 3D simulation [6] for the decision (Figure 1e), the treatment plan was a wisdom teeth extraction upper and lower with 3 mini screws distalization upper and torque upper incisors, proclined lower incisors a little by class II elastic for compromise treatment. After treatment, 12 22 filling for solving Bolton discrepancies. To
reduce excessive overbite and distalize the upper and retract maxillary incisors, control the occlusal plane and gummy smile. 3 mini-screws were used in the maxillary arch. After the treatment, filling was indicated for 12 and 22 for aesthetics and good occlusion achievement. (Figure 2a, 2b, 2c, 2d)

2nd Stage: Botulinum toxin
Botulinum toxin after treatment is an indication for reducing gummy smile. Two doses of botulinum toxin were indicated. (Figure 3f)

Treatment results
All treatment objectives were achieved with a well-aligned dentition and improved facial esthetics. Upper incisors were retracted and torque and lower incisors were proclined a little, overbite and overjet are normal, as class I occlusion and reduced gummy smile after treatment. We got Class I "canine" and molar relationships, normal overbite, and achieved midline correction by distalization upper, torque intrude upper incisors. Maxillary and mandibular intra-arch width was slightly expanded with the uprighting of molars. The whole treatment resulted in the retraction of both upper and lower lips, resulting in a passive lip seal and straight profile after treatment. Good root parallelism was achieved with a little root resorption because of torque and intrusion of upper incisors. On cephalometric superimposition, the lower curve of Spee was leveled by upper and lower incisors intrusion and lower incisors proclination. There was an improvement in the incisor inclination and soft tissue profile, particularly the E-line and nasolabial angle. These changes were further confirmed with cephalometric analysis, which showed an increase in the inclination of the maxillary incisors by 5.2°. But after the treatment, the L1 – MP angle is 105° for achieving dental lass I relationship of compromise treatment. Combining orthodontic treatment and botulinum toxin, the gummy smile was treated well. (Figure 3a, 3b, 3c, 3d, 3e)

After 1 year follow-up, the occlusion was stable but the gummy smile relapsed because the time for botulinum is 4-6 months, so we need to redo it every 4-6 months. The patient was happy with the result so we don’t do it again. (Figure 4)

Discussion:
The patient complained about her gummy smile, maxillary protrusion, and difficulty in closing her lips. After active treatment and retention, these orthodontic problems were satisfactorily relieved through the intrusion of the upper incisors and the elimination of the class II dental malocclusion. The upper lip became more relaxed and was placed more backward, which allowed the patient to close her lips effortlessly. For camouflage of severe class II skeletal malocclusion combined gummy smile, 3D simulation for treatment planning is useful for clinicians. In 3D views, we can see the problems and prepare for the mechanics. In this case, mini-screws are the key to a successful result. With mini-screws, we can manage the gummy smile, and control the occlusal plane and distalization for solving class II dental malocclusion at the same time.
Conclusion:
Surgical orthodontics is not a very common and acceptable procedure. However, the use of a skeletal anchorage system has broadened the horizon of camouflage treatment in moderate to severe skeletal dysplasia. Simultaneous intrusion and distalization of anterior teeth are now possible with mini-screws without losing anchorage and vertical control. Stable occlusion is key in the long term for orthodontic treatment.

Ethical Statement
Because this report involves no experiment, ethics approval was not required.

Acknowledgment
The authors would like to thank the patient for giving their consent.

Patient consent
Written informed consent was obtained from the patient to publish this report by the journal's patient consent policy.

Conflict of Interest
The authors report no conflict of interest.

Author contributions: VH: patient treatment, diagnosis, treatment planning, manuscript preparation, review, and editing.

References:
Figure Legends

Figure 1A: Pre-treatment Intraoral Images of the patient
Figure 1B: Pre-treatment Extraoral Images of the patient

Figure 1c: Pre-treatment X-rays and Pre-treatment cephalometric analysis
Figure 1d: Pre-treatment Dental Model
Figure 1e: 3D simulation before treatment
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Figure 2b: Fixed orthodontic treatment progress – Alignment & Leveling phase
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Figure 2d: Fixed orthodontic treatment progress – Finishing stage
Figure 3a: Post-treatment Intraoral Images of the patient

Figure 3b: Post-treatment Extraoral Images of the patient
Figure 3c: Post-treatment X-rays, cephalometric analysis, and superimposition
Figure 3d: Post-treatment Dental Model
Figure 3e: Cephalometric analysis before and after treatment

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<th>Measurement</th>
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Figure 3f: Patient’s smile

Pre-treatment  Post-treatment  After botulinum toxin
Figure 4: After 1 year follow-up.