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Surgical miniscrew assisted orthodontics; changes in facial appearance and smile of an adult female: A case study

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Abstract

Proclined upper incisors are the reasons for lip incompetence, excessive incisor display and very unesthetic smile characters for a good number of patients seeking orthodontic treatment. Majority of these cases are treated following extraction of premolars and intrusion and retraction of incisors, which became much more feasible through usage of temporary anchorage devices like miniscrew implants. Before titanium orthodontic miniscrew were available in the market, surgical screws for fixation of bone-plates were started to be used for orthodontic anchorage. This article presents a case to show how surgical miniscrews can be utilized to intrude and retract severely proclined upper incisors to bring upon noticeable improvement in facial appearance and smile.

Keywords: Incisor proclination, surgical screws, aesthetics

Introduction

Orthodontics in pursuance to achieve ultimate facial aesthetics and smile characters had undergone huge metamorphosis to achieve today's state, ensuring successful introduction of various gadgets with advantages.

Proclined and crooked teeth had been the biggest menace to create absolute negative impact on the facial appearance and smile of the individual. There had been several efforts with introduction of newer biomechanical pattern to get an acceptable positioning of upper and lower incisors so that the subject may have a pleasant appearance and smile. Connecticut Intrusion Arch, Burstone Segmented Arch, Utility arches by Ricketts, K-Sir Appliance by Kalra, 3-piece Intrusion Arch by Bhavna Shroff were a few amongst the several approaches to intrude the incisors. Most of these force application system seemed to be apparently successful, but there were several drawbacks. Firstly when intrusive forces were applied on the incisors availing anchorage from the molars, the reactionary forces likely extruded the molars which were undesirable. Secondly, only tooth supported anchorage system became less efficient for adult patients^[8].

Surgical screws were used to fix mini-plates or bone-plates as rigid fixation of fracture line in maxilla and mandible. Before availability of titanium orthodontic miniscrews, bone screws of size 1.8X8 mm were started to be used for the purpose of orthodontic anchorage. In comparison to the several intrusion arches, surgical mini-screws proved to be advantageous because of absolute anchorage without any reactionary forces^[3].

Here is the description of a case of an adult female with severe proclination, had been treated successfully using four surgical miniscrews.

Case report

Miss R. Bhowmick (R.B), 23 years female, reported at the OPD of Department of Orthodontics, NBDC&H complaining of juttied out upper incisors with unacceptable facial appearance and smile. On clinical examination, it was found that Miss R.B had bud-stage crowding, severe proclination of upper incisors, totally incompetent lips due to short upper lip, deep and complete bite. Lower right canine was blocked out labially with a bilateral Class I molar relation.

Pre-Treatment Photographs



Fig 1: Extraoral pre-treatment photographs of Miss R. Bhowmick



Fig 2: Intra-oral pre-treatment photographs

Due to excessive over-jet and 100% display of upper incisors during rest and unaesthetic gummy smile, extraction treatment was considered. Study model analysis showed about 10mm space discrepancy in upper arch and 8mm space crisis in lower arch. The case was decided to be treated with extraction of all four premolars. Mandibular right lateral incisor was also had to be extracted to meet the Bolton's discrepancy criteria in order to avoid proximal diskling. Altogether, the main challenge was to retract the severely proclined upper incisors and to intrude them to reduce incisor display.

The treatment was started with 0.022 MBT Pre-adjusted Edgewise Appliance. Initial alignment and leveling of both the upper and lower arches was done using 0.014 and 0.018 NITI wire. After completion of the first stage of the treatment, four surgical screws of diameter 1.8mm and length 8mm were inserted under local anaesthesia. Two screws were placed between the roots of right and left maxillary 2nd premolars and 1st molars and two screws between right and left maxillary lateral incisor and canine. The anteriorly placed surgical screws were for intrusion of upper incisors while those placed posteriorly were for retraction of the incisors. This intrusion and retraction was done in a "torque-control" manner upon a 19X25 rectangular stainless steel arch wire both in the upper and lower arch.

In-Treatment Photographs



Fig 3: Extra-oral in-treatment photograph

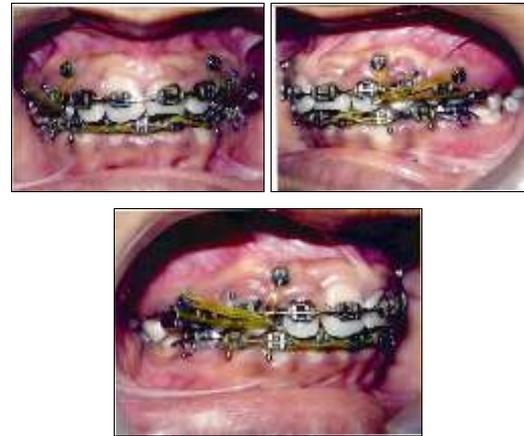


Fig 4: Intra-oral in-treatment photograph

Miss R.B had undergone treatment for about 20 months and her occlusion was achieved and detailed using 0.014 NITI wire with settling elastics. Before debonding of the appliance a good Class I molar and canine relationship was successfully achieved along with sound intercuspation of buccal occlusion. Unfortunately, there was still a midline shift owing to the fact that the lower right lateral incisor was extracted. In spite of this fact we could achieve an acceptable facial appearance and smile characters along with all the post-operative occlusal parameters including normal overjet and overbite.

Post-Treatment photographs



Fig 5: Extra-oral appearance after treatment



Fig 6: Intra oral correction after treatment

Discussion

Orthodontic anchorage system can broadly be classified into two varieties - Intra-oral and Extra-oral. For retrusive and intrusive tooth movements extra-oral anchorage had not been proved to be desirably successful, also it needs patient compliance to a great extent. Intra-oral tooth supported anchorage proved to be less efficient for the same purpose

because of the reactionary forces which tends to extrude the molars increasing the vertical dimension of the face. At the same time intra-oral devices were found to be inefficient in correcting gummy smile where more than 2-3mm of intrusion of incisors was required ^[6].

Successful application of orthodontic miniscrew implants helped expand the horizon of orthodontic treatment enabling to create a force generating system without unwanted reactionary forces, thus referring them to be known as absolute anchorage. Due to the fact that osseointegration does not occur, these mini-screw implants can be removed easily.

Surgical mini-screws were the forerunner of present day orthodontic temporary anchorage systems. They were mainly used until Ryuzo Kanomi ^[9] introduced the mini-implants in the year 1997. Those mini-implants were modified surgical miniscrew of 1.2mm diameter and 6 to 7mm in length. Later Dr Birte Melsen developed Aarhus implants and present day micro-implant anchorage system (MIA), a customized implant system was developed by a team of Korean Orthodontists ^[6].

These screws are made of pure titanium because of its excellent biocompatibility and corrosion resistance. The ductility of titanium is less compared to stainless steel because of its hexagonal crystal structure ^[4].

The areas of placement of the mini-implant and the mode of loading determine greatly whether or not the mini-implant would be successful or not. It has been found that anterior maxillary and mandibular interdental region and buccal and palatal implants placed between 2nd premolar and 1st molars within the attached gingiva were most stable. Diameter of screw of 1mm or less showed inflammation of peri-implant tissues and caused failure. Subjects with high mandibular angle or with vertical growth pattern was shown to have very thin cortical bone and showed maximum failure incidences ^[4]. For this reason a longer screw is preferred for maxillary than mandibular arches owing to the differences in the thickness of cortical bone. One of the main reasons for failure of mini-implants is encroachment or placement of the mini-screws in very close to the root surfaces which causes vibration of the screws while mastication leading to eventual failure ^[4].

While a few school of thought propose to load upon the implants after at least 2-3 weeks to ensure proper healing of the area whereas Melsen and Costa ^[7] demonstrated on animal studies that immediate loading is possible with light forces as they deliver 25-50grams of forces using Sentalloy springs.

Conclusion

Surgical screws in absence or unavailability of contemporary orthodontic mini-implant systems (MIA) successfully provided precise placement and orderly biomechanics can be followed. Those mini-screws has enormously expanded the orthodontic treatment horizon, careful application of these can result in miraculous orthodontic treatment outcome. The screws are cost effective, easy to place and remove with very minimal post insertion complication thus proving to be very adorable surgical gadget for orthodontic treatment purpose.

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