Microimplants Fracture: Prevention is Better than Cure

Rajiv Ahluwalia, Ankur Kaul, Gurkeerat Singh, Vishwas Kumar, Jagriti Singh

ABSTRACT

More orthodontists are now using microimplants to achieve favorable results. Although extensive literature exists on the uses of microimplants, but implant failure is not documented as much. Specifically, fracture of microimplant resulting in implant failure is hardly focused on. This article highlights fracture of microimplants and its management.

Keywords: Microimplants, Implant fracture.


INTRODUCTION

Temporary anchorage devices (TADs) or microimplants have added a whole new dimension to orthodontic treatment, allowing tooth movements to be carried out, which were previously thought difficult or impossible. The use of microimplants, although useful on one hand, has also led to their nonjudicious use by orthodontists. This has led to an increase in associated iatrogenic damages. These iatrogenic insults can, however, be minimized by thorough knowledge of bone densities, anatomic variations, implant material and sizes in relation to fracture resistance of the TADs used. The following case reports illustrate instances of TAD fractures with various management protocols.

CASE REPORTS

Case 1

An 18-year-old female patient came to the department of orthodontics and was diagnosed as having bimaxillary protrusion. It was decided to use mini-implants for retraction since the anchorage requirements were critical. A 9 mm in length and 1.3 mm diameter stainless steel implant (SK surgical, Pune) was used. Having successfully placed the upper implants, lower right side was attempted. The TAD fractured at the neck with 10 mm inside (Fig. 1A).

An IOPA was taken and the position of the implant fragment vis-a-vis proximity to the roots of the adjacent teeth was ascertained. Thereafter, a decision to surgically remove the implant was made. A micromotor with a contra-angle handpiece and a tungsten carbide bur was used to remove bone circumferentially around the implant under copious irrigation.

Having removed about 2 to 3 mm of bone around the fractured implant, the implant fragment was about 3 mm in length. An orthopantomogram was taken to ascertain the position of the TAD fragment retrieved (Figs 1B and C). Access was irrigated with saline and suture was placed. Mild antibiotics [ciprofloxacin 500 mg (twice a day) and ibuprofen 400 mg (thrice a day)] were prescribed for 3 days. Postoperative instructions were given for the uneventful healing of the wound. Suture removal was done after 7 days.

Case 2

The case involved a male patient aged 22 years with a skeletal Class III pattern and dental Class I pattern. The anchorage was critical in the mandibular arch and hence it was decided to use TADs as anchorage units. The retraction was routine and accomplished using elastomeric chains (Fig. 2A). Upon completion of the treatment, while removing the implants, one of the implants fractured in the middle. The fractured fragment was about 3 mm in length. An orthopantomogram was taken to ascertain the position of the TAD (Fig. 2B). Upon discussion with the surgeon, it was decided to leave the fragment inside, because the fragment was small and not visible, externally, and surgical intervention for removal would have necessitated extensive bone removal. The same was explained to the patient. The healing at the end of one week was uneventful (Fig. 2C).
Case 3

The case involved a 28-year-old female patient with a skeletal Class I bimaxillary protrusion. It was planned as maximum anchorage case with implant-assisted retraction. The implants were to be placed between the first and second molars. A tissue punch was made at the site of implant placement. An implant of 9 mm length and 1.5 mm in diameter (Infinitas, DB Orthodontics) was inserted (Fig. 3A).

The TAD fractured after the first 2 to 3 turns. Since, this was a very thin and tapering implant and the wound was considered to be sterile, it was decided to leave the implant fragment in place and insert a different implant at a new location (8 mm and 1.6 mm in diameter, TOMAS, Dentauram, Germany, between the first molar and the second premolar). However, on the following appointment after one week a purulent swelling was noticed in the location of the fractured implant (Fig. 3B).
Using a surface anesthetic and a 810 nm soft tissue laser, the soft tissue around the site was removed (Fig. 3C), and the implant tip retrieved surgically (Fig. 3D). The wound showed an uneventful healing 7 days postoperative (Fig. 3E).

**DISCUSSION**

Mini-implant fracture, although rare, is a clinical possibility. Various studies have been done evaluating various aspects of mini-implant fracture in orthodontics. Barros SE et al¹ evaluated the fracture of mini-implants vis-a-vis diameter and found that implants with diameter <1.5 mm are more prone to fracture. Suzuki EY and Suzuki B² evaluated the placement and removal torque values of orthodontic mini-screw implants and concluded that fracture values of orthodontic implants are directly proportional to the torsional resistance (at insertion or removal). Chen Y et al³ studied the torsional forces during implant insertion and
found torsional forces to be related to material type, implant diameter and length. Although the above-mentioned criteria are known to the operator, the surprise element is maintained by bone type and anatomic deviations which inevitably vary in every patient. Mish has classified bone densities as D1, D2, D3 and D4. D1 bone type is most dense and hence most prone to cause implant fracture, especially in the mandible.\(^4,5\)

In the light of foregoing discussion, a critical preplacement evaluation becomes imperative. Presurgical assessment using radiographs does not give accurate assessment of bone density and CBCT scan slices are too invasive, if used for this purpose. Therefore, it is wise to proceed with care while placing orthodontic implants, especially in Class II div 2 and Class III cases with large and strong mandibles. Again while placing the implant, if tough resistance is met, pilot drills or a bone punch may be used for better implant acceptance prior to implant insertion.\(^6-8\)

For utmost safety, torque measuring devices may be used in conjunction with implant inserting screwdriver which digitally displays constantly changing torque values during insertion/removal (Fig. 4). Insertion torque values of more than 10 Ncm may result in fracture; hence care must be taken to deal with such situations. However, when the torque is less than 5 Ncm the primary stability may be compromised. Hence suggested range of 5 to 10 Ncm is optimum.\(^9\)

Implant removal is more unpredictable for the clinician. If titanium implants with hydroxyapatite surface treatment are used then chances of osseointegration increase. Although it gives greater implant stability during treatment, removal is rendered difficult. Therefore, stainless steel (medical grade) implants or titanium implants, without surface treatment, may be recommended. Also periodically [every 2-3 months (sigma(\(\sigma\)) time period for bone formation)] the implant may be twisted counterclockwise and then clockwise to break any initial osseointegrated contact areas keeping in mind the bone turn over period for a normal human being which is 17 weeks (4 months).\(^9\)

However, once the implant fractures, the clinician is left with only two options: the implant fragment may be left in place or it may be retrieved. A decision regarding this depends on a number of factors, the foremost being, the location and site of fracture and informed consent of the patient. In case, the implant is not retrieved, it may be wise to evaluate it periodically.

If a decision to retrieve the fractured implant fragment is taken, one of the following methods may be followed. If the implant stump is at the surface and clearly visible a groove/trough may be cut into the stump so that a screwdriver could be used to unscrew it. Alternatively, trephine burs, which are also used to remove dental implants, can be used. However, trephine burs may remove chunks of bone around the implant, therefore, care should be taken not to harm the adjacent roots and/or minimize the bone removed. A still simpler method would be to use a thin surgical bur to reduce the bone around the implant circumferentially, taking care not to trim the implant stump, and then using a pull out motion, with no wriggling, to remove the implant fragment. A soft tissue laser-assisted surgical approach may be preferred, because, it provides one with a clean bloodless field, a faster postsurgical healing and could be done without anesthesia.\(^10\)

**CONCLUSION**

It is only logical to interpret that as far as mini-implant fracture is concerned, Prevention is Definitely Better Than Cure. Thorough knowledge of biologic and mechanical aspects of mini-implants in orthodontics is an essential prerequisite before attempting mini-implants as a novice.

**REFERENCES**