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Abstract

Background: Temporary anchorage devices (TADs) are frequently used in orthodontics and had many indications but, before inserting them, clinicians have to respect some important rules, first of all an adequate preoperative preparation consisting of an exhaustive history, an accurate diagnosis report and a precise selection of implant site. Aim of this review is to evaluate the failure rates of the TADs implant and the reasons for the failure. Materials and methods: A systematic review was performed on principal medical databases. Results: The failure rates of TADs implants reported in literature vary from 0% to 40,8% with an overall mean value of 13,8%. Failure rates are higher when TADs are implanted in mandible than in maxilla. Failure can occur when screw-related problems such as screw too narrow with risk of fracture, operator-related problems such as the application of excessive pressure during insertion of a self-drilling screw that can fracture the tip of the screw and patient-related problems such as thin cortex and low density of bone are present. Conclusions: Failure of TADs implants has a high incidence and is associated to problems related to screw, operator or patient.

Introduction

Anchorage is one of the limiting factors in orthodontics, and its control is essential for successful treatment outcomes. The term â€˜orthodontic anchorageâ€™ denotes the nature and degree of resistance to displacement offered by an anatomic unit. According to the intended treatment goals, desired tooth movements should, therefore, be maximized, and undesirable effects should be minimized. Traditionally, orthodontic therapy used teeth, extraoral and/or intermaxillary appliances for anchorage.

Since a patientâ€™s cooperation is not always optimal, temporary anchorage devices (TADs) have been introduced.[2]

TADs are anchored in bone and removed after completion of the intended orthodontic tooth movement. They are designed to overcome the limitations of conventional orthodontic anchorage devices. Unlike orthodontic devices that have a single indication, such as distalizers or expanders, TADs are an orthodontic tool to aid in orthodontic anchorage planning and management. For this reason, they can be used in many clinical situations, limited only by the experience and knowledge of the clinician.[3-6]

The TADs are used to achieve any dental movement such as intrusion, extrusion, uprighting, mesialization and distalization. [3-6]

Skeletal anchorage by TADs is indicated in all cases where forces acting on reactive units are undesirable and / or cannot be easily neutralized.[7]

We can classify contraindications to TADs in local and generals. Local contraindications are qualitative and/or quantitative deficiency of bone at site insertion site, free mucosa insertion, insertion into mandibular lingual side, insertion in close proximity to dental gems and / or deciduous teeth, insufficient oral hygiene conditions, recurrent stomatitis, osteomyelitis, radiotherapy in the cranial region. [8]

General contraindications are immunodeficiency, corticosteroid and/or bisphosphonate therapy, alteration of blood coagulation, decompensated endocrine disorders, rheumatic diseases, bone metabolic pathology, liver cirrhosis, patient's inability to follow postoperative instructions.[8]

The insertion of a TADs is a very simple therapeutic procedure but requires respect for important rules, first of all an adequate preoperative preparation consisting of an exhaustive history and an accurate diagnosis report.

To select the TADs location, clinical data such as radiographic examinations, patterns, as well as treatment goals and the orthodontic system that will be implemented will be considered. A TADs for ideal operation requires stable bone anchorage (primary stability) and a positioning in the adherent gingiva.[9.10]

The interradicular distance and the radicular axis pattern can only be approximately evaluated on the OPT exam; therefore, it is good practice to evaluate in detail the interradicular distance to perform an endoral radiographic examination with the help of centering of the selected site.[9-10] In some cases a CT scan can be useful.

Three-dimensional studies allowed us to evaluate the

thickness of the cortical and bone volume (the inter-root distance must be at least 3.1 mm for a screw of 1.6 mm in diameter) of the various inter-radicular, maxillary and mandibular sites by allowing the creation of visual maps for the detection of "safe zones" for the insertion of TADs.[9-10]

On this basis, purpose of this review is to evaluate the failure rates of the TADs implant and the reasons for the failure.

Methods

In order to evaluate success rates and failure reasons of TADs, a systematic review was performed on major databases: Pubmed (Medline) and Scopus). Keywords used were: TADs, miniscrews, success, failure rates. After this search, 44 articles were found.

Review

Analyzing literature, failure rates of TADs implants vary from 0% to 40,8%.[11-54]

Papageorgiou in his metanalysis reported a mean incidence of failure of 13,5%.

Regarding factors associated with TADs implant failure, no difference in the miniscrew implant failure rates was observed for the following factors: patient sex and patient. The miniscrew implant's thread diameter and thread length were found not to be associated with the miniscrew implant failure rates. No significant differences of the miniscrew implant failure rates were observed with regard to side of placement and site of placement.[55]

Higher overall failure rates were observed when the miniscrew implants were inserted in the mandible than in the maxilla (19.3% and 12.0%, respectively).[55]

Melsen has identified risk factors of failure related to the screws, to the operator and to the patient[8].

Screw-related problems are screw fracture that can occur if it is too narrow or the neck area is not strong enough to withstand the stress of removal (the solution is to choose a conical screw with a solid neck and a diameter appropriate to the quality of bone) and infections that can develop around the screw if the transmucosal portion is not entirely smooth. If a screw system with variable neck lengths is used, the clinician can select one that suits the particular implant site.[8]

Regarding operator-related problems, the first is the application of excessive pressure during insertion of a self-drilling screw that can fracture the tip of the screw.[8] Overtightening a screw can cause it to loosen. It is crucial to stop turning the screw as soon as the smooth part of the neck has reached the periosteum. With a bracket-like screw head, the ligature should be placed on top of the screw in the slot perpendicular to the wire. Turning the ligature around the screw will make it impossible for the patient to keep the area free of inflammation. It is important not to wiggle the screw driver when removing it from the screw head. The screw driver will not stick if the long extension is removed before the part surrounding the screw.

Melsen said regarding patient-related problems that the prognosis for primary stability of a mini-implant is poor in cases where the cortex is thinner than .5mm and the density of the trabecular bone is low. [8]

In patients with thick mucosa, the distance between the point of force application and the center of resistance of the screw will be greater than usual, thus generating a large moment when a force is applied.

Loosening can occur, even after primary stability has been achieved, if a screw is inserted in an area with considerable bone remodeling because of either the resorption of a deciduous tooth or post-extraction healing. As previous said, Mini-implants are contraindicated in patients with systemic alterations in the bone metabolism due to disease, medication, or heavy smoking.

Conclusions

Rate of failure in TADs implants is described in literature varying from 0 to 40,8%. The overall failure rate was 13.5%. Factors associated with the failure are insertion in the mandible, screw-related problems such as screw too narrow with risk of fracture, operator-related problems such as the application of excessive pressure during insertion of a self-drilling screw that can fracture the tip of the screw and patient-related problems such as thin cortex and low density of bone.

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