Biodegradable polyurethane for closure of oroantral communications
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Chapter 1
General introduction and aim of this thesis
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An oroantral communication (OAC) is a pathologic connection between the oral cavity and the maxillary sinus. In most cases OACs are the result of extraction of maxillary (pre-) molars due to the close relationship between the roots of the molars and the maxillary sinus floor. Although the incidence is relatively low (5 %) (1), OACs are frequently encountered due to the large number of extractions. It is stated in literature that OACs smaller than 5 mm heal by themselves (2). However the size of an OAC is difficult to measure accurately. Therefore, surgical treatment, preferably within 24 hours, is recommended in many cases to minimize the risk of maxillary sinusitis and subsequent fistula formation (2).

Surgery of OACs by means of a buccal or palatal flap currently still seems the treatment of choice. The buccal advancement flap was first described by Rehrmann in 1928 (3) and involves a broad-based trapezoidal mucoperiosteal flap which is sutured over the OAC. Its broad base assures adequate blood supply. Success percentages over 90 % have been reported in literature (4-6). However, the risk of permanent flattening of the buccal sulcus is a disadvantage of this method (4). A different approach to the buccal flap was described by Moczár (7). Moczár described a buccal mucoperiosteal flap that is displaced 1 tooth width distally. The latter has the advantage that the buccal sulcus remains intact but it may give rise to periodontal disease and is therefore recommended for edentate patients only (4).

Full- or split-thickness mucoperiosteal palatal flaps in various forms are also often used for closure of OACs. Many surgeons even prefer the palatal flap over the buccal flap because it is less vulnerable than a buccal flap, and also has excellent blood supply. Some suggest the application of palatal flaps especially for large OACs measuring more than 10 mm (8), were others claim its use for secondary repair of OACs in case a buccal flap procedure failed.

Other methods for surgical repair of OACs using autologous tissues include use of the buccal fat pad (9;10), various tongue flaps (11-13) and autogenous bone grafts from the iliac crest (14), chin (15), zygoma (16) or retromolar area (17).

Surgical treatment of OACs requires surgical equipment and expertise. Even if the treatment is performed by skilled hands it still leads to postoperative discomfort like pain and swelling.

For both the patient as well as the general dental practitioner it would be convenient if the latter could close an OAC him-/herself instead of having to refer the patient to a maxillofacial surgeon. It would be interesting, also from an economical perspective, to develop an alternative method for OAC repair that is easy, quick, has predictive results and is applicable in general dental practice.

Alternative techniques using synthetic materials for closure of OACs have been presented in literature. For example the use of hydroxyapatite blocks (18;19) and root analog made of β-tricalciumphosphate (20) have been studied. All of these new techniques claimed to be suitable alternatives but none seem to have gained wide acceptance because either the costs are too high or because they offer no significant simplification to the standard surgical treatment. Alternative methods using animal-derived materials have been described a well. However, nowadays in the development of new biomaterials, synthetic materials are preferred over animal-derived ones. Theoretically there is always the possibility of transmission of pathogens from animal derived products. More important, the production of synthetic materials is controllable, the materials can be produced in any amount, and characteristics of the material can be changed when necessary.

The biodegradable polyurethane (PU) foam, described in this thesis, also is a fully synthetic biomaterial. It is a highly porous foam composed of repeating units of hard urethane segments which give it its strength and soft segments made of D/L lactide and ε-caprolacton with polyethylene glycol added for hydrofilicity. The foam retains its mechanical capacities for 2 weeks after which degradation sets in.

Aim of this thesis

The aim of this thesis was the development of a safe, quick, cost-effective and easy to perform treatment for closure of OACs with predictive results, which may also be used in general dental practice.

In chapter 2 an overview is presented of the most common surgical treatment strategies of OACs and the alternative treatment options, including their advantages and disadvantages.

Little information could be found in literature regarding the (general) complication rate associated with standard surgical closure of OACs in terms of recurrences of OACs. To facilitate a comparison between treatment outcomes of conventional surgical treatment and new and upcoming strategies, a retrospective cohort study on the treatment outcome of surgical closure of OACs was conducted (chapter 3).

In chapter 4 a long term in vivo degradation study is described. The aim of this study was to provide conclusive information about the end stage of degradation of biodegradable PU foam used for closure of OACs.

A human study (chapter 5) was conducted to assess the feasibility of the PU foam, and to further optimize the treatment strategy.

Lastly, in chapter 6 a clinical study involving a large patient cohort is described. The aim of this specific study was to answer the question if closure of OACs with PU foam can be considered a suitable alternative for conventional surgical closure in terms of recurrences of the OACs.
Reference List


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