A screening protocol to identify patients at risk for dental implant treatment

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Background
A dental implant is an artificial tooth which replaces a permanent tooth that has been lost due to extraction (1). There are several reasons why a tooth has to be extracted. It can be due to periodontitis, caries, orthodontics, trauma etc.
The implant, which consists of a titanium screw, is anchored biomechanically to the jaw by osseointegration, a bone healing process. After the incision, the implant is placed and a blood clot forms. The blood clot is later on replaced by granulation tissue consisting of neutrophils, macrophages and leucocytes. Further on, there is a breakdown of necrotic bone tissue by osteoclasts. Thus new bone is formed by osteoblasts. Simultaneously during osseointegration, the mucosa attaches to the implant and provides a seal which stops products from the oral cavity entering the bone (2). At present, two techniques for implant placement exists (1):

- Immediate
- Two-stage

The success rate of implant treatment is 95% or higher (3). The remaining 5% either have risk factors that make them more vulnerable to implant failure or they were never suitable candidates for implant treatment in the first place.
Risk factors associated with implant failure can primarily be subdivided into three categories (4):

- Local
- Systemic
- Lifestyle related

Local risk factors
The local risk factors are related to the status of the oral tissues. The structure of the jawbone is imminent. It is crucial to know what type of bone, spongious bone or cortical, the proposed implant area encompass. This can be measured through x-ray as well the technique of grouping bone as proposed by Lekholm and Zarb in 1985. The mandible generally has more cortical bone compared to the maxilla (5). Cortical bone has a less frequent implant failure rate than spongious bone, which has a longer healing time. In order to proceed with osseointegration, it is recommended that at least 7mm of bone is available. Therefore, the location of the proposed implant and nearby anatomic landmarks e.g. the sinus is of importance. The width, the diameter and the surface of the fixture also plays a crucial role in the success of implant treatment (4). A rough surface and a surface coated with NaOH have a potential to adapt better and heal quicker (2). In addition, an assessment should be made whether proposed bone treatment area is healthy or diseased and what type of loading it will suffer.

A disease commonly affecting the bone area is periodontitis. It is a chronic infectious disease caused by subgingival oral bacteria which initiate inflammatory reaction. If left untreated, the bacterial toxins and the inflammatory response cause successive breakdown of the periodontal apparatus (6). If a tooth has been extracted due to periodontitis, the surrounding bone can potentially be infected and inflamed, which could interfere with the implant treatment. Furthermore, if neighbouring teeth have periodontitis this may spread to the implant and cause peri-implantitis.

Peri-implantitis is also a disease related to oral hygiene. Inflammation and bone loss occurs, followed by bone resorption and ultimately, implant failure. Overload by an antagonist can also lead to bone resorption (2).

Other conditions that could affect the proposed treatment are candidiasis, periapical lesions, jaw infections and cysts (2). Therefore before implant treatment is initiated, oral hygiene needs to be optimized and a thorough examination needs to ensure that the jaw is clear from pathological conditions (2).

Systemic factors

Several systemic diseases including Crohn's disease and osteoporosis interfere with the osseointegration of an implant. Crohn's disease at times requires steroid treatment which may cause osteoporosis and impaired immune system. This may slow the healing of bone and cause formation of bone with poor quality (2, 4). Although rheumatoid arthritis has not been associated with implant failure, these patients also receive steroids and it is also a disease in which the bone quality is affected negatively. Menopause is also an osteoporotic condition (7). Other diseases in which the immune system becomes compromised are AIDS and cancer (2).

Patients with blood disorders bleed more and their healing is much slower. Patients with diabetes also have an increased risk of implant failure as these patients are prone to infection and have a slower healing potential. Radiation of the head and neck leads to a reduced salivary flow and necrosis of some areas of the bone (7). Lung diseases interfere mainly during the surgical procedure, by spreading infection. Young people with a growing jaw are not suitable for implant treatment (2).

Patients who take antidepressants have a reduced salivary flow, which in turn can contribute to elevated levels of IL-6 and therefore affecting the healing potential (8). These patients may also have poor compliance to follow oral health instructions and thus influence the outcome of the implant treatment.

Lifestyle related factors

Smoking is the main lifestyle factor associated with implant failure. It has been suggested that smoking more than 20 cigarettes or more a day have a 30% higher risk of implant failure (9). Nicotine and carbon monoxide have the potential to alter the immune response, masking classic inflammation signs and slow down bone healing (10). Smoking cessation during the treatment period can significantly promote osseointegration (2).

Alcohol excess is associated with increased risk of infection, bleeding and impaired healing. Alcoholics may also have poorer compliance to follow oral health instructions (2).

Stress has been linked with reduced salivary flow, which can also lead to implant failure.

Other factors of importance

Implant failure can also be due to factors controlled by the dentist. It is important to initially

assess if implant treatment is a viable option. Further, an assessment of type of material used in specific cases needs to be established. Using aseptic technique is also imminent. In order to minimize such errors, it is important that dentist follow specific surgical protocol e.g. Lekholm and Jemt 1989. The dentist should also be aware that each patient will have different healing time.

What measures can be taken to identify patients at risk for implant failure?
The above mentioned risk factors have highlighted the importance of screening patients prior to deciding if implant treatment is an option. Therefore a screening protocol, consisting of questions relating to local, systemic and lifestyle risk factors contributing to implant failure have been outlined. The format is an organized form of a regular medical history, the only difference is that special emphasize has been given to certain conditions and aspects that are known to be related to or can potentially affect the success of implant treatment.

The protocol is divided into two parts. Part one should be completed by the dentist and part two by the patient. It is vital that the dental specialist makes an overall clinical judgement whether implant treatment should be proceeded with.

Using this protocol, I hope to determine if a patient would need more frequent regular review and follow-up before and after treatment compared to current recommendations. Patients with poor oral health may need to be called more frequently for professional tooth cleansing and prophylaxis. A smoker may need to be refereed to a smoking cessation programme.
Below is the screening protocol to identify patients at risk for implant failure.

What happens after the screening protocol has been filled in?
By using the protocol the specialist dentist has to make a decision whether implant treatment is a viable option. If not, other prosthetic alternatives must be considered. If the candidate is a suitable, but still has a risk factor that could potentially interfere with osseointegration, the specialist must decide whether immediate or two-stage implant placement is feasible. Following decision to proceed with implant treatment, appropriate material needs to be selected. A biocompatible fixture material that would compensate for the retarded healing must be selected. For instance coated fixtures (NaOH), rough surface or long ones. Investigations to find a coating which could act like emdogain is an interesting future possibility.

In order to identify failures early, an assessment of the bone quality is important before and after treatment. Today most x-ray techniques are two dimensional, which makes it difficult to assess pure bone volume. However, in the future three dimensional x-rays may be more readily available. This alone would significantly improve bone quality assessment and identification of treatment failures.

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