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The Leaning Tower of Pisa Syndrome

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The leaning *Tower* of Pisa is one of the wonders of the world and is well known to most mature individuals. However, while a dentist and his wife were in the city of Pisa he grabbed her arm and shouted *be careful that tower is about to fall*. This is a common fear and it is interesting that Wits University has a link to the *Tower* of Pisa through **John Burland**, a civil engineer, who has been involved in devising a solution to the possible collapse of the tower. He wrote a fascinating account about this under the title *A strong inclination* in *ARENA* the magazine for alumni of the University of the Witwatersrand, Johannesburg (1997).

What the dental arch and the *Tower* have in common, is that they are under threat of collapse. The collapse of an individual tooth is a risk in periodontal therapy. Why not then compare the collapsing tooth to the Tower of Pisa?

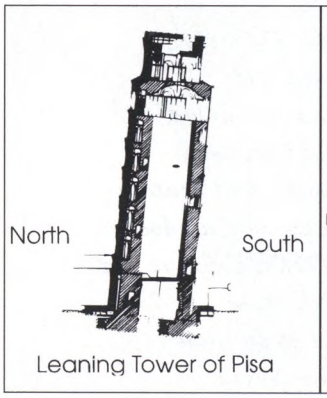


Fig 1

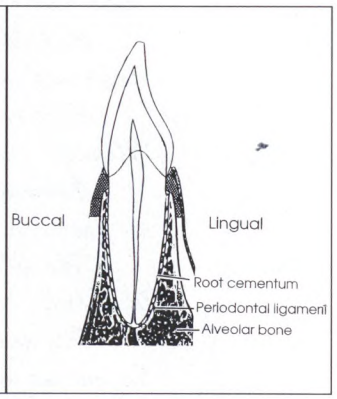


Fig 2

The construction of the ***Tower*** *may be seen in* ***Fig 1*** *and consists of a hollow masonary cylinder composed of distinct elements such as marble blocks, limestone and mortar*. The periodontium consists of the cementum of the tooth, periodontal ligament and alveolar bone. **(Fig 2)**, which form the foundation of the tooth.

To assess periodontal disease activity is often difficult, and it is for this reason that one needs to understand the natural histories of the diseases and appreciate the mechanisms of tooth support; *as one would look at the geology of the soil into which the Tower was set.*

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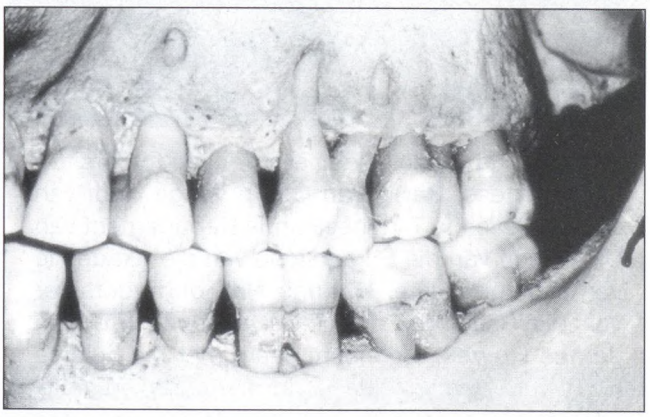


Fig 3

There may be underlying problems such as dehiscence or fenestration of the alveolar bone, (Fig 3) that could weaken the support for the tooth.

The geologist uses borehole records, the dentist uses signs of inflammation, bleeding and exudate, radiographs, probing depths and mobility (and or inclination and extrusion of the tooth) in his diagnosis.

THE CONSTRUCTION HISTORY — HISTORY OF THE CONDITION

One cannot simply look at the Tower and say it is going to fall down. When did the tilting of the tower first commence? Careful measurements of the relative inclinations between the masonary levels up to the top of the tower have been made but it was not until 1817 that two British architects made the first reliable measurement of the inclination of the Tower.

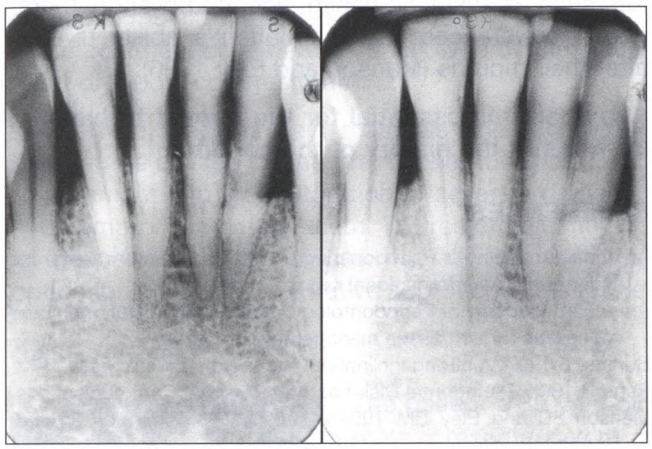


Fig 4(a) *Fig 4(b)*

Early history of periodontal involvement (*tooth tilting*) may not be that easy to establish. It is only when old radiographs of the patient are available that a reliable measurement of alveolar bone loss can be established as in the example in **Fig 4(a)**. Looking at these radiographs in sequence, there is a 10 year difference between 4(a) and 4(b), and very little evidence of further bone loss in this time span. However if one examined **Fig 4(b)** first one could say that tooth collapse was imminent.

An excavation around the ***Tower*** *some years ago caused a disturbance that activated a continuous very slow creep and placed the tower under further jeopardy.*

For the tooth an exacerbation of the condition could arise due to a pulp involvement, illness, excess smoking, an hormonal imbalance such as diabetes or even trauma to the tooth and periodontium.

This patient **[Fig 5(a)]** was involved in an accident which resulted in loosening and pulp necrosis of tooth 21. The dentist placed an endodontic pin to stabilize the tooth. The radiograph in **Fig 5(b)** was taken two years after the accident. Five years later the apical root resorption and crestal bone loss have continued **[Fig 5(c)]**. This could be due to the ankylosis of the tooth to the alveolar bone and associated remodelling.

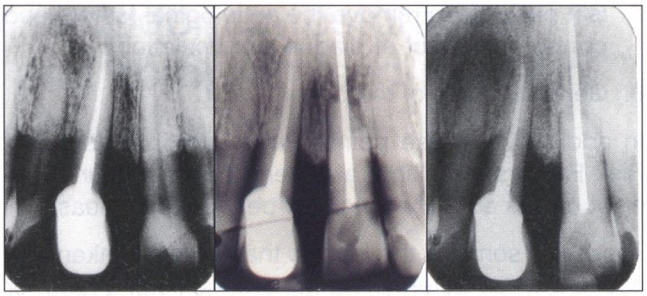


Fig 5(a), 5(b) and 5(c)

Before one can say that the *Tower*/tooth will fall or what treatment can be employed to upright the tooth or restore and regenerate the support – the dentist needs to prognosticate the likely outcome. Manson (1996) has said *looking into the future can be a hazardous exercise, but a prediction of the way in which the periodontal tissues will behave can be made on the basis of an understanding of the way in which the tissues of that individual have behaved in the past in the face of disease – the producing factors.*

Some of these factors are;

1. The extent of periodontal destruction, i.e. alveolar bone loss as seen on radiographs and compared from year to year.
2. The age of the patient, eg Early onset periodontitis or Juvenile periodontitis affects specific teeth and the diagnosis is definitive. With an understanding of this condition the prognosis (treatment plan) can be readily determined.

   Adult periodontitis requires careful history taking and gathering of information to help in the assessment of the rate of periodontal breakdown.

   Age is also important because of wear and resistance to infection.

   The American Academy of Periodontology has published guidelines for the *care of the older adults* (1994).
3. The nature of the periodontal loss is also important in determining prognosis.

   (a) Should the alveolar bone loss be vertical (an infrabony defect) rather than horizontal, this could indicate a favourable outcome.

   (b) Attachment loss (gingival recession), the site and degree must be noted.
4. Tooth mobility
5. Occlusal interferences
6. Missing teeth

7. Is it possible to remove the aetiological factors and control the effect of plaque accumulation?
8. General health of the patient.

In addition to these points Page (1995) adds in his Risk Factors, smoking, a patient that is immunodeficient or has a family history of periodontal disease.

These are some of the factors that must be taken into account when determining the prognosis of a tooth or the dentition as a whole.

Possible ways of permanently controlling the subsidence or clinical collapse.

Burland suggested *very soft* solutions. These are aimed at:

Reducing the inclination by means of controlled ground substance; scale, root plane, control plaque accumulation and the effect of the bacteria, and in this way reduce the inflammation and pocket depth. This form of treatment could be termed *soft tissue management*, (American Academy of Periodontology, 1996). Should soft tissue management not control or reduce the disease activity and movement, more elaborate steps should be undertaken. This could be surgical in nature; *a slab may be placed to support the* ***Tower***; a form of regenerative surgery, where the foundation of the tooth is improved.

The movement could also be controlled by anchors; i.e. splinting the teeth.

The treatment of the inclined tooth may not be simple. The practitioner needs to employ clinical judgement, to know the anatomy of the teeth and the periodontium, and to understand the physiology of the periodontal structures and its potential to healing. The practitioner should also appreciate patient-related factors such as systemic health, age, compliance, therapeutic preferences and the patient's ability to look after their mouths (Manson and Eley 1996).

Above all it is essential for the dentist to have an insight into the history of the condition

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