



Delayed Implant Loading in Cases with Implants and Natural Teeth

Fix occlusion issues with implants with delayed loading.

Natural teeth move more than implants because the periodontal ligament is so resilient. In mixed implant-natural tooth occlusal schemes, this movement discrepancy means an implant prosthesis, which moves significantly less, can interfere with the natural teeth completely depressing into the periodontal ligament. Therefore, the implant prosthesis receives most of the occlusal forces,



Fig. 1 Before

To minimize excessive implant prosthesis force, the occlusal scheme can include a quantifiable time delay, such that the natural teeth occlude before the implant.

Natural teeth move in a two-stage process. The first stage is the intrasocket stage, during which a tooth moves within the periodontal ligament¹. The second stage is an elastic deformation of the alveolar bone¹. It is during the Intrasocket stage that most tooth movement occurs under occlusal loading.

Non-mobile posterior teeth depress into their periodontal ligament fibers about 28 microns vertically and 56–75 microns laterally. Anterior teeth move from 90–110 microns².

Implants depress 5 microns vertically and 12–66 microns laterally². Because of this movement discrepancy when natural teeth and implants occlude simultaneously, the natural teeth are "stopped" on the way into their periodontal ligament fibers by the immovable implant prosthesis. The implant prosthesis then receives the majority of the occlusal forces. This phenomenon will affect the long-term prosthesis integrity, implant integration, and supporting bone level stability.

Therefore, in mixed implant-natural tooth occlusal schemes, it is best if the implant prosthesis occludes after the natural teeth. This gives the natural teeth enough elapsed time to depress partway into the periodontal ligament fibers and begin to meet alveolar housing resistance before the implant prosthesis occludes. This time delay³ must be kept short (less than .4 seconds) for the implants to occlude at all.

In a clinical report by Stevens⁴, it was demonstrated that by applying the time delay principle to implants supporting a distal extension implant prosthesis, prior radiographic bone loss was regenerated around the implants a few months after the time delay was established.

Establishing a time delay is a precise occlusal adjustment that requires patience and clinical trial. The operator should first create implant prosthesis and natural tooth loading time simultaneity, then gently lessen the occlusal contacts on the implant prosthesis so that a thin layer of occluding material is

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Fig. 2 Earliest tooth and implant prosthesis occlusal contacts (A) at .122 sec; The natural tooth depression into the periodontal ligament results in a force increase (B) at .189 sec; The end of intrasocket tooth movement with teeth at maximum force (C) at .281 sec; The first significant implant prosthesis force increase (D) at .396 sec; moderate forceful occlusal contacts on the implants (E) at .530 sec. Time delay is approximately .4 seconds.

shaved away. Repeated T-Scan® II analyses reveal whether or not there is a delay, as well as its duration.

After the implant prosthesis is seated, bring the occlusal contact arrangement in line with the rest of the occlusion so it and the neighboring teeth are in occlusion. Record a T-Scan II Full Closure Force Movie⁵ and play it back to watch for when the segmental prosthesis loads in comparison to the natural teeth. If the implants precede the teeth by more than .25 seconds, major occlusal adjustments are required. If the implants load simultaneously (less than a .05 second delay of either teeth before implants, or implants before teeth), or slightly after the natural teeth (less than .1 second delay), further adjusting will establish a definitive implant prosthesis time delay.

Mark the implant prosthesis with Accufilm™ and gently shave the occlusal contact marks.

Record another Full Closure Force Movie. If the delay is close to .3 seconds, then stop the occlusal adjustments as further adjustment will take the prosthesis out of contact. The closer to .3 seconds, the better the chance the teeth will depress significantly in advance of the implant segment occluding.

The figures on page 16 demonstrate how to establish a quantifiable time delay. This force movie recording is of a maxillary left PFM splint on 3 implants. The remaining maxillary teeth are restored with PFM crowns on natural teeth (fig. 1).

Fig. 2 shows five 3-D sequential force plots (A-E) that illustrate the desired delayed occlusal result.

Natural teeth move vertically and horizontally in their periodontal ligament fibers far more than dental implants move in bone. T-Scan II occlusal analysis can determine the relative time of initial contact of natural teeth and dental implants so that it is possible to separate them according to when they come into occlusal contact. By delaying the implant prosthesis until after the initial tooth contact occurs, the natural teeth have time to undergo most of the intra-socket phase of tooth movement before the implant prosthesis commences occluding. ■

References:

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