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| 4A-1 |
| **Basic Science Question:** |
| How do implants osseointegrate? |
| **Report:** |
| Osseointegration is the structural and functional attachment of a newly placed implant into the alveolar bone (Mavrogenis). Once a tooth is extracted from the alveolar bone, the ridge resorbs, making the bone ideal for a new implant placement (Salvi). In order to create osseointegration, bone should be removed conservatively while preserving the basic topography of the area (Jayesh). Once the implant is placed, bone grows onto the surface of the implant, leading to a functional coexistence between the titanium implant and bone. Osseointegration is obtained once there is no significant movement between the implant and the bone (Mavrogenis).  This healing process of the disrupted socket is similar to primary bone healing. The disrupted blood vessels between the implant and bone lead to blood clot formation. Phagocytic cells such as leukocytes, macrophages, and lymphoid cells enter the clotted area typically one to three days after implantation. This clot transforms into granulation tissue, also called a procallus, which creates a fibrous integration between the implant and developing bone. Next, dense connective tissue is developed over the implant. Mesenchymal stem cells then differentiate into osteoblasts and fibroblasts and form a callus around the implant and healing bone (Jayesh). Osteoblasts form the new woven bone through intramembranous ossification (Mavrogenis). The woven bone eventually matures and calcifies over time with increasing density and hardness, also known as Haversian or compact bone . This bone directly attaches to the notches on the screw-type implant. Occlusal stresses help develop this surrounding bone as it matures to withstand masticatory forces (Jayesh).  Overall, osseointegration creates an anchorage system between the titanium implant and the alveolar bone in the jaw which allows structural and functional compatibility. A properly osseointegrated implant withstands occlusal stresses and allows for proper masticatory function. |
| **References:** |
| Jayesh, Raghavendra S, and V Dhinakarsamy. “Osseointegration.” *Journal of pharmacy & bioallied sciences* vol. 7,Suppl 1 (2015): S226-9. doi:10.4103/0975-7406.155917  Mavrogenis, A F, et al. “Biology of implant osseointegration.” *Journal of Musculoskeletal and Neuronal Interactions*, vol. 9, no. 2, 2009, pp. 61–71.  Salvi, Giovanni E et al. “Long-term biological complications of dental implants placed either in pristine or in augmented sites: A systematic review and meta-analysis.” *Clinical oral implants research* vol. 29 Suppl 16 (2018): 294-310. doi:10.1111/clr.13123 |