# Endplate

The endplate is a bilayer of cartilage and bone that separates the intervertebral discs from the adjacent vertebrae.

Vertebral endplates, innervated by the basivertebral nerve, can be a source of vertebrogenic low back pain when damaged with inflammation, visible as types 1 or 2 Modic changes.

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GH directly on epiphyseal endplates of long bone to stimulate chondrocyte proliferation.

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Plain films in vertebral osteomyelitis diagnosis (more common in infections anterior to dura). Look for lytic lesions, demineralization, and scalloping of endplates (may take 4–6 weeks after onset of infection).

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Spondylodiscitis may start in the cartilaginous endplate and spread to the disc and vertebral body (VB). Similar to vertebral osteomyelitis, except osteomyelitis primarily involves the VB and spreads secondarily to the disc space.

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These surfaces are the vertebral endplates which are in direct contact with the intervertebral discs and form the joint. The endplates are formed from a thickened layer of the cancellous bone of the vertebral body, the top layer being more dense.

The endplates function to contain the adjacent discs, to evenly spread the applied loads, and to provide anchorage for the collagen fibres of the disc. They also act as a semi-permeable interface for the exchange of water and solutes.

Modic type endplate changes

see Modic changes

Vertebral end plate is the place—that actually serves as an interface—between the intervertebral disc and the bone (of the vertebral body) underneath. At first consideration, it may seem to you like an end plate is not fully bone, and not fully cartilage, but a combination of the two.

And you may be right. According to the article “The Role of the Vertebral End Plate in Low Back Pain,” the end plate a bilayer of cartilage and bone that creates separation between the more pliable disc and the rigid vertebra.

In the low back, the spine carries a lot of load and is subject to strong forces of movement. The discs, on the other hand, are lacking in blood vessels. As the intermediary substance between the two, the end plates are charged both with being strong to help prevent vertebral fracture and being porous to help nutrients flow between cells in the disc and capillaries in the bone, Lotz, et. al say.

End plates are perhaps the most vulnerable area of the discs and are easily damaged when compressed. When this happens, it may increase communication activity between inflammatory substances located in the disc and the blood vessels located in the bone marrow. A damaged end plate, Lotz, and fellow researchers say, can provide a site for reactive bone marrow that includes proliferating nerves susceptible to movements, changes in positions, (i.e., mechanical stimuli) and also to chemical stimuli.

End Plate Damage on MRI The problem is, this type of innervated end plate damage can be difficult to detect with diagnostic imaging tests such as MRI. For this reason, Lotz, Fields, and Liebenberg say that even though innervated end plate damage can be a source of chronic low back pain, doctors probably don't consider it much when evaluating their patients.

According to Nguyen, Poiraudeau, and Rannou, MRI may be able to detect changes in the bone layer of the end plate that could be associated with degenerative disc disease and chronic low back pain. These are called Modic changes. The researchers assert that such changes may be related to local inflammation, and suggest that Modic changes may be a biomarker for identifying a link between the bone changes and pain in certain types of patients with low back pain. This, in turn, may facilitate more targeted back therapies.

## Cervical Endplate Removal

A study of Lin et al. compares four cervical endplate removal procedures, validated by finite element models.

To characterize the effect of biomechanical strength and increased contact area on the maximum von Mises stress, migration, and subsidence between the cancellous bone, endplate, and implanted cage.

Anterior cervical discectomy and fusion (ACDF) has been widely used for treating patients with degenerative spondylosis. However, no direct correlations have been drawn that incorporate the impact of the contact area between the cage and the vertebra/endplate.

Model 1 (M1) was an intact C2C6 model with a 0.5 mm endplate. In model 2 (M2), a cage was implanted after removal of the C4-C5 and C5-C6 discs with preservation of the osseous endplate. In model 3 (M3), 1 mm of the osseous endplate was removed at the upper endplate. Model 4 (M4) resembles M3, except that 3 mm of the osseous endplate was removed.

The range of motion (ROM) at C2C6 in the M2-M4 models was reduced by at least 9º compared to the M1 model. The von Mises stress results in the C2C3 and C3C4 interbody discs were significantly smaller in the M1 model and slightly increased in the M2-M3 and M3-M4 models. Migration and subsidence decreased from the M2-M3 model, whereas further endplate removal increased the migration and subsidence as shown in the transition from M3 to M4.

The M3 model had the least subsidence and migration. The ROM was higher in the M3 model than the M2 and M4 models. Endplate preparation created small stress differences in the healthy intervertebral discs above the ACDF site. A 1 mm embedding depth created the best balance of mechanical strength and contact area, resulting in the most favorable stability of the construct [1)].

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Lin M, Paul R, Shapiro SZ, Doulgeris J, O'Connor TE, Tsai CT, Vrionis FD. Biomechanical Study of Cervical Endplate Removal on Subsidence and Migration in Multilevel Anterior Cervical Discectomy

and Fusion. Asian Spine J. 2022 Mar 11. doi: 10.31616/asj.2021.0424. Epub ahead of print. PMID: 35263829.