

## Jaw suspension in Vertebrates

Jaw suspension means attachment of the lower jaw with the upper jaw or the skull for efficient biting and chewing. There are different ways in which these attachments are attained depending upon the modifications in visceral arches in vertebrates.

**Amphistylic:** In primitive elasmobranchs there is no modification of visceral arches and they are made of cartilage. Pterygoquadrate makes the upper jaw and meckel's cartilage makes lower jaw and they are highly flexible. Hyoid arch is also unchanged. Lower jaw is attached to both pterygoquadrate and hyoid arch and hence it is called amphistylic.

**Autodiastylic:** Upper jaw is attached with the skull and lower jaw is directly attached to the upper jaw. The second arch is a branchial arch and does not take part in jaw suspension.

**Hyostylic:** In modern sharks, lower jaw is attached to pterygoquadrate which is in turn attached to hyomandibular cartilage of the 2nd arch. It is the hyoid arch which braces the jaw by ligament attachment and hence it is called hyostylic.

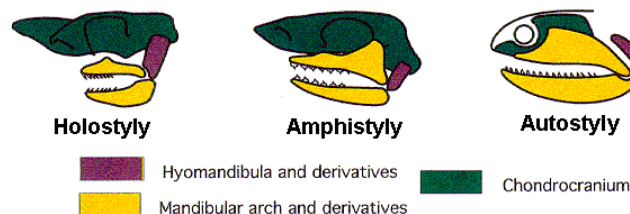
**Methostylic:** In bony fishes pterygoquadrate is broken into epipterygoid, metapterygoid and quadrate, which become part of the skull. Meckel's cartilage is modified as articular bone of the lower jaw, through which the lower jaw articulates with quadrate and then with symplectic bone of the hyoid arch to the skull. This is a modified hyostylic jaw suspension that is more advanced.

**Autostylic:** Pterygoquadrate is modified to form epipterygoid and quadrate, the latter braces the lower jaw with the skull. Hyomandibular of the second arch transforms into columella bone of the middle ear cavity and hence not available for jaw suspension.

**Monimostylic:** This type of suspension is a modification of autosystylic suspension in which quadrate is immovable and not flexible as in amphibia and many reptiles. Hyomandibular is modified as columella bone of the middle ear cavity.

**Holostylic:** This type is found in lung fishes and Holocephali. Upper jaw is fused with the skull and the lower jaw is attached directly with it. Hyoid arch does not participate in jaw suspension and is a typical branchial arch. There is no columella bone.

**Craniostylic:** Found in mammals, in this type of jaw suspension, pterygoquadrate is transformed into alisphenoid and incus, while meckel's cartilage is changed into malleus and not available for jaw suspension. Lower jaw is directly attached to the skull bone called squamosal. Monotremes also possess this type of jaw suspension.



### Variation in the suspension of vertebrate jaws

**Hyostyly** - mandibular arch supported primarily by hyomandibula (typical **Chondrichthyes**).

**Amphistyly** - mandibular arch supported in part by hyomandibula (typical **Actinopterygia**).

**Autostyly** - mandibular arch not supported by hyomandibula (**Dipnoi**, Tetrapoda).

## COMPARATIVE ACCOUNT

- 1) In agnathans the jaw suspension is in paleostylic stage in which none of the arches attach themselves directly to the skull.
- 2) In ganathostomes and acanthodians jaw suspension is autodiastylic in which jaws are attached to the cranium by anterior and the posterior ligaments. Hyoid arch remains completely free and does not support the jaws.
- 3) In primitive sharks the jaw suspension is amphistylic in which the quadrate or the basal and otic processes of upper jaw (mandibular arch) are attached by ligaments to chondrocranium. Similarly the upper end of hyomandibula is also attached to chondrocranium.
- 4) In modern sharks and all bony fishes the type of jaw suspension is hyostylic, in which the upper jaw (palatoquadrate) is loosely attached by anterior ligament to cranium. Both the jaws are suspended from the hyomandibular. Since only hyoid arch binds the two jaws against cranium it is called hyostylic jaw.
- 5) In most tetrapods like amphibians, reptiles and birds hyomandibular does not participate but becomes modified into columella or stapes of middle ear for transmitting sound waves.
- 6) In most lung fishes upper jaw is firmly fused with skull and lower jaw suspended from it. Hyoid arch is complete independent and not attached to the skull; this is holostylic type of jaw suspension.
- 7) In many tetrapods monimostylic jaw suspension is seen i.e. hyomandibular forms columella and articular articulates with quadrates. However the quadrate remains immovably attached with skull.
- 8) In some reptiles (lizard, snakes) and birds the type of jaw suspension is streptostylic i.e. quadrate is loosely attached and is movable at both the ends a condition known as streptostylism.
- 9) In mammals craniostylic type of jaw suspension is seen it is modification of the autostylic suspension. Upper jaw fuses throughout its length with cranium, and hyomandibular forms the ear, ossicle, stapes. But articular and quadrate also become modified into ear ossicles malleus and incus.