

## The Lethality and Effectiveness of Sword Techniques to the Head

Discussions on- and offline with interested layman and practitioners of martial arts sometimes touch upon the lethality and effectiveness of sword techniques as taught in traditional Japanese martial arts. A common topic within this discussion is the effectiveness of sword attacks against the head. I try to add to this discussion from the view of a Hokushin Ittō-ryū Hyōhō (HIRH) kenshi (swordsman) who studies this art directly under the sōke (headmaster) and is currently a Hatsu-Mokuroku ranked Shidōin (teacher) of the art. I'll provide quotes from several sources, mainly anthropological, archaeological, anatomical and forensic research as well as some entry level reading.

First of all, I'd like to establish some background needed for this discussion. Namely, the parts of the human skull and its ability to withstand trauma. The human head roughly consist of the following layers starting from the crown and from outside to inside: Hair (variable) - scalp (4 – 10mm, depending on location <sup>1</sup>) – skull (5 – 6mm<sup>2</sup>) – dura mater (0.25mm <sup>3</sup>) and other meninges – brain. Starting from the front: facial skin (1.5 – 5mm) – muscle (variable) – bone (variable, several cavities<sup>2</sup>) – spine/neck.

The skull is made of several bone plates connected by fibrous joints, so called cranial sutures. These sutures ossify over time and some take up to the age of 60 to fully ossify <sup>2, 4</sup>. Grain direction in the decalcified skull is more or less orthogonal to one of the cranial sutures. In most cases though, these directions change to parallel in the lines closest to the sutures <sup>2</sup>. It is plausible, that this structure makes it easier to cleave a skull along these grain directions, although I could find no source either to confirm or refute this assumption.

Clinical reality as well as forensic evidence show, that the human skull can fracture surprisingly easy in specific circumstances, i.e. an attack with a beer bottle <sup>5</sup>. Even walking into an obstacle can be enough <sup>6</sup>. Archaeological findings and forensic evidence proof the ability of sword attacks to severely damage the human skull <sup>7, 8, 9, 10, 11</sup>.

Now that we have established the ability of a sword to damage the skull, the question arises how dangerous this trauma can be. Internal and external bleeding, damage to the brain tissue or subsequent infections of the wound and possibly the brain, could all be lethal. Also possible are spinal injuries due to the sudden acceleration following the impact <sup>12</sup>.

But interestingly, some archaeological findings indicate that this type of trauma, i.e. sword blows to the head, were not immediately lethal. A fractured skull was quite often survived, if infections did not occur and the skull was not penetrated. Still, a severe blow to the head, even if survivable, would greatly lower the fighting capacity of the struck person due to a concussion, blood loss or visual obstruction due to blood flowing into the eyes.

Sword cuts to the skull seem to only occasionally penetrate the skull in a way that the cranial cavity is compromised (compound fracture). But, cutting out parts of skull can be observed as well, so depending on the ability of the attacker and circumstances of the attack, penetrating the cranial cavity was most likely a regular occurrence during times when bladed weapons were used as tools of warfare <sup>7, 8, 9, 10, 11</sup>.



*Woodblock print showing a head wound on a samurai after battle; probably late Edo period.*

I will now give you a brief overview of the targets on the human head and the relevant attack techniques in sword fighting as taught within the Hokushin Ittō-ryū. Most of these attacks and targets are also taught in other traditional Japanese sword arts and most likely also in other (historical) weapon arts around the globe. The names might differ from school to school. Explanations are given as if two opponents face each other in a duel.

1. (Shō)Menuchi: A straight downward cut towards the upper frontal part of the skull or face. Even if the face is missed, depending on the distance and length of the swing, the cut can damage the torso or forearms and/or hands of the opponent.
2. Hanmenuchi: A diagonal cut to the side of the skull, approximately at temple height. This cut might also damage the eye of the struck side.
3. Ganmen: Targeting the area between the eye brows. This can be done with a cleaving strike (ganmenuchi) or with a thrusting motion (ganmenzuki).
4. Me: Targeting the eye. Usually attacked with a thrust to the face and might also result from a ganmenzuki which the opponent tried to evade. This target is often used when fighting in full armor.

5. Kuchi: Targeting the mouth. Usually attacked with a thrust. This is a technical variation of a thrust towards the throat if the opponent is wearing a menpō (throat guard).

The three targets shōmen, hanmen and ganmen all coincide with cranial sutures or are in line with grain structures in the decalcified skull. As already mentioned, some of these sutures are not fully ossified at the age of 20 and can take up to the age of 60 to completely ossify<sup>2,4</sup>. The back of the orbit is formed by the sphenoid bone, which can easily fracture<sup>13,14</sup>. The mouth is not protected by any bones and teeth are most likely not able to stop a sword thrust. To conclude, all attacks target the skull in a way to make use of at least some structural weakness.

At this point, I want to stress that immediate lethality is not the goal of effective attacks. Instead, an attack should force an opponent to stop his hostile actions. This can be achieved by death, loss of consciousness, loss of motor ability, loss of sensory ability or loss of cognitive functioning.

Considering this, I'll list the possible results of these attacks.

Common symptoms of head trauma include in no particular order: concussion, bleeding, confusion, ringing ears, memory loss, trouble with concentration and attention, movement problems, disorders of consciousness including coma and vomiting<sup>13,14,15,16</sup>. All of these symptoms reduce the ability to further act aggressively to a variable extent. Shōmenuchi, hanmenuchi, ganmenuchi and ganmenzuki should all lead at least to lacerations in the upper facial area or forehead and possibly apply a significant amount of force to the head. This most likely ends in at least a concussion and possible loss of consciousness as well as a cranial fracture. A quick death is possible, but not likely, unless the cranial cavity is penetrated and the brain or major blood vessels are damaged. A thrust towards the eye is at least blinding on that side. If the back of the orbit is penetrated, brain damage and severe internal bleeding is a likely outcome, possibly ending in death after a short time. A thrust towards the mouth results at least in laceration of the lips and tongue, possibly damaging the teeth as well. This will be very painful and the bleeding might hinder breathing. If the sword pierces further through, damage to the throat, spine or base of the skull, depending on the angle of the attack, are possible. Bleeding of the throat will hinder breathing and damage to the spine or skull this close to the foramen (opening on the base of the skull) can lead to the immediate loss of motor functions, consciousness or life.

At this point, I will list some of the usual points brought up against hitting the head as an effective attack. The most popular counter argument against the effectiveness of certain attacks to the head is the perceived round nature of the skull, which is stated to deflect a sword strike. This is certainly a possibility, but seems to not be a common occurrence based on skull findings<sup>7,8,9,10,11</sup>. Furthermore, even a glancing blow to the head transfers a significant amount of force and lacerates the scalp severely. In case of a shōmenuchi or hanmenuchi, the deflected cut might damage the shoulder, specifically the trapezius muscle, which is required to move the arm above the horizontal<sup>17,18</sup>. So, even a deflected blow will most likely lower the fighting ability of the opponent.

Another counter argument is the use of helmets and face protection, most importantly the kabuto and the menpō. Protective head gear is successfully used to protect the head and face in all kind of settings and the kabuto combined with the menpō was used in feudal Japan as such. There were also other kinds of helmets, e.g. the jingasa or hachigane, and face protection in use. The kabuto combined with the menpō covers most parts of the face and head, in some variants only the eyes and part of the forehead is uncovered. This severely limits the effectiveness of sword attacks, mainly shōmenuchi and hanmenuchi, to the head. Ganmen, eyes and mouth can still be attacked to full effect. Some menpō had a protected mouth area, further increasing the protection of the face. Be reminded, that protective gear reduces the damage done, but it usually does not nullify all damage. Continuous blows to the head still remain dangerous.

A few last words regarding defensive actions of the opponent. Preventing a hit by deflecting, blocking or dodging the blow is a very effective measure to prevent damage to the head. The success of these

measures obviously depend on the skill of the two adversaries. If attacked with shōmenuchi or hanmenuchi, dodging with the head alone is not sufficient, as the cut can be extended towards the chest or arms. A thrust with the full body behind the motion can also be extended into a body blow, continuing the attack.

In conclusion: Sword attacks to the head as taught in traditional Japanese martial arts are an effective tool to force the opponent to stop his hostile actions.

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