Optimization of fat suppression in the head/neck area
**Application tips**

## Optimization of fat suppression in the head/neck area

Obtaining good fat suppression is not always easy in the head/neck area. There are various reasons for this, including the sharp angles in the anatomy of the head and neck, and also the presence of many different tissues within the area, such as muscle, air, fat, fluid, arteries and veins.

Obtaining the best possible fat suppression begins with choosing the correct shimming technique. In addition, careful setting of the size and position of the shim volume is required. Particularly in head/neck imaging, the shim volume must be tailored to the area of interest. Fat suppression may be incomplete without the right shimming technique and proper shim volume placement.

### Tip 1: Patient positioning

Position the patient as high as possible in the coil. For good fat suppression, keep the shoulders relaxed and point the hands to the feet. When the shoulders are not relaxed but pulled up, there could be a hole between the shoulder and the neck. This hole makes fat suppression more difficult because of the B0 disturbance.

![Patient positioning with shoulders pulled up](image)

Patient positioning with the shoulders pulled up. Holes, marked with arrows, appear between shoulders and neck. This results in imperfect fat suppression in that area, see right image.

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The sharp angles of the head/neck anatomy are marked with red lines. These cause a B0 disturbance within the field of view, making fat suppression difficult.

Sharp angles in the head/neck anatomy are marked with red lines.
**Tip 2: Choose the right shim method**

The first decision is the kind of shim method to use. At 1.5T the available options are volume shim and autoshim. For 1.5T head/neck imaging, volume shim is the best option. At 3.0T you can choose between volume, pencil beam (PB) and autoshim. In the head/neck area best results are obtained with PB shim.

**Tip 3: Shim volume size and position for bilateral posterior triangle**

Imaging the posterior triangle with a large field of view (shoulder-to-shoulder) requires using a carefully tailored volume shim. The head/neck-thorax junction is the most difficult area for obtaining good fat suppression. The best approach is to position a small shim volume (approximately 10 x 10 cm) at the head/neck-thorax junction, centered at the junction. Make sure that half the volume is placed in the thorax and half in the neck. Do not position the shim volume too high or too low. When the shim volume is positioned too high, only fat of the neck is suppressed. When the shim volume is too low, it will be in the lungs.

**Tip 4: Shim volume size and position for transverse soft tissue neck**

In the soft tissue neck, fat suppression is most difficult in the area around the chin and at the back of the skull base. Use volume- or pencil beam shim with the complete anatomy inside the shim volume. This approach usually provides improved fat suppression over the whole field of view.

Good fat suppression over entire FOV with pencil beam shim (3.0T) with complete anatomy inside the volume. Imperfect fat suppression at the chin when using autoshim.
**Tip 5: Size and position of shim volume for unilateral posterior triangle**

Again, tailor the shim volume to the area of interest. To suppress fat in the head/neck-thorax curve, adjust the shim volume to that area.

Place an angulated shim volume at the head/neck-thorax junction. Keep the shim volume partly in the neck and partly in the thorax. Try to exclude the lungs as much as possible.

![Shim volume correctly placed in the curve of the head/neck-thorax junction.](image1)

![Poor fat suppression with shim volume placed over the whole FOV.](image2)

![Good fat suppression in the area of interest with proper shim volume positioning.](image3)

**Tip 6: Size and position of shim volume for coronal soft tissue neck**

When only visualization of the neck’s soft tissue is of interest, then place the shim volume only in the neck, above the head/neck-thorax junction. Keep the shim volume completely within the neck, so that no air is included.

![Placement of the shim volume as shown in red will result in good fat suppression in the neck.](image4)

**Tip 7: SPAIR frequency offset (3.0T only)**

In the head/neck area B0 disturbance often occurs within the field of view, which may cause F0 determination to go wrong.

Ideally, F0 is placed exactly on the water peak. When the determined F0 is shifted towards the fat signal, partial fat suppression can occur.

This is likely to happen when the frequency offset is set to its default value, which is 130 Hz. Usually, a frequency offset of 220 Hz provides better fat suppression results in the head/neck region. Note: If you experiment with the frequency offset, be aware that a larger frequency offset, increases the risk of water saturation.

![F0 exactly on the water peak](image5)

![F0 closer to the fat signal may lead to partial fat suppression.](image6)