Augmentation materials and their clinical application

3 questions for Dr Markus Tröltzsch

Dr Markus Tröltzsch gave a live online presentation at the European Symposium in Stockholm on augmentation materials and their clinical application.

Dr Tröltzsch, regarding your presentation on augmentation materials, we would like to know what criteria you consider decisive when selecting augmentation materials in everyday clinical practice. In particular, regarding biocompatibility, resorption behaviour and long-term results.

When selecting augmentation materials in everyday clinical practice, there is no single "right" material, but rather a variety of sensible options. The fact that there are so many different materials and treatment strategies is not a disadvantage, but rather an expression of the fact that each strategy has its merits. Not every material works equally well in every indication or in every practitioner's hands. Accordingly, the criteria for material selection can only be formulated in relatively broad terms, and in many situations there are several alternative ways to achieve the desired result.

A key point is therefore that the practitioner must be able to choose from a range of options. Experience, surgical concepts, defect morphology, soft-tissue situation, time planning and patient-specific factors play a decisive role here. Basically, the considerations can often be reduced to one core question: In the respective situation, is resorption stability or rapid implementation behaviour more desirable?

- Resorption stability is a decisive and often preferable criterion in many augmentation situations, especially in cases of larger defects, vertical augmentations or when volume needs to be maintained over the long term.
- Rapid implementation may be advisable, however, if rapid bone regeneration is desired or biologically active materials are to be prioritised. Autogenous bone, xenogeneic porcine or allogeneic materials may be considered in this case.

In summary, the choice of augmentation material is always an individual decision that must be based on the specific clinical situation. A wide range of materials means therapeutic freedom—and this is precisely what is needed to find the optimal solution for every patient and every indication.

Are there any recent studies or personal experiences that particularly support or critically question the use of certain materials?

Here too, the current state of research—as well as our own clinical experience—confirms one thing above all else, namely that the various material classes have clearly different areas of application and do not replace each other but rather complement each other.

For alloplastic, i.e. synthetic, materials, the data—which is also reflected in the current, recently revised augmentation guidelines—shows that a key issue is that these materials lack a biological background. From a scientific point of view, this is precisely one of the main reasons why they are sometimes significantly inferior to other material classes in many indications, particularly in terms of bone quality, remodelling behaviour and long-term results.

At the same time, however, this lack of biological origin can also be an advantage in certain patient situations, for example in cases where there are clear reservations about biological materials or special individual requirements. In such cases, alloplastic materials can certainly be used to good effect—but only in a very targeted manner and for specific indications.

In contrast, autologous, allogeneic and xenogeneic materials have been well established for many years and are scientifically and clinically proven for a wide range of indications.

Autologous materials have the obvious advantage that they originate from the patient themselves and are therefore opti-

mally integrated biologically. However, this is offset by additional morbidity associated with removal and fundamentally limited availability—although the latter is usually less problematic in practice than is often assumed, depending on the removal technique used.

Allogeneic materials, like xenogeneic materials, are available in unlimited quantities and do not require an additional collection site. However, they exhibit different biological behaviour. In many cases, both allogeneic and autologous materials are metabolised relatively quickly by the body, which can have both advantages and disadvantages depending on the clinical objective.

Materials with similarly rapid conversion behaviour also include xenogeneic porcine materials, which are biologically active and very useful in certain situations.

Xenogeneic bovine materials occupy a special position: they exhibit very high long-term and volume stability and are therefore particularly suitable for augmentations where no or only very little volume loss is tolerated or where specific protection against resorption is desired.

In summary, neither studies nor clinical experience identify any single material as fundamentally superior. Rather, they confirm that the right choice of material always depends on the indication, the biological goal and the treatment concept. This is precisely why it is crucial that the practitioner has access to a range of materials and strategies in order to tailor the therapy to the individual and the situation. However, it is also important that the practitioner ensures that the material used has a sufficiently large scientific database. From this perspective, xenogeneic bovine materials have a scientific basis that is in some cases far superior.

What developments do you foresee in the field of augmentation materials in the coming years?

This is an excellent question—and, of course, none of us has a crystal ball. Nevertheless, current scientific developments and clinical practice clearly indicate that the field of augmentation materials will continue to evolve dynamically in the coming years. There is currently a lot of movement in the field of biomaterials, and this development will continue. In recent years, a certain selection of materials has become increasingly established scientifically, while other techniques have lost importance. Classic procedures such as autologous block augmentation have become decreasingly common. Blocks have been shown to have poorer integration compared to particulate materials, so this trend is not expected to reverse.

Instead, in the field of regeneration—even for larger defects—it has been shown that GBR with reinforced barriers has replaced block augmentation in many cases. Support screw techniques are becoming increasingly important due to their good applicability, flexibility and clinical predictability. Techniques using shells, both autogenous and allogeneic, continue to have their place and usefully complement the therapeutic spectrum.

One particularly exciting area of development is digital planning and 3D-printed augmentation aids. It is becoming increasingly clear that resorbable materials will be a real option in the future. Very interesting innovations are expected in this segment soon, which will further simplify and refine surgical implementation.

Overall, these developments mean that even large augmentations can be performed with significantly lower morbidity for patients. At the same time, complications are easier to manage, and the predictability of results will continue to increase. The associated simplification of techniques also suggests that the complication rate will decline.

In the future, augmentation surgery will also evolve in such a way that we will be able to understand material classes even better and combine them in a more targeted manner. The combined use of different materials within a single case will become increasingly important, for example, materials that undergo rapid conversion in combination with those that exhibit high resorption stability.

From my perspective, we will see numerous developments in the coming years that will make augmentations even safer and more predictable for practitioners and patients alike and make them an integral part of overall regenerative concepts.

Thank you very much for this comprehensive interview.

The interview was conducted by Editor-in-chief Anita Wuttke.