

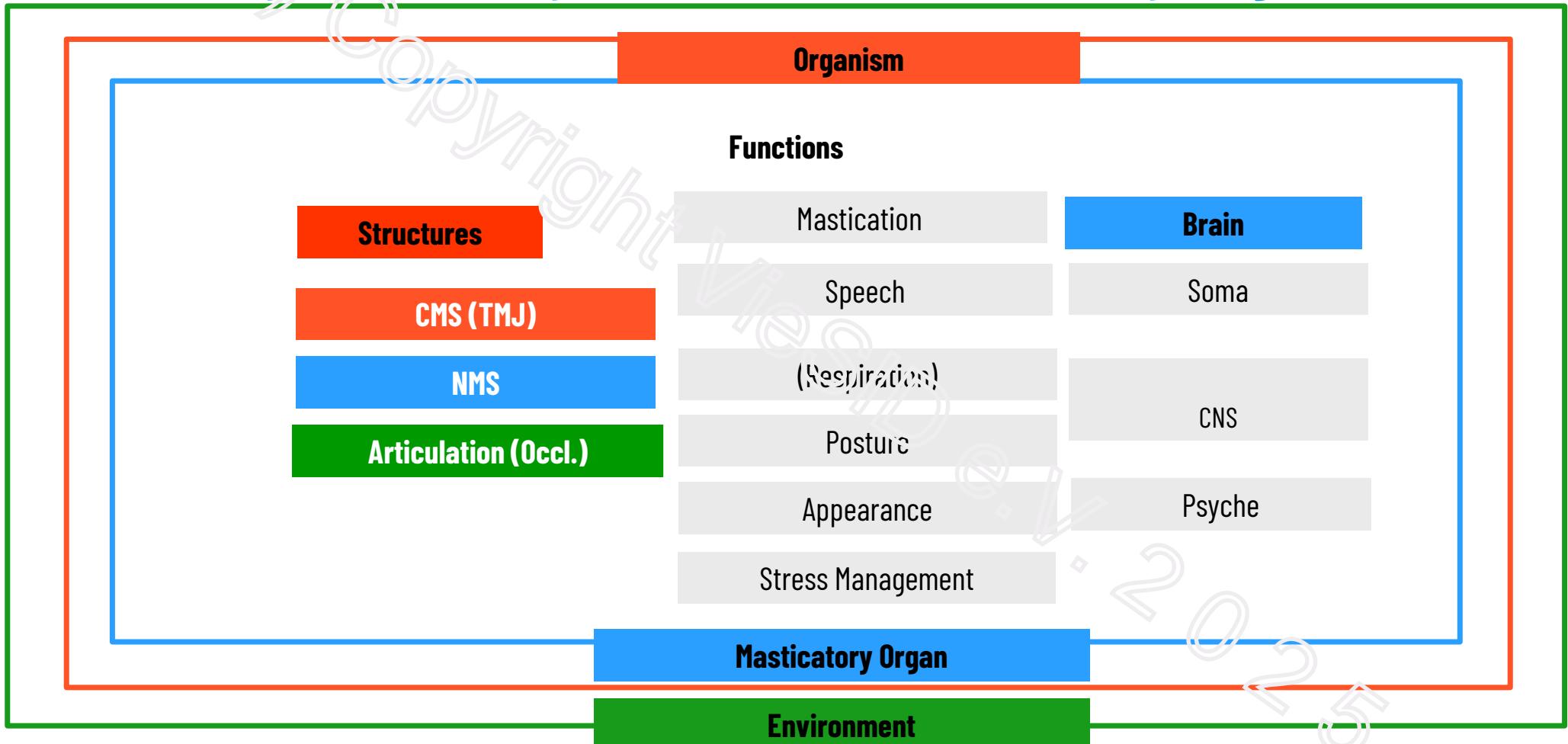
CHAPTER 13:

Reference Position

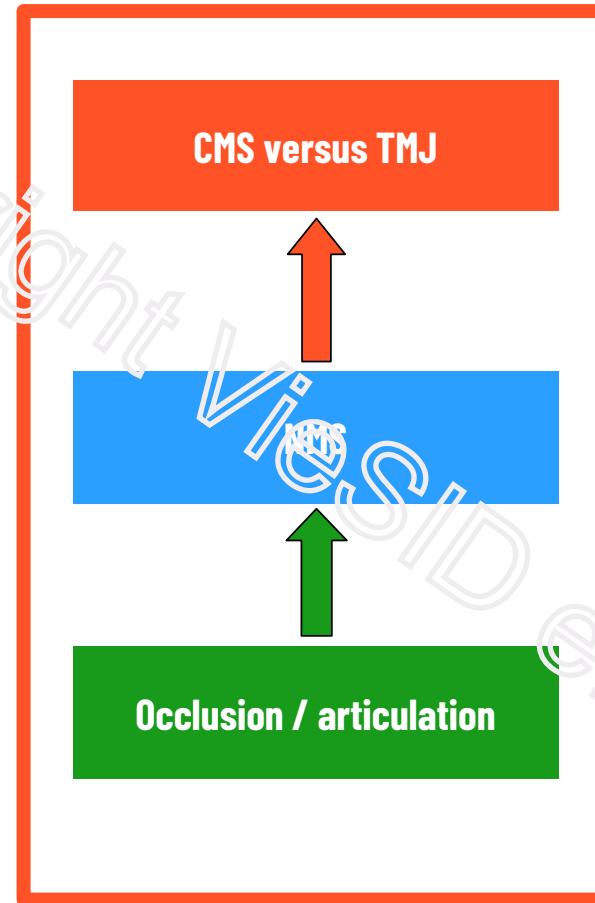
Centric Relation (CR) versus
Reference Position (RP)



Cybernetic System of the Masticatory Organ



Structures



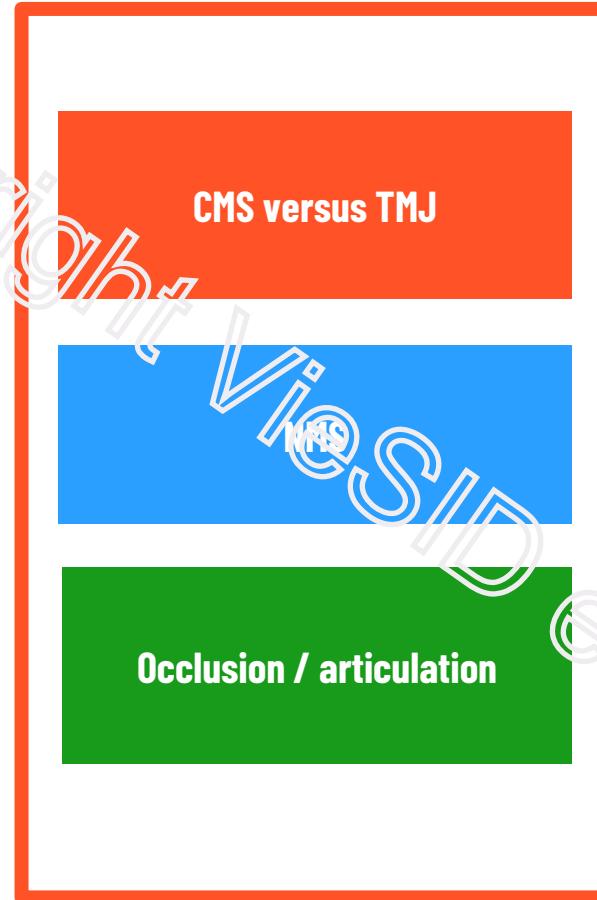
“The anatomist Harry Sicher describes the mandibular joint clearly and simply as a synovial gliding joint with a movable socket.”

A.D. 1922

Thus, according to this definition Sicher replaces the Fovea articularis of the temporal bone into a meaningful functional movable socket, namely the articular disc

This clearly says that the gliding function is the most important aspect. Rotation supports the mobility of joint movement.

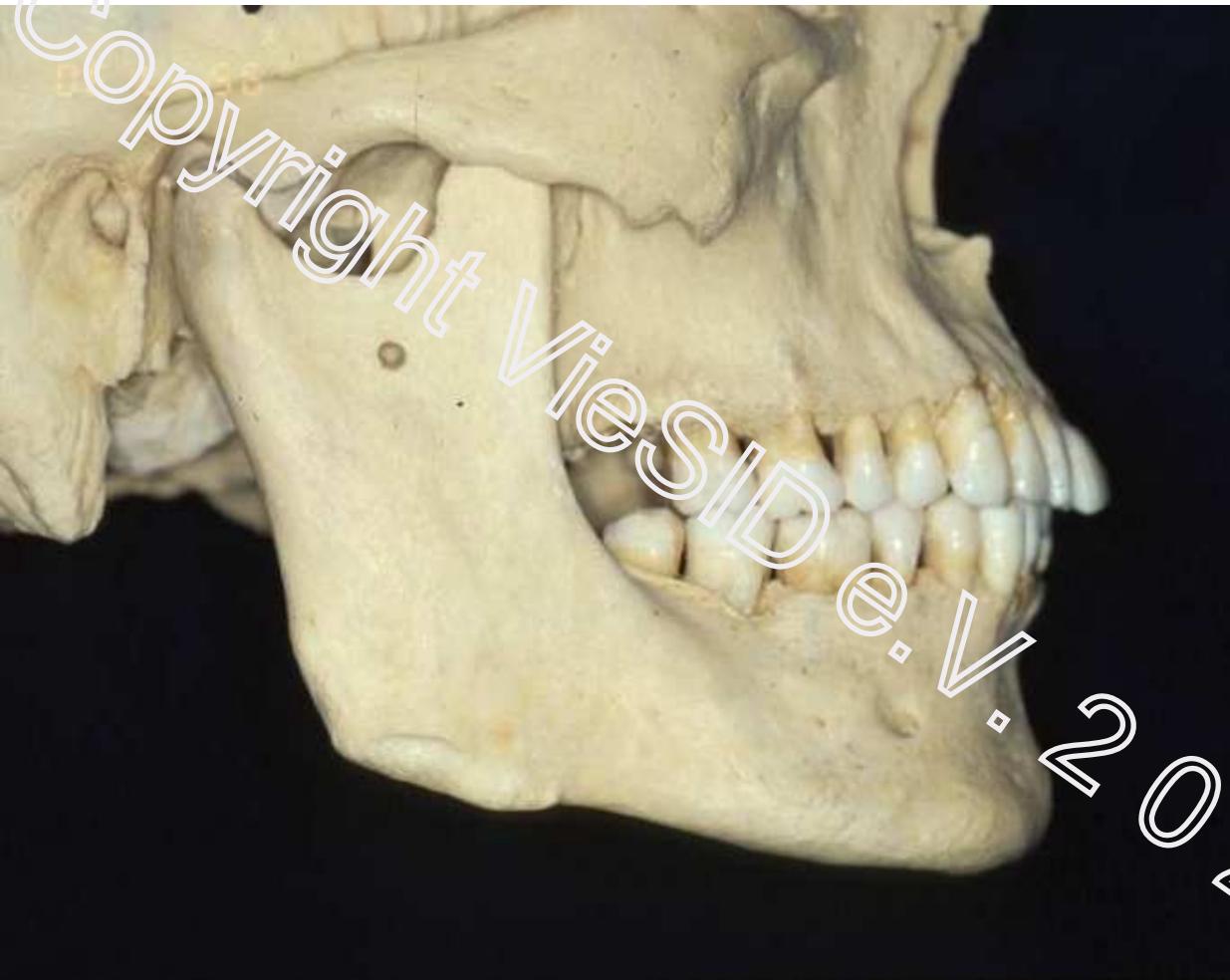
Structures



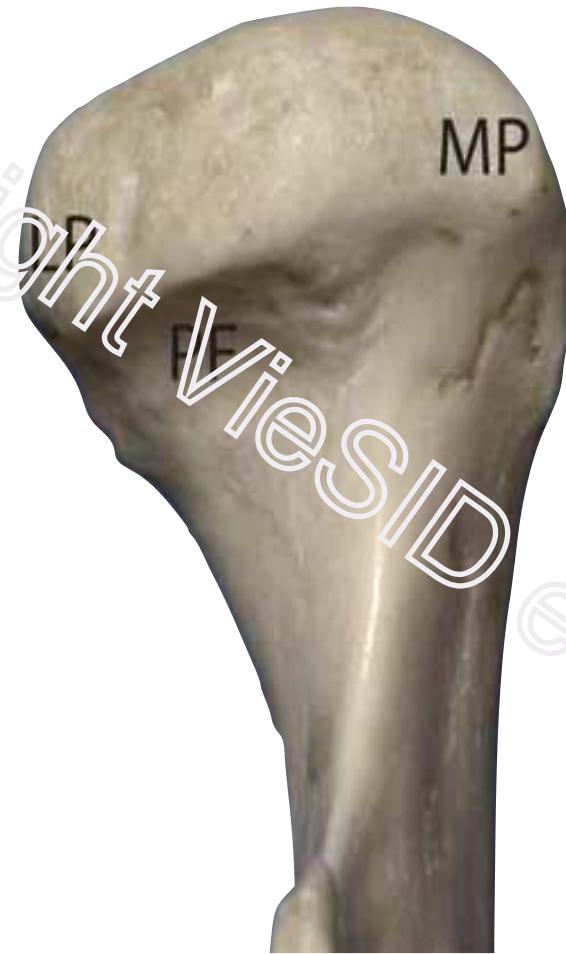
The Crano-Mandibular System includes

- The bony structures of the jaw joints
- The ligamentous structures of the jaw joints
- The articular disc
- The bilaminar zone
- The immanent muscles of the TMJs
- The connecting and passively centering ligamentary apparatus and
- The synovial apparatus

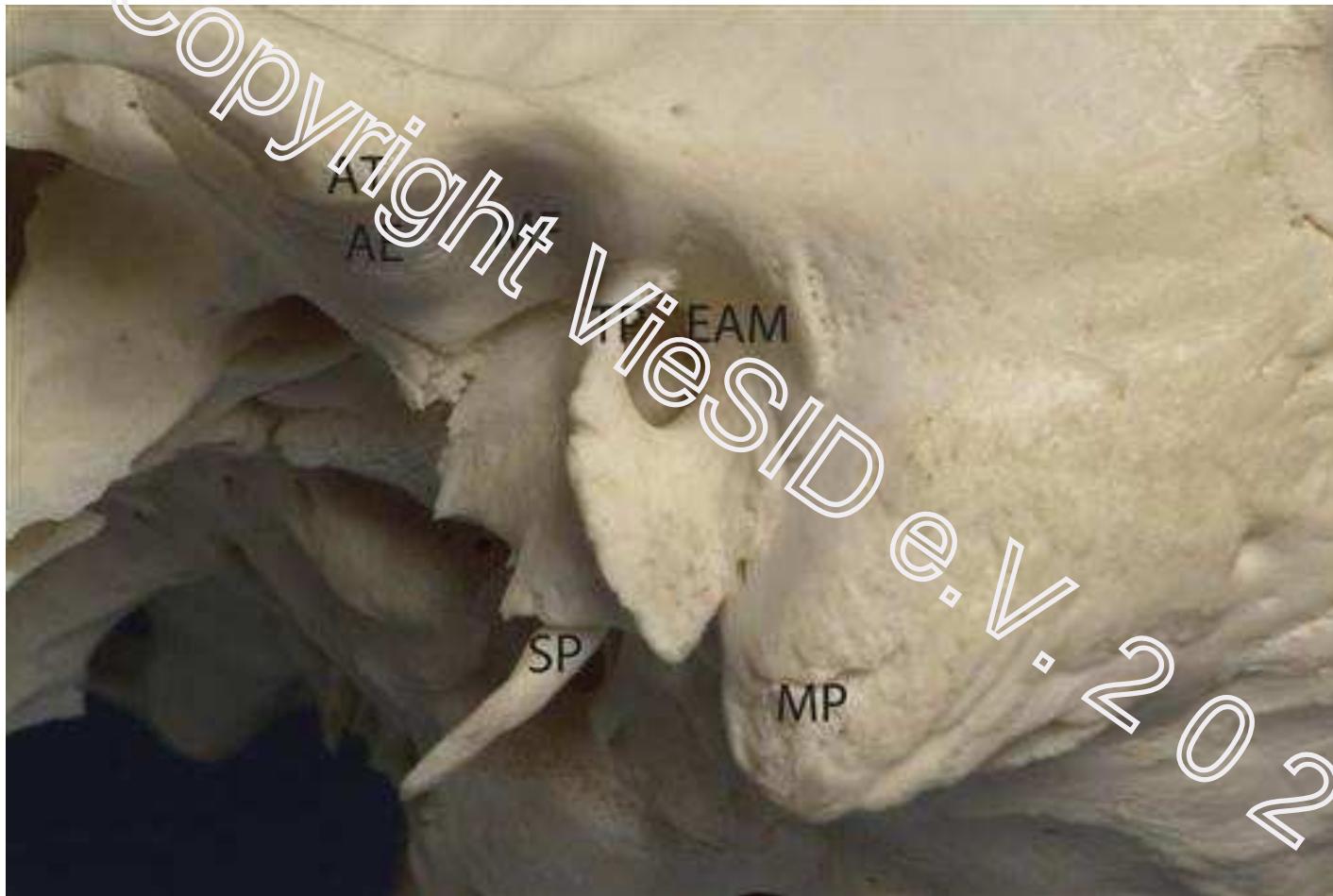
Bony Structures



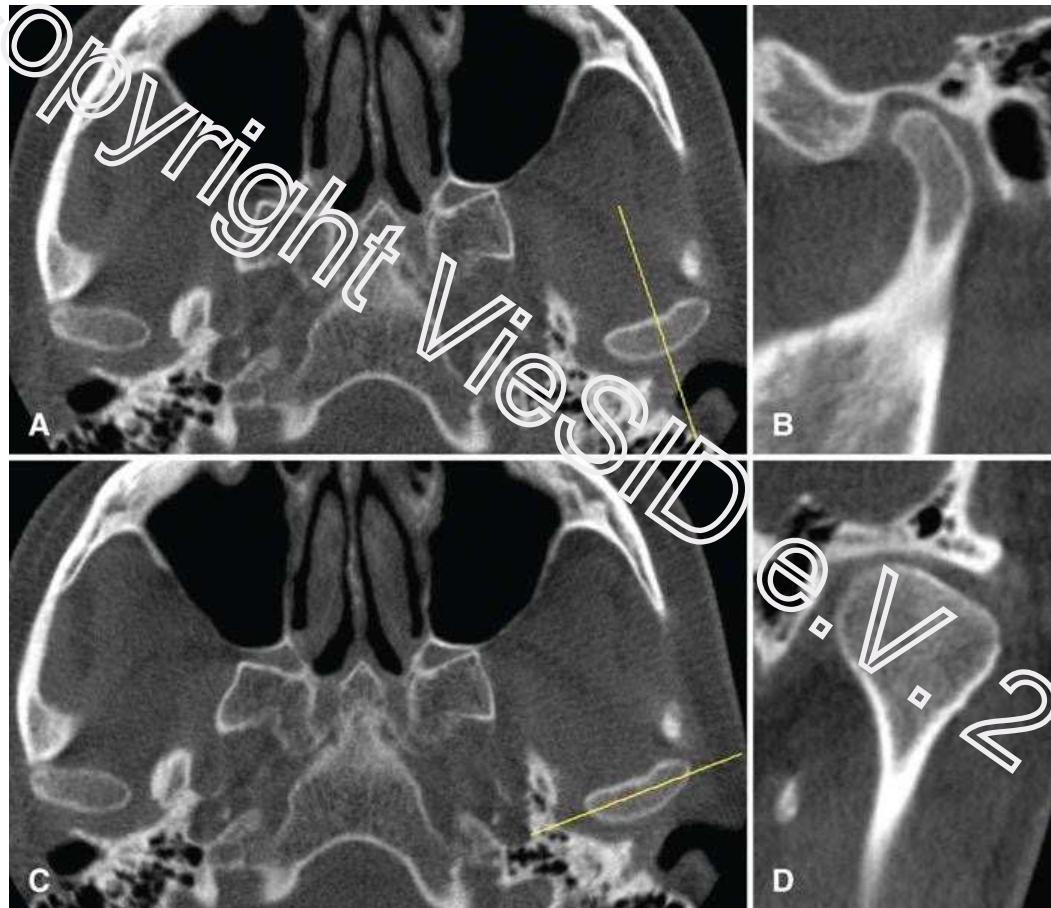
Mandibular Condyle

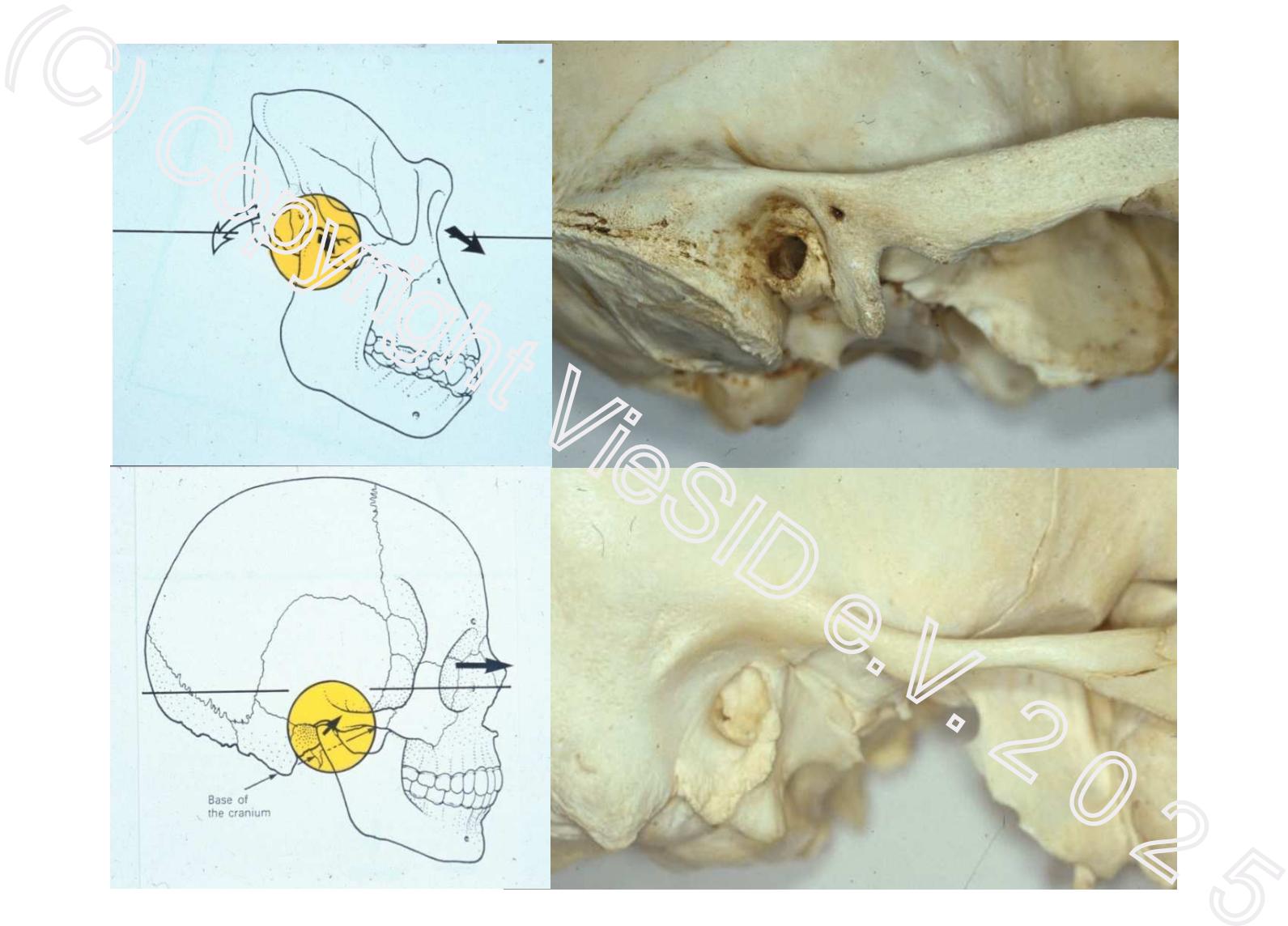


The Glenoid Fossa

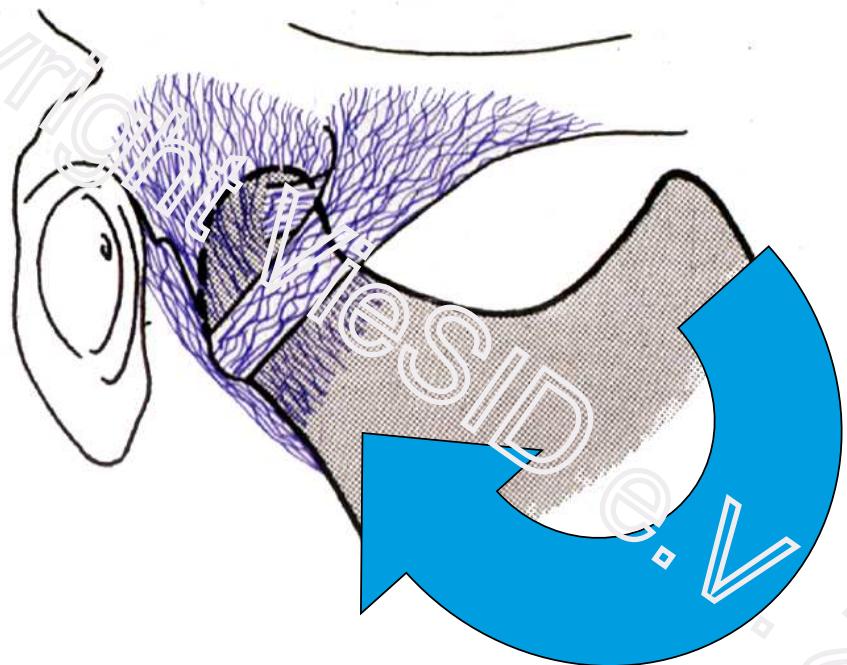


CBCT Sagittal, Coronal TMJ Views



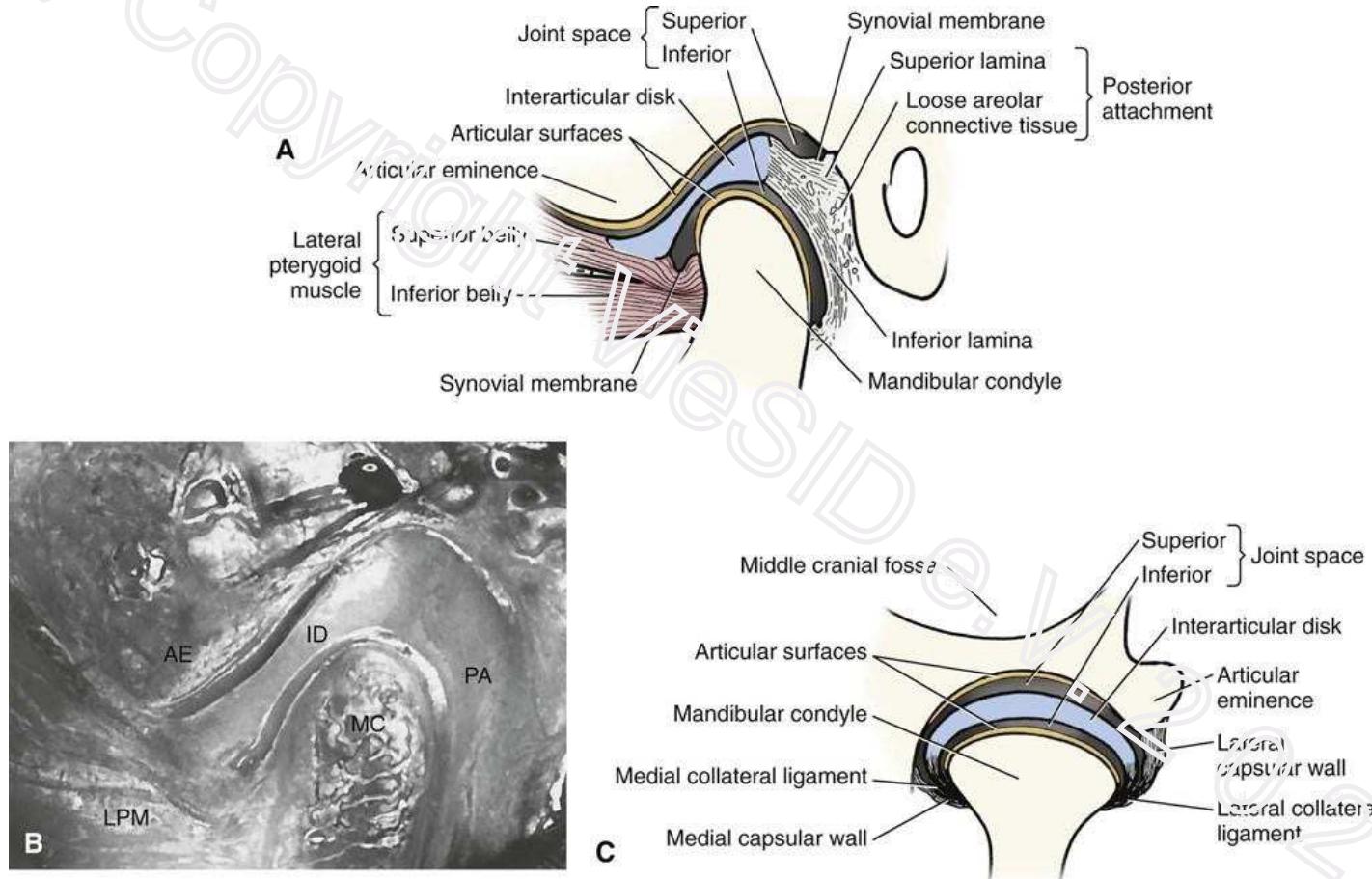


The Joint Capsule & The Temporo-Mandibular Ligament

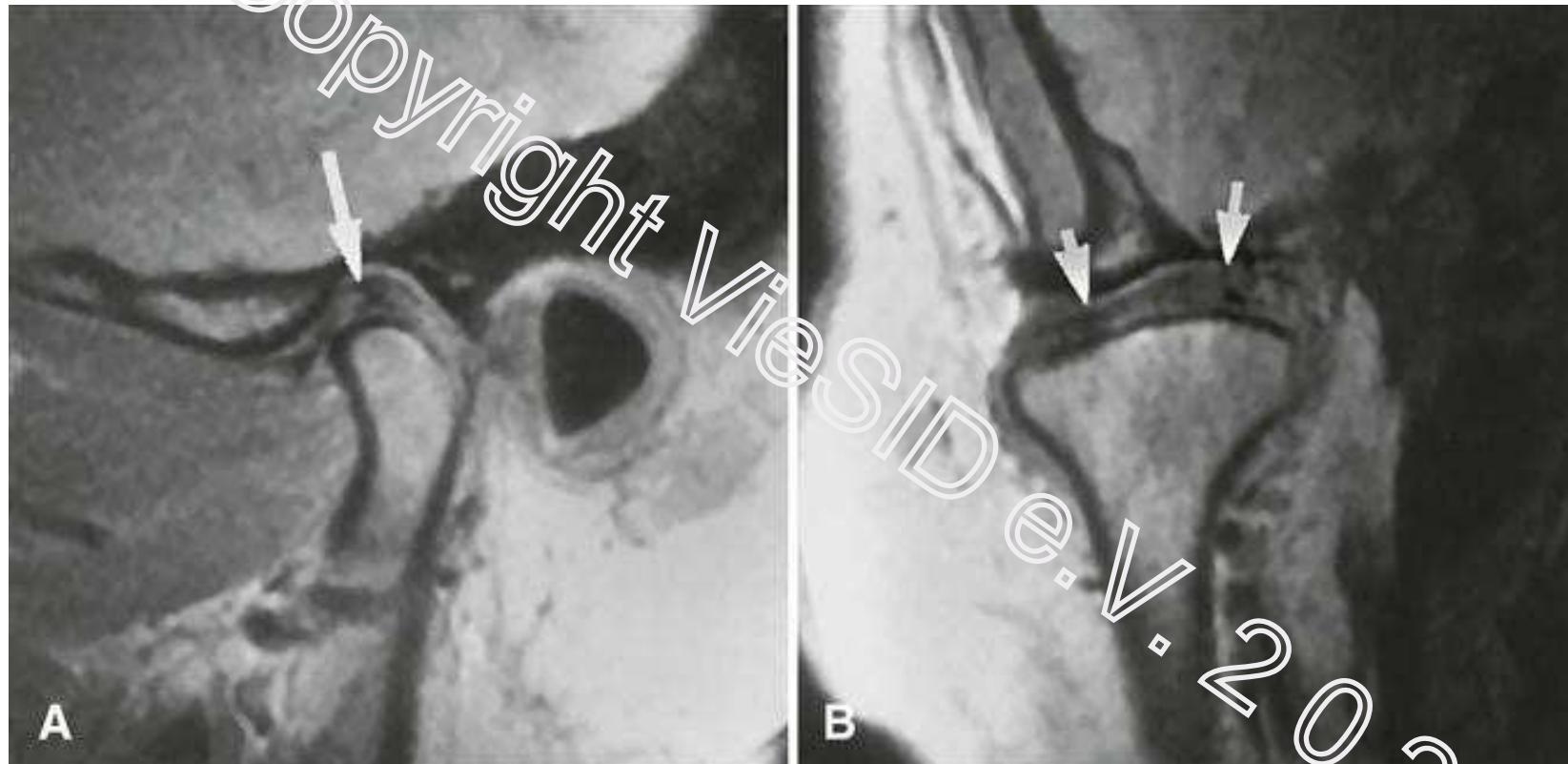


With "loose" ligaments, and with functional problems in the occlusion, the condyles can be displaced postero-superiorly

Articular Disc

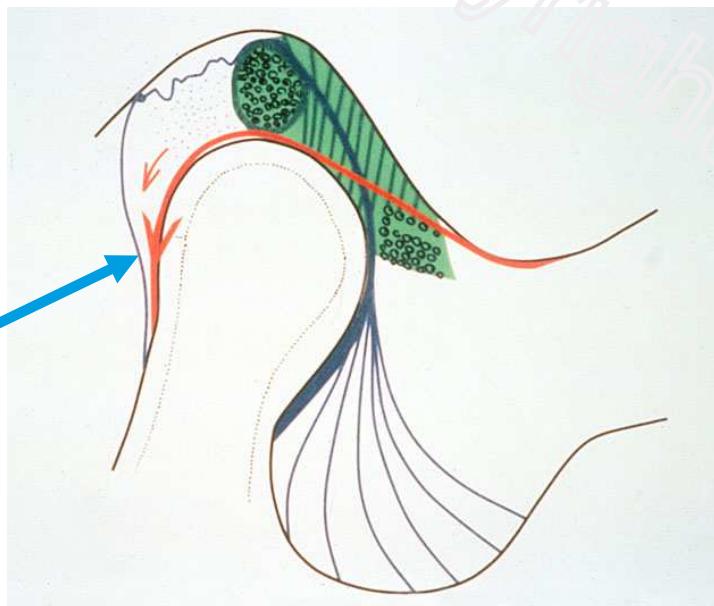


Articular Disc

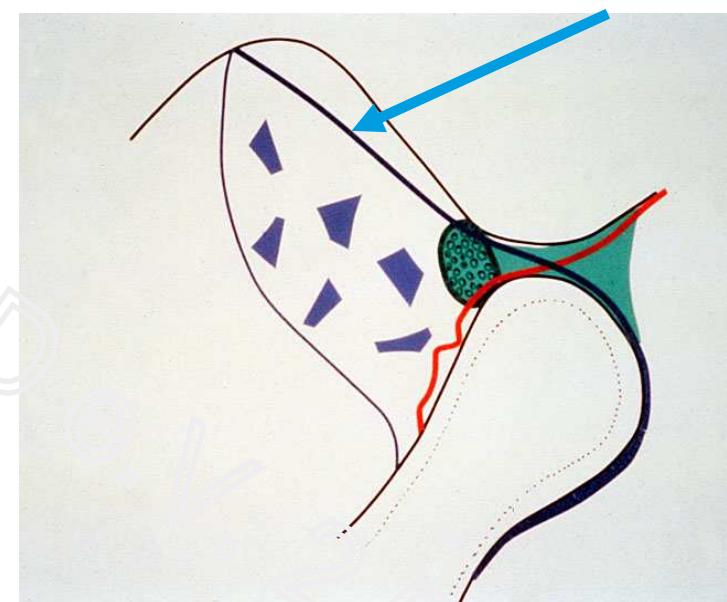


The Bilaminar Zone

Lig. disco-coraylare



Lig. disco-temporale

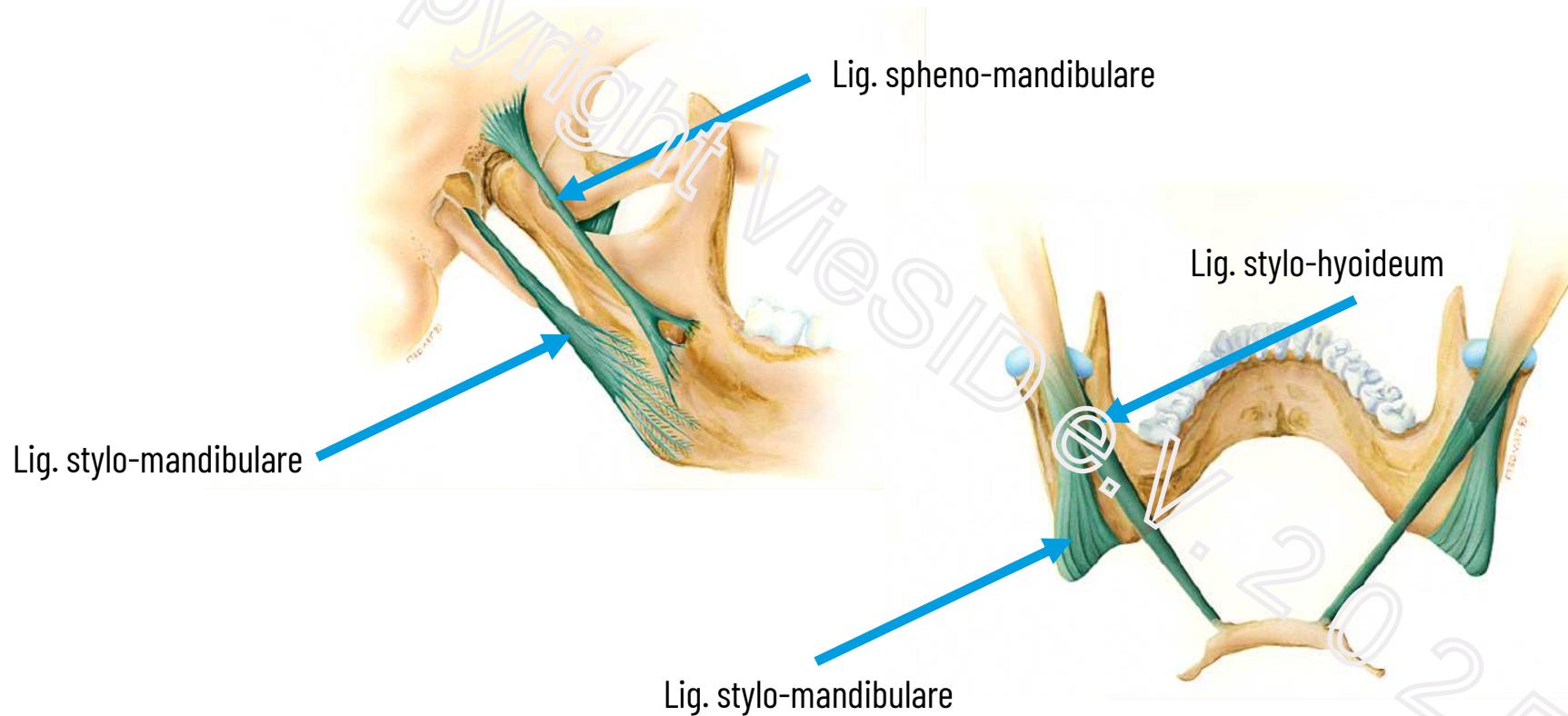


Between the two lamellae lies the hydrodynamic retral pad with functional positioning and protective function.

The Immanent Muscle System of the TMJs

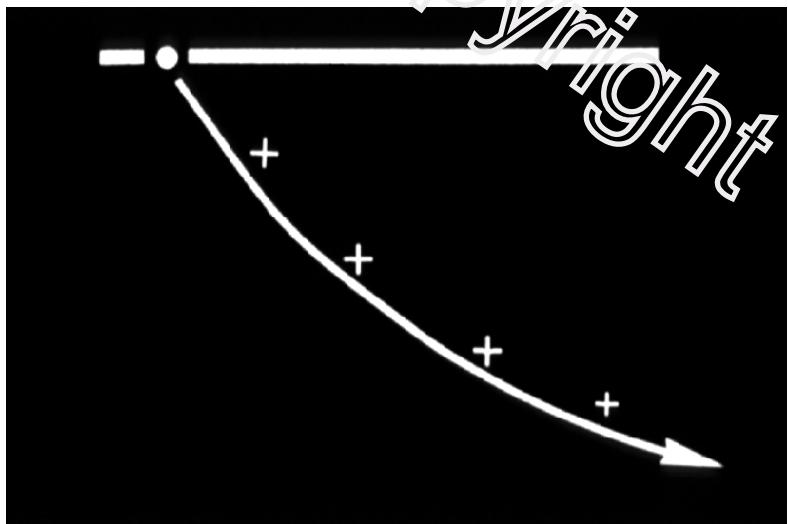


The Extended Ligamentous Attachments

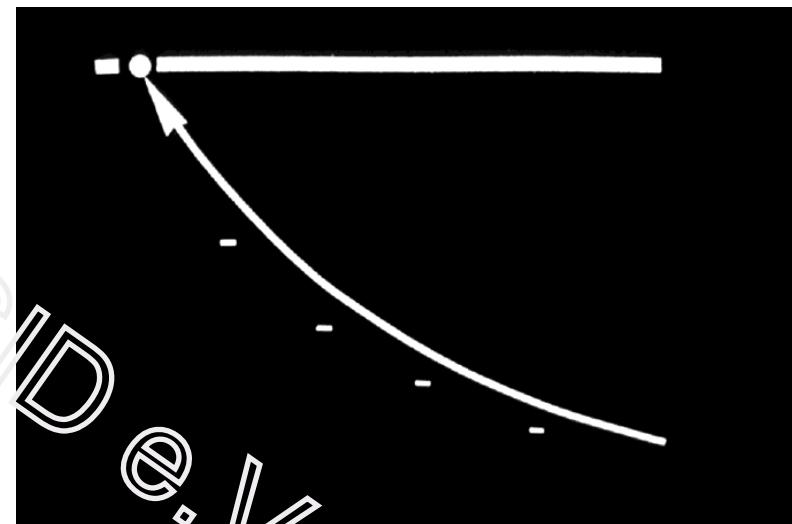


For a smooth functioning, the synovial gliding joint requires frictionless gliding of the articular disc on the articular eminence.

The Synovial Apparatus



Excursive movement



Incursive movement

The two Crano-mandibular joints are in their retral translatory boundary position. The structures of the joints are not loaded in this state.

This gliding motion is always oriented protractively, because it takes place from a retral resting position.

Normal T.M.J.



Per-Lennart Westesson DDS PhD, Lars Eriksson DDS, PhD, University of Lund, Sweden

Centric Relation (CR)

versus

Reference Position (RP)

Centric Relation (CR)

"A maxillomandibular relationship, independent of tooth contact, in which the condyles articulate in the anterior-superior position against the posterior slopes of the articular eminences; in this position, the mandible is restricted to a purely rotary movement; from this unstrained, physiologic, maxillomandibular relationship, the patient can make vertical, lateral or protrusive movements; it is a clinically useful, repeatable reference position".

GPT-9 NEW

Driscoll CF, Freilich MA, Guckes AD, Knoernschild KL, McGarry TJ. The Glossary of Prosthodontic Terms. J Prosthet Dent 2017;117:C1-e105.

Centric Relation (CR)

"The maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the shapes of the articular eminencies. This position is independent of tooth contact. This position is clinically discernible when the mandible is directed superior and anteriorly. It is restricted to a purely rotary movement about the transverse horizontal axis (GPT-5)".

GOPT-8, 2005. The Glossary Of Prostodontic Terms. Prosthetic Dentistry. 94, 10-92.

Centric Relation (CR)

"2: the most retruded physiologic relation of the mandible to the maxillae to and from which the individual can make lateral movements. It is a condition that can exist at various degrees of jaw separation. It occurs around the terminal hinge axis (GPT-3) 3: the most retruded relation of the mandible to the maxillae when the condyles are in the most posterior unstrained position in the glenoid fossae from which lateral movement can be made at any given degree of jaw separation (GPT-1) 4: The most posterior relation of the lower to the upper jaw from which lateral movements can be made at a given vertical dimension (Boucher) 5: a maxilla to mandible relationship in which the condyles and disks are thought to be in the **midmost, uppermost position**. The position has been difficult to define anatomically but is determined clinically by assessing when the jaw can hinge on a fixed terminal axis (up to 25 mm). It is a clinically determined relationship of the mandible to the maxilla when the condyle disk assemblies are positioned in their **most superior position in the mandibular fossae** and against the distal slope of the articular eminence (Ash) 6: the relation of the mandible to the maxillae when the condyles are in the **uppermost and rearmost position** in the glenoid fossae. This position may not be able to be recorded in the presence of dysfunction of the masticatory system 7: a clinically determined position of the mandible placing both condyles into their **anterior uppermost position**. This can be determined in patients without pain or derangement in the TMJ (Ramsfjord)".

Centric Relation (CR)

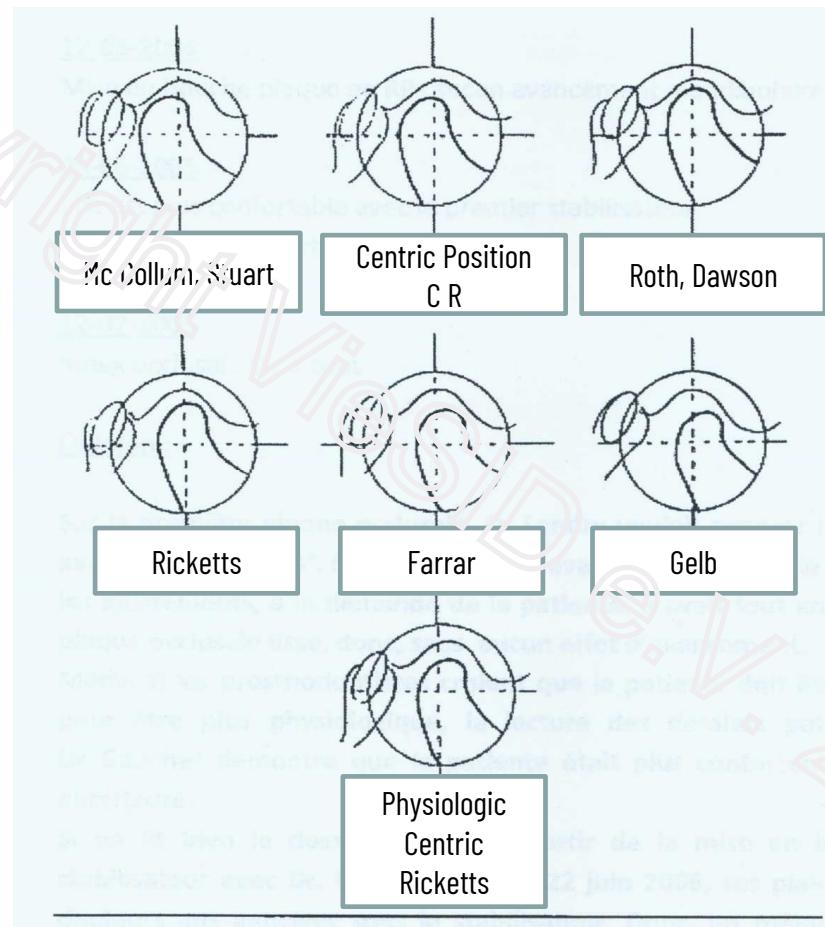
"2: the most retruded physiologic relation of the mandible to the maxillae to and from which the individual can make lateral movements. It is a condition that can exist at various degrees of jaw separation. It occurs around the terminal hinge axis (GPT-3) 3: the most retruded relation of the mandible to the maxillae when the condyles are in the most posterior unstrained position in the glenoid fossae from which lateral movement can be made at any given degree of jaw separation (GPT-1) 4: The most posterior relation of the lower to the upper jaw from which lateral movements can be made at a given vertical dimension (Boucher) 5: a maxilla to mandible relationship in which the condyles and disks are thought to be in the **midmost, uppermost position**. The position has been difficult to define anatomically but is determined clinically by assessing when the jaw can hinge on a fixed terminal axis (up to 25 mm). It is a clinically determined relationship of the mandible to the maxilla when the condyle disk assemblies are positioned in their **most superior position in the mandibular fossae** and against the distal slope of the articular eminence (Ash) 6: the relation of the mandible to the maxillae when the condyles are in the **uppermost and rearmost position** in the glenoid fossae. This position may not be able to be recorded in the presence of dysfunction of the masticatory system 7: a clinically determined position of the mandible placing both condyles into their **anterior uppermost position**. This can be determined in patients without pain or derangement in the TMJ (Ramsfjord)".

Centric Relation Definition: ADA

The CR is the position of the mandible when the condyles are orthopedically stable. This happens when the condyles are in the more antero-superior position in the glenoid fossae, while staying posteriorly to the articular eminence with the disc properly interposed. This position is independent of dental contacts.

Rinchuse, D., S, K., 2006. Centric relation. Jada. 137, 494-501.

Examples of Different Schools of Thought



Jasinevicius, T.R., Yellowitz, J. A., Vaughan, G.G., Brooks, E.S., Baughan, L.W., Cline, N., Theiss, L.B., 2000. Centric relation definitions taught in 7 dental schools: results of faculty and student surveys. *Journal of prosthodontics : official journal of the American College of Prosthodontists*. 9, 87-94.

Purpose:

The purpose of this investigation was to assess the level of consensus regarding the definition of centric relation and its clinical use in 7 US dental schools.

Materials and methods:

The preclinical and clinical faculty in the departments of prosthodontics, operative and general dentistry ($n=137$) at 7 dental schools and a convenience sample of fourth year students ($n=150$) at the same schools were invited to complete 2-page surveys regarding the definitions and use of centric relation at their institutions. The faculty and student survey included 6 commonly used centric relation definitions from the 1994 Glossary of Prosthodontic Terms, and provided space for writing in definitions not listed on the form. The participants were asked to identify which definition was used at their school.

Results:

Numerous definitions are in use at each institution. There were no statistical differences between prosthodontic specialists and nonspecialists in choice of definitions.

Conclusion:

The results of this survey suggest that the controversy will continue, because to date there is no consensus regarding the definition of centric relation within the 7 dental schools surveyed.

Reference Position (RP)

"Both temporomandibular joints are located in translator fashion in their retrial border position, the structures of the joint are not under tension; the condyles are located in the structures of the corresponding articular disks, in contact with the articular eminence. The position is a joint-relative one and is not determined by the occlusion. It is dependent on and influenced by the ligamentary situation and determined by the muscles of the CMS."

Slavicek, R., 2002. The Masticatory Organ: Functions and Dysfunctions. GAMMA Medizinisch-wissenschaftliche Fortbildung-AG.

Reference Position (RP)

- RP is diagnostically the baseline, the zero position, i.e. the neutral zero method, like for other joints of the body in orthopedics.
- RP is the unstrained retral border position of the mandible from which movements start.
- RP is used for the analysis of all of our cases.

Abb. 1a

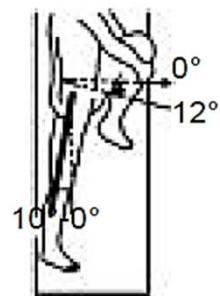
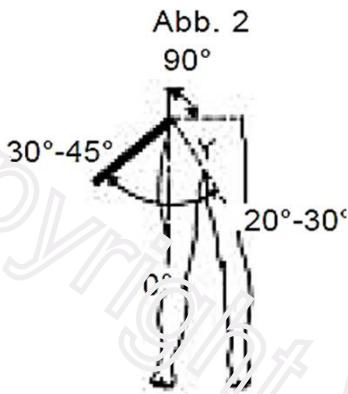


Abb. 1b

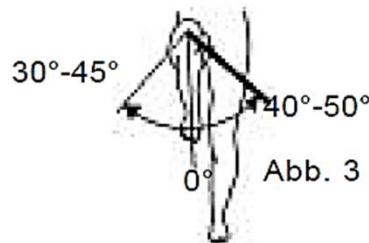


Abb. 2



Streck./Beugg.

Abspreiz./Anführen



Drehg. ausw./einw.

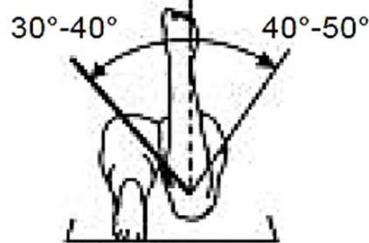


Abb. 4

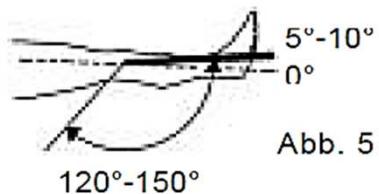


Abb. 5

0° seitw./körperw.
95°

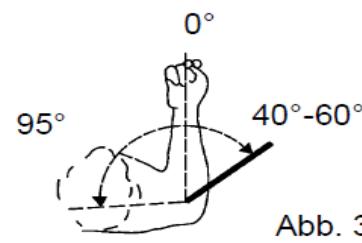


Abb. 3

Drehg. ausw./einw.

0° rückw./vorw.
70°

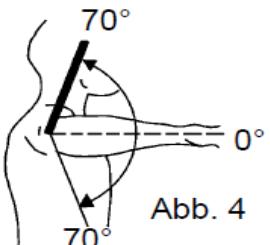
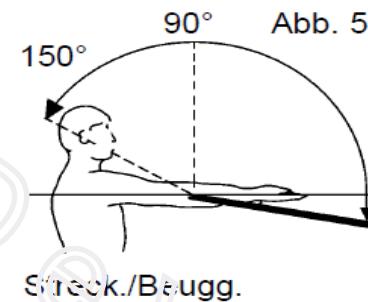


Abb. 4

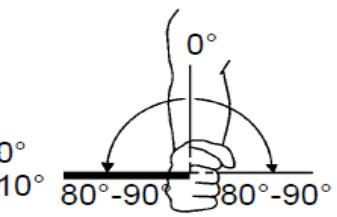
Drehg. ausw./einw.

90° Abb. 5



Streck./Beugg.

0° Abb. 6



Drehg. ausw./einw.

35°-60°

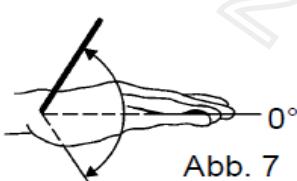
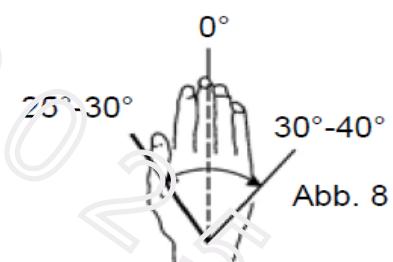


Abb. 7



However, this does not mean that all of our cases will be treated in RP position. After the analysis of each individual case, we must determine if the structures of the joint are in a physiologic union or there exist some kind of internal derangement.

Clinical Applicability of the RP

- RP must be used for the **initial analysis** of every individual case, because it is a border position from which movements start
- During therapy, the decision to treat the **case** in RP or not, must be **based on the diagnosis**.
- If the condyle-disc-eminence are in a physiologic union, RP taken under these conditions could be used for therapy.
- If the condyle-disc-eminence are in a pathologic dis-union, RP taken under these conditions could be also used or changed and used for therapy

Reference Position Record

Reproducible

starting point for assessing, diagnosing and reconstructing the functions (movements) of the masticatory system!

Reference position Record



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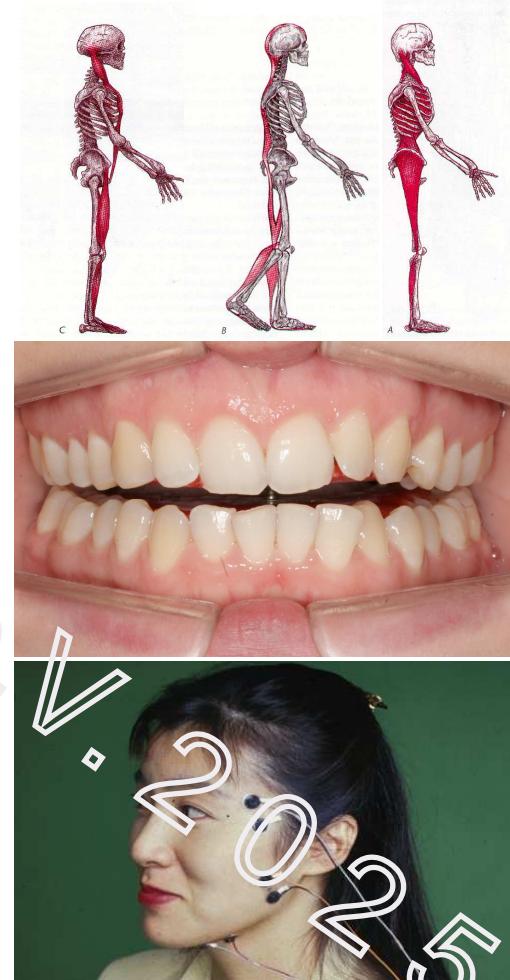
Recording Principles

- Deprogramming of muscles
- Take advantage of the nociceptive trigeminal inhibition reflex of the lower incisors
- Gentle chin-point control (no strain of the ligamentary and articular joint structures; Slavicek 1978)
- Registration material of low vertical dimension, additionally providing minimum resistance during the closing movement.

Dahlström, L., Haraldson, T., 1989. Immediate electromyographic response in masseter and temporal muscles to bite plates and stabilization splints. Scandinavian journal of dental research, MEDLINE. 97, 533-8.

Deprogramming

- The patient should be in a sitting position.
- Several protrusion/retrusion and/or opening/closing movements should be carried out for stretching the muscles and filling the joint chamber with synovia ("lubrication").
- 4-6 min. separating the dental arches with anterior flat plane or central bearing pin
- In neuromuscularly still unstable patients use Transcutaneus Electric Nerve Stimulation (TENS)



International Literature

Olivo, S., Bravo, J., & Magee, D. (2006). The association between head and cervical posture and temporomandibular disorders: A systematic review. *Journal of orofacial Pain*.

Hanke, B. A., Motschall, E., & Türp, J. C. (2007). Association between orthopedic and dental findings: what level of evidence is available? *Journal of orofacial orthopedics*

Monaco, A., Sgolastra, F., Ciarrocchi, I., & Cattaneo, R. (2012). Effects of transcutaneous electrical nervous stimulation on electromyographic and kinesiographic activity of patients with temporomandibular disorders: a placebo-controlled study. *Journal of electromyography and kinesiology : official journal of the International Society of Electrophysiological Kinesiology*, 22(3), 463-8.

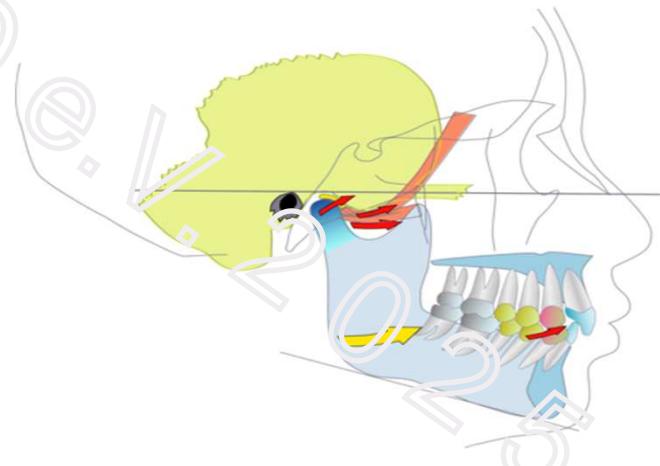
Eble, O. S., Jonas, I. E., & Kappert, H. F. (2000). Transcutaneous electrical nerve stimulation (TENS): its short-term and long-term effects on the masticatory muscles. *Journal of orofacial orthopedics = Fortschritte der Kieferorthopädie : Organ/official journal Deutsche Gesellschaft für Kieferorthopädie*, 61(2), 100-11.

Gentle Chin-Point Control

Every manipulation “enforces” the patient’s counter reaction

During the closing process, CMS muscles position the condyle against the articular eminence (semi-active technique)

“We do not take the bite, but the patient provides us with it!” – whilst avoiding tooth contact, only “dominated” by the NMS and the ligamentary apparatus



International Literature

Shafagh, I., Yoder, J. L., & Thayer, K. E. (1975). Diurnal variance of centric relation position. *The Journal of prosthetic dentistry*, 34(5), 574-82. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/1058959>

Shafagh, I., & Amirloo, R. (1979). Replicability of chinpoint-guidance and anterior programmer for recording centric relation. *The Journal of prosthetic dentistry*, 42(4), 402-4. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/290792>

Simon, R. L., & Nicholls, J. I. (1980). Variability of passively recorded centric relation. *The Journal of prosthetic dentistry*, 44(1), 21-6. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/6929920>

Hobo, S., & Iwata, T. (1985). Reproducibility of mandibular centricity in three dimensions. *The Journal of prosthetic dentistry*, 53(5), 649-54. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/3858529>

International Literature

Piehslinger, E., Celar, A., Celar, R., Jäger, W., & Slavicek, R. (1993). Reproducibility of the condylar reference position. Journal of orofacial pain, 7(1), 68-75. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/8467299>

McKee, J. R. (1997). Comparing condylar position repeatability for standardized versus nonstandardized methods of achieving centric relation. The Journal of prosthetic dentistry, 77(3), 280-4. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9069083>

Keshvad, A., & Winstanley, R. B. (2003). Comparison of the replicability of routinely used centric relation registration techniques. Journal of prosthodontics : official journal of the American College of Prosthodontists, 12(2), 90-101. doi:10.1016/S1059-941X(03)00036-6

Alvarez, M. C., Turbino, M. L., Barros, C. de, Pagnano, V. O., & Bezzon, O. L. (2009). Comparative study of intermaxillary relationships of manual and swallowing methods. Brazilian dental journal, 20(1), 78-83. Retrieved from <http://www.scielo.br/pdf/bdj/v20n1/v20n1a14.pdf>

Bite Registration Techniques

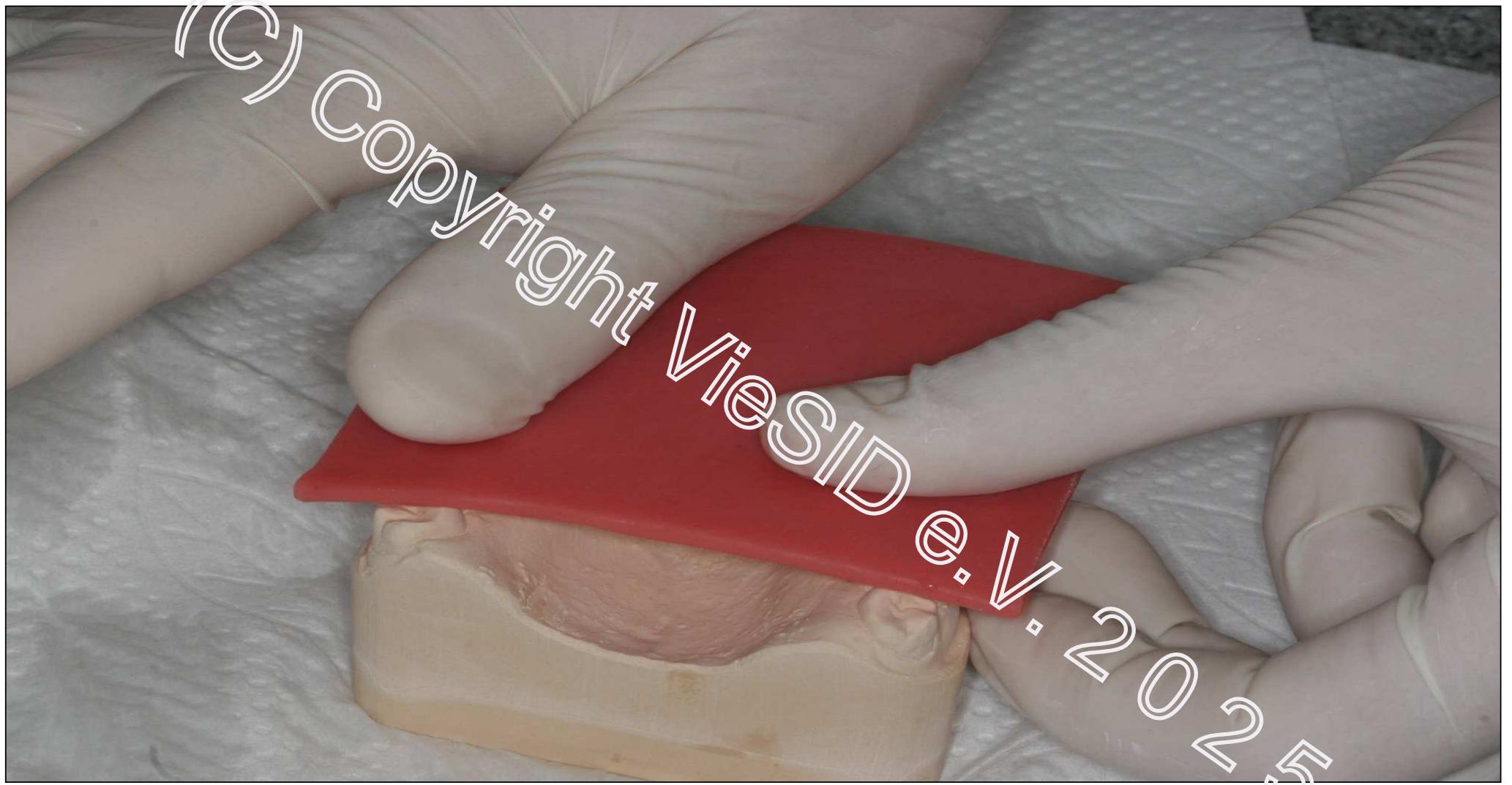
- Beauty pink base plate with aluminium wax
- Primobyte base plate with Primobyte detail paste
- Anterior resin bite stop with lateral Beauty pink wax stripes
- Central bearing pin (without arrowhead tracing)

Beauty Pink Base Plate with Aluwax

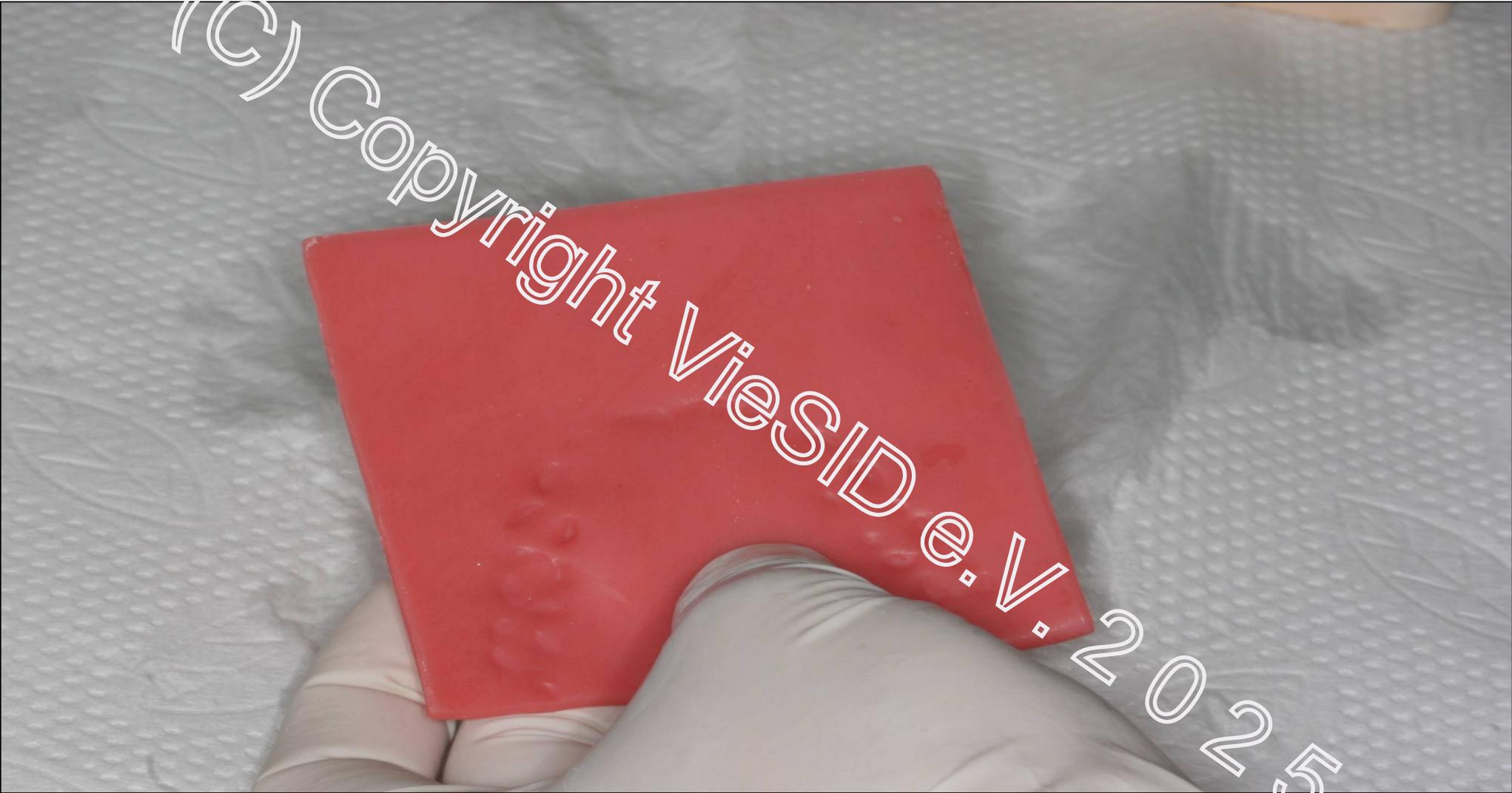




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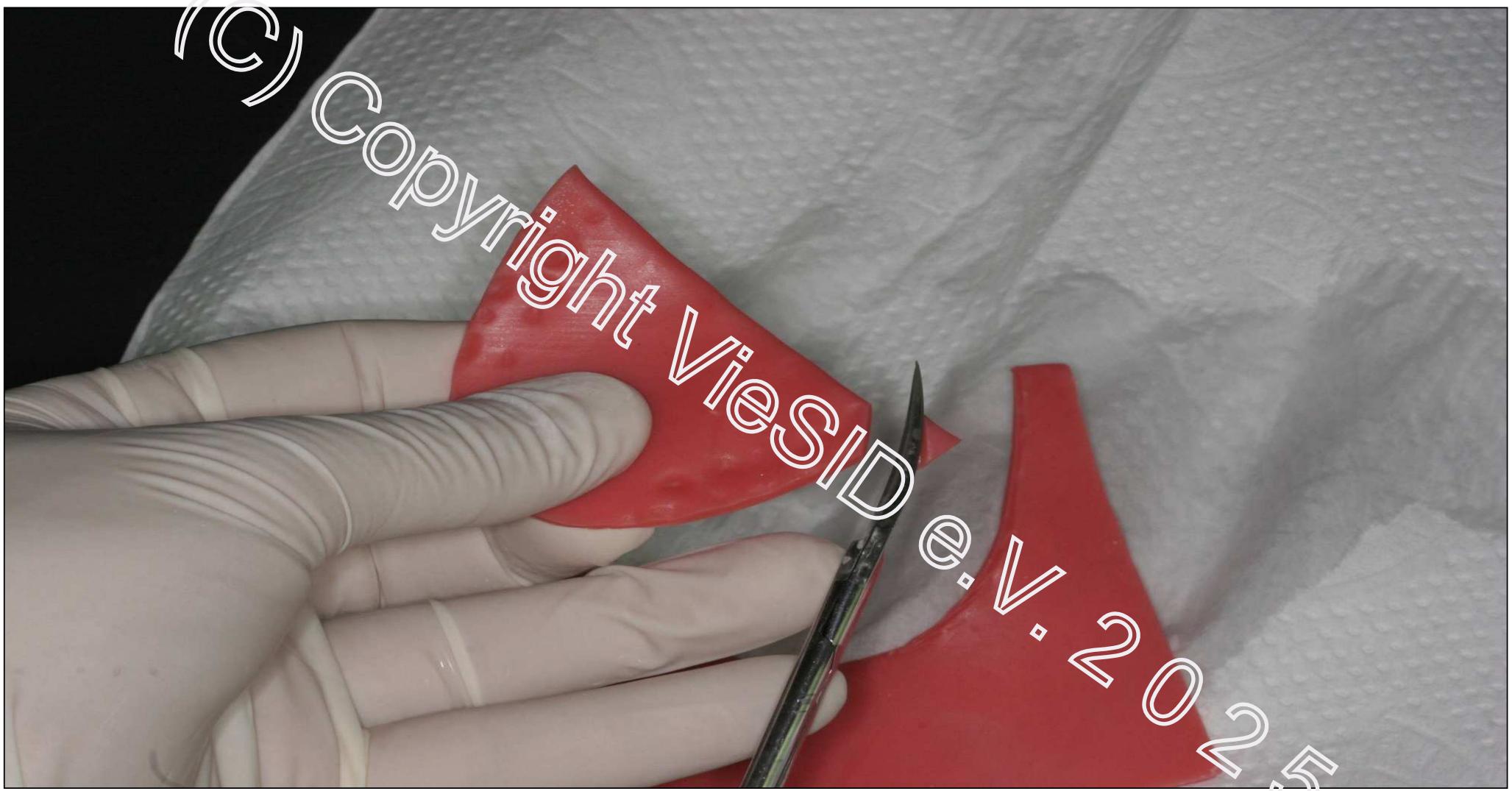


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A close-up photograph of a red rectangular identification card being held by two hands wearing white nitrile gloves. The card has 'VieSID e.V.' printed on it. The background is a light-colored, textured surface.

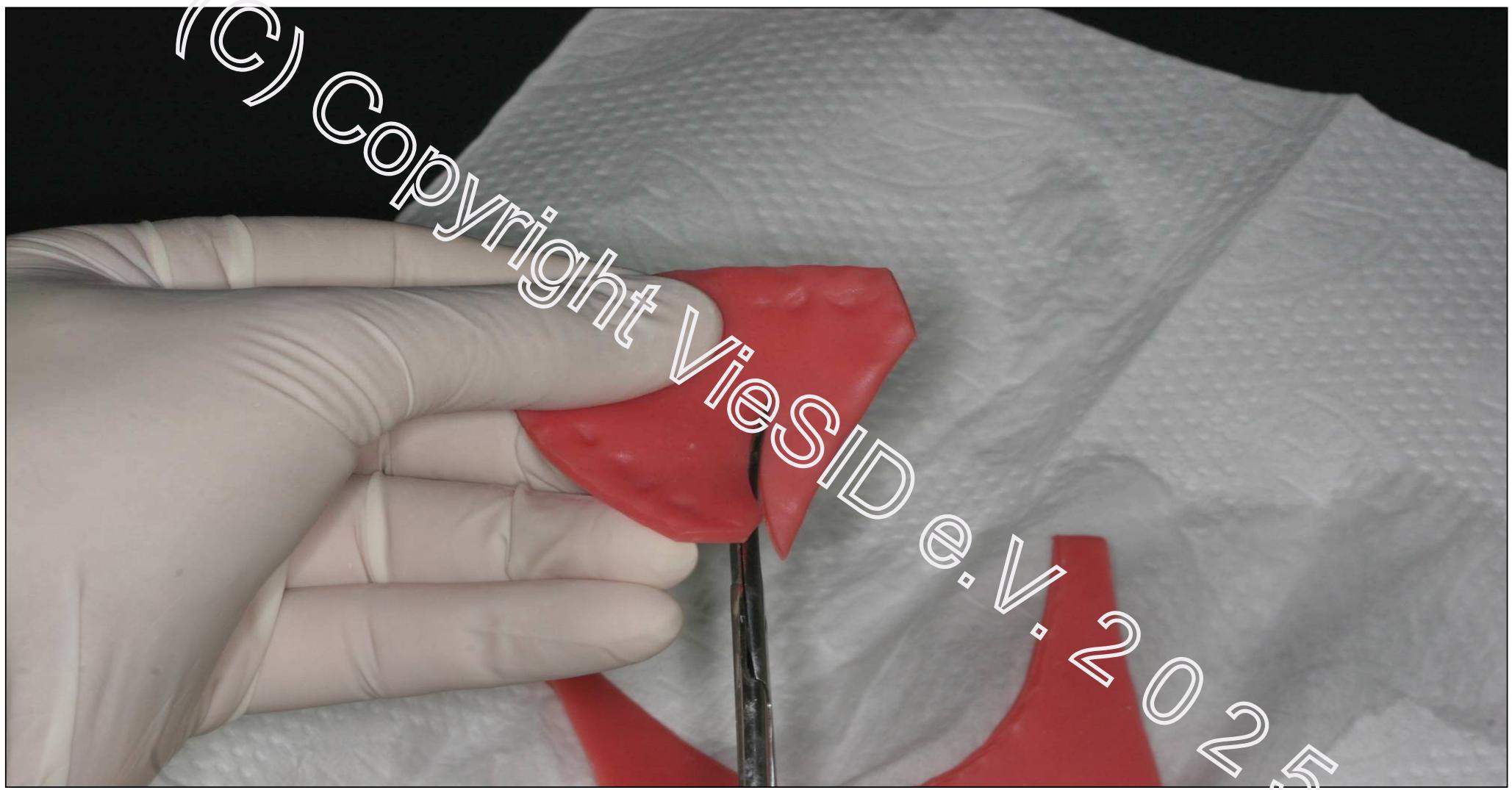
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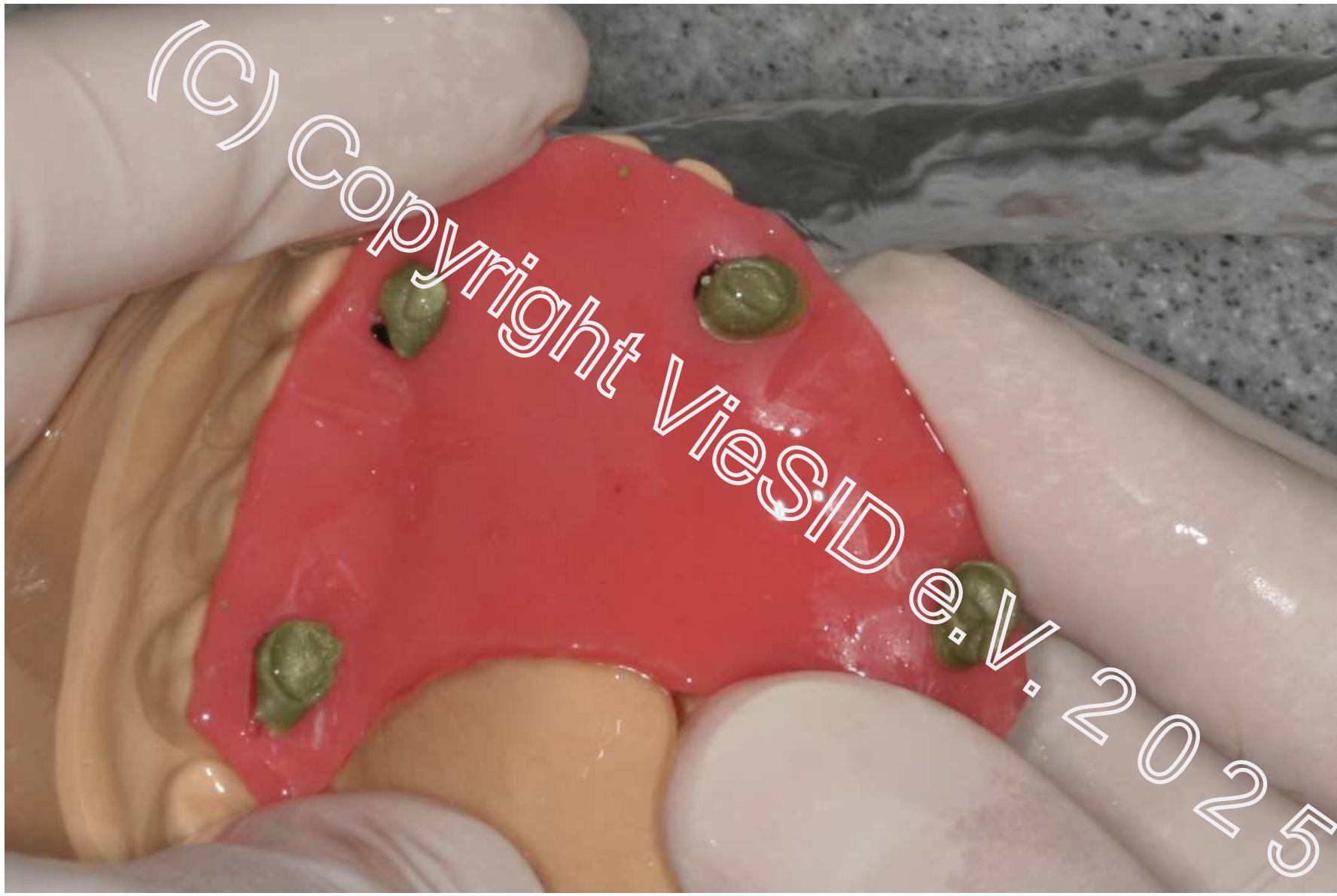
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Few Other Techniques



Plate registration (light-curing plastics) using composite or aluminum wax as detail paste.

The Primebyte Technique



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The Primebyte Technique



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Anterior Bite Stop, Lateral Wax Stripes



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Anterior Bite Stop, Lateral Wax Stripes



Central Bearing Pin



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Central Bearing Pin



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Central Bearing Pin



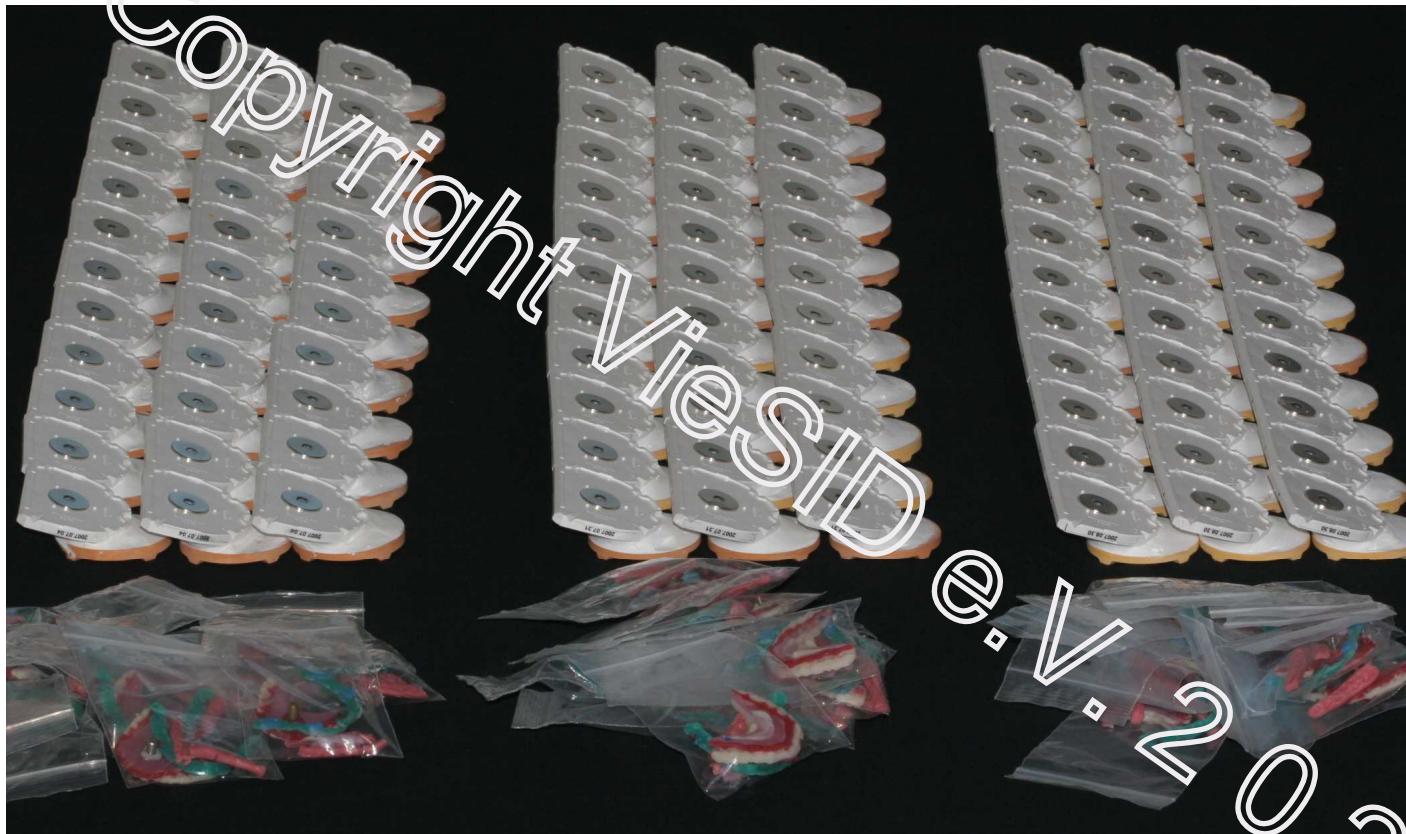
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Verification Study Reference Position

Ury E., Master Thesis, 2007, DUK

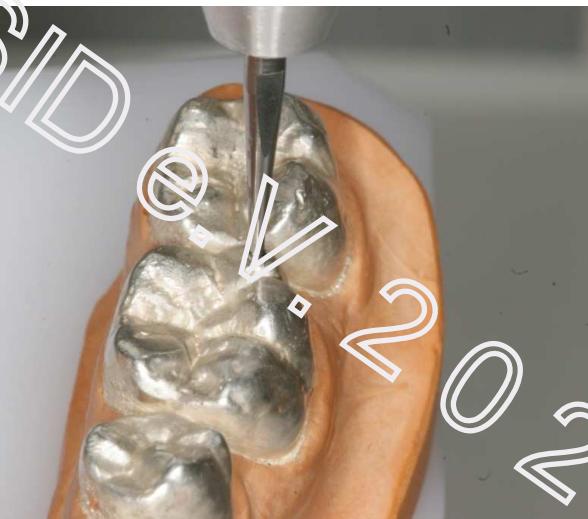
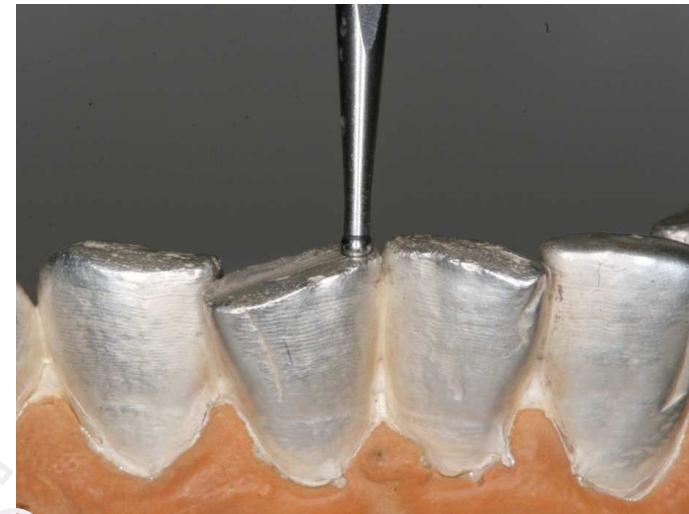


The 3 Different Techniques



3D-digitalization of the X, Y, Z coordinates of 3 points in the same lower dental arch after 99 mountings to the same upper jaw model.

Highly reproducible



The End of Presentation

