CM LOC® – Clinical Cases
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1.

Implant-Retained Overdentures Using an Attachment with True-Alignment Correction

PD Dr. Murali SRINIVASAN / Prof. Dr. med. Dent. Frauke MÜLLER
Implant-Retained Overdentures Using an Attachment with True-Alignment Correction: A Case Series

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Severely resorbed residual alveolar ridges in edentulous patients preclude the construction of retentive and stable complete dentures (CDs). Ill-fitting CDs can compromise oral function, thereby affecting the individual’s oral health–related quality of life (OHRQoL) and possibly causing psychosocial problems. Implant therapy is often preferred to preserve the residual ridges in the peri-implant area, improve the retention of the removable dental prosthesis (RDP), and maintain the stability of the RDP during function, thereby improving the masticatory efficiency as well as the patient’s OHRQoL. However, for implant overdenture (IOD) therapy to be successful, the number and position of implants are considered essential aspects in an ideal treatment concept. This may not always be possible in functionally compromised elderly individuals, particularly in those with severely resorbed jaws. Factors such as anatomical constraints, compromised multimorbid health statuses, economic factors, or the patient’s choice to not opt for complex surgeries in addition to implementing the geriatric treatment aspect of reducing the treatment burden could greatly influence the number of implants planned and also sometimes the alignment parallelism.

Implant parallelism is considered a cardinal criterion for the successful rehabilitation of edentulous jaws with implant-retained overdentures (IODs), especially if freestanding anchorage systems (unsplinted attachments) are employed. This report aimed to demonstrate the successful use of a novel IOD attachment with a true-alignment capability in complex cases with large inter-implant angular discrepancies. The report further aimed to highlight the use of a novel polyetherketoneketone (PEKK) framework as a reinforcement material for fabricating a completely metal-free IOD. Although some freestanding attachments exploit their geometric form and/or use various retentive inserts to compensate for inter-implant angular discrepancies, a true-alignment correction is seldom achieved. The CM LOC FLEX (Cendres+Métaux attachment) provides a true alignment correction and produces parallelism between implants in clinical situations where the implants are not parallel to one another. The functionality of the CM LOC FLEX was described in this case report for two different clinical situations: a conventional mandibular IOD retained by two implants, and a maxillary IOD retained by four implants. Both cases involved a complex clinical situation with compromised implant parallelism. The CM LOC FLEX abutment has a true-alignment correction mechanism that can be advantageous in clinical situations where the inter-implant axial alignments are not parallel. PEKK frameworks are lightweight, strong, and can be esthetic substitutes for conventional metal frameworks. However, well-designed clinical studies are further needed to assess the clinical performance as well as the maintenance requirements of the illustrated novel attachment and the PEKK framework before advocating them as validated and standard protocols. Int J Prosthodont 2019;32:482–496. doi: 10.11607/ijp.6469
of the implants placed. In effect, inter-implant alignments may deviate from the ideal, resulting in clinical situations that may not always be easy to rehabilitate and may potentially cause frequent prosthetic complications and lead to increased maintenance needs. In such situations, the right choice of anchorage system may play a fundamental factor in achieving a successful rehabilitation. The selected attachment should not be cumbersome to process; ought to be easy to clean, repair, or remake; must not be too retentive for frail elderly individuals with low hand force and/or dexterity; and, finally, not have a high initial cost.

The CM LOC FLEX anchor (Cendres+Métaux), is an unsplinted, stud-type attachment system that is specifically designed for clinical situations where the inter-implant angulation is not parallel. The attachment system has an angular compensatory mechanism for up to 60 degrees between implants. The abutment head is designed to act as a swiveling head, which is free to rotate until the desired parallelism is achieved. A dual-curing resin cement is then injected into the abutment head, which is fixed at the desired angulation once the cement has set. The female component of this anchor comprises a housing assembly that holds a retentive insert. The retentive inserts are available in different strengths and are made from polyetherketoneketone (PEKK) (Pekkton, Cendres+Métaux). For higher retentive demands, a gold alloy (Elitor, Cendres+Métaux) insert is further available. This Elitor insert is adjustable, as the retentive force can be further increased or decreased per the patient’s individual requirement. The housing itself is available in two material options: Pekkton or titanium, both of which utilize the same PEKK inserts; the Elitor insert, however, can only be used with a titanium housing. Furthermore, PEKK being a strong and durable polymer, it is versatile in its use and can be used with various different veneering materials, making it a suitable material of choice for a framework that can be utilized for both fixed and removable implant reconstructions.

Therefore, the objectives of this clinical report were to demonstrate the functionality of a novel attachment with a true-alignment correction capability in complex cases with large inter-implant angular discrepancies and to demonstrate the use of PEKK as a viable reinforcing framework material in IODs.

CASE 1: MANDIBULAR IOD RETAINED BY CM LOC FLEX ATTACHMENTS ON TWO TISSUE-LEVEL IMPLANTS

A 59-year-old man dissatisfied with his existing mandibular IOD retained by two implants opposing a conventional maxillary CD was referred to the Removable Prosthodontics Clinics for rehabilitation. His chief complaints included an unstable mandibular IOD, lack of retention, inability to eat, pain, and discomfort. The patient also reported the need for frequent maintenance visits to improve the retention of his unstable IOD. He also complained of pain in the peri-implant region around the implant on his left side. He did not have any complaints with his maxillary CD. The existing prostheses had been in situ for approximately 2 years. His medical history revealed controlled diabetes mellitus, but the patient was otherwise healthy. Extraoral examination revealed no apparent pathology, no TMJ problems, and no history of parafunctional habits. His mouth opening was normal. Intraoral and radiographic examinations revealed a severely resorbed maxilla and mandible (Figs 1a to 1c). There were two Regular Neck Tissue-Level Straumann implants (Institut Straumann) with a stud-type anchorage system (Locator, ZEST Anchors) present in the mandible in the regions corresponding to tooth positions 33 and 43 (FDI). The implants were divergent to one another, and the inter-implant angular deviation was large (estimated to be > 40 degrees) (Fig 1d). The peri-implant mucosa around implant 33 was inflamed, revealing signs of pressure and frictional trauma (Fig 2a). After careful consideration of the patient’s current complaints and his financial situation, a conservative treatment plan was decided. A decision was made to change the existing attachments to CM LOC FLEX attachments and to process the corresponding housings in the existing IOD intraorally.

The Locator abutments were first unscrewed from the implants. The case guides (Cendres+Métaux) were then mounted on the implants to check the height of the gingival cuff for choosing the correct FLEX abutments (Fig 2b). The gingival cuff height was measured as 1 mm and 2 mm on implants 43 and 33, respectively. The appropriate CM LOC FLEX attachments were selected (Figs 2c and 2d). The abutments were first hand tightened on the implants (Fig 3a), then subsequently tightened to 35 Ncm using a ratchet and torque control device (Cendres+Métaux) per the manufacturer’s recommendations (Fig 3b). As a next step, for aligning the abutments, a separating medium (Vaseline, Unilever) was first applied on the abutment head to help easily remove the excess cement. The abutment aligners (Cendres+Métaux) were then seated on the abutments (Fig 3c). Extreme care was exercised to ensure that the filling funnel of the aligner was properly seated onto the central filling hole on the abutment head (Fig 3d). For aligning the abutments, a dual-curing resin cement (Rely X, 3M ESPE) was injected into the aligner in order to fill the abutment’s cement chamber (Fig 4a). The excess cement flow was confirmed through the lateral escape outlets present adjacent to the central filling hole (Fig 4b). The abutments were then tipped manually until the desired parallelism was achieved (Figs 4c and 4d).
Fig 1  (a) Orthopantomogram showing initial situation. (b) Intraoral occlusal view of edentulous maxilla. (c) Occlusal view of mandible with two tissue-level implants. (d) Planners in place illustrating inter-implant angular discrepancy. Note: The discrepancy between the implant positions in (a) and (d) is due to the poor three-dimensional positioning of the implants.

Fig 2  (a) Evidence of peri-implant inflammation. (b) Abutment height selection. (c) Selected CM LOC FLEX abutment (GH1). (d) Positioning of abutment.
The alignment was performed within the cement’s specified setting time. The aligners were then left undisturbed until the final setting of the cement was completed (Figs 4c and 4d). Subsequently, the aligners were removed, and the abutment heads were cleared of the excess cement (Figs 5a and 5b). The former denture caps were removed from the IOD using a housing extractor (Cendres+Métaux) (Figs 5c and 5d). The Pekkton housings (Figs 6a and 6b) were subsequently snapped on the aligned abutments (Fig 6c). The available space in the IOD was then verified using a silicone material (Fit Checker Advanced, GC) (Fig 6d). Exposed denture intaglio surfaces were marked and trimmed until the required clearance was obtained. After a final check, the IOD was cleaned and prepared for the intraoral processing of the housings. Petroleum jelly (Vaseline, Unilever) was applied on the mucosa of the edentulous ridge adjacent to the implants and on the lips of the patient to prevent any possible irritation from the autopolymerizing polymethylmethacrylate (PMMA) resin. The housings were removed from the attachments in order to place the block-out spacers (Cendres+Métaux) onto the abutments, and the housings were subsequently snapped back onto the abutments (Figs 7a and 7b). Care was taken not to contaminate the housing surfaces with the petroleum jelly, as this could interfere with the mechanical locking of the resin to the housing. The PMMA resin (Unifast, GC EUROPE) was mixed and applied with a disposable microbrush (3M ESPE) on top of the housing and then into the housing spaces of the IOD using a regular cement spatula (Fig 7c). The IOD was then carefully seated, and the patient was requested to close into centric occlusion and maintain the bite until the PMMA resin polymerization was complete (Fig 7d). The IOD was then removed and inspected. Excess resin around the housings was trimmed, finished, and then polished (Fig 8a). The white processing inserts were then removed using the multi-tool (Cendres+Métaux) with the side marked “OUT” (Figs 8b to 8d), and then replaced with green (medium-strength) inserts with the same multi-tool but with the side marked “IN” (Figs 9a to 9c). The multi-tool used in this case history has currently been replaced with a multi-tool with a central slot to facilitate easier placement of the retentive insert. Final checks were then performed, and the patient was given postinsertion and denture hygiene instructions (Fig 9d).
Fig 4  (a) Injection of dual-curing resin cement. (b) Verification of excess cement flow. (c) Abutments tipped to correct parallelism. (d) Occlusal view of aligned abutments.

Fig 5  (a) Removal of abutment aligners and excess cement. (b) Occlusal view of aligned abutments. (c, d) Removal of former denture caps using housing extractor.
Fig 6  (a) Basic Pekkton set. (b) Pekkton housings with white processing inserts. (c) Housings positioned for space verification. (d) Space verification.

Fig 7  (a) Block-out spacers in place. (b) Housings positioned. (c) PMMA resin filled in housing space. (d) IOD in situ with patient in centric occlusion.
**Fig 8**  
(a) Processed housings in IOD.  
(b) Multi-tool.  
(c, d) Removal of processing insert with side marked “OUT.”

**Fig 9**  
(a, b) Insertion of green retentive insert with side marked “IN.”  
(c) Finished prosthesis.  
(d) Prostheses in situ.
A 72-year-old man was referred to the Removable Prosthodontic Clinic for the rehabilitation of a completely edentulous maxilla and partially edentulous mandible. His chief complaints included inability to eat properly and poor esthetics. His desire was to have a good reconstruction that was functional and esthetic. His extraoral examination revealed a piercing in the left ala of the nose, no pathologies, a mouth opening that was considered normal, and no evidence of TMJ problems. He did not report any history of parafunctional habits. Intraoral and radiographic examinations revealed a completely edentulous maxilla rehabilitated with an immediate CD opposing a Kennedy Class III, Division 1 partially edentulous mandible with the following remaining teeth: 48, 43, 42, 41, 31, 32, 33, and 38. Tooth 43 was nonvital and revealed an apical pathology. The patient reported that he was very uncomfortable with the palatal part of the immediate denture and expressed a desire for a prosthesis without a palate. The definitive treatment plan included a palate-free maxillary IOD retained by four tissue-level implants and a mandibular tooth-supported, chrome-cast RDP and a root canal treatment (RCT) planned for tooth 43. Furthermore, the maxillary IOD was planned to be reinforced with a PEKK framework (Pekkton, Cendres+Métaux).

As a first step, the RCT was performed on tooth 43. Next, four Regular Neck Tissue-Level Straumann implants (Institut Straumann) were placed in the maxilla, in the regions of 15, 13, 23, and 25, in a single-stage surgery adhering to the implant manufacturer’s recommended standard surgical protocol (Fig 10a). The immediate denture was well relieved to not engage the implants during the healing phase and was subsequently relined using a functional tissue-conditioning material (F. I. T. T., Kerr). A cast post-and-core coping with a ball anchor was planned for 43 in order to eliminate an unesthetic anterior clasp assembly in the mandibular cast RDP. However, it was then decided to not engage the tooth for RDP support, as the tooth was not entirely symptom-free and the prognosis was considered...
questionable. Hence, a decision was made to amputate the crown portion of 43 to the level of the gingival margin, and a composite restoration was placed to cover the amputated part. The tooth was left in place, unloaded, to help maintain the bone in that region (Fig 10b). The implants were allowed to heal for a period of 6 weeks before construction of the definitive prostheses commenced (Fig 10c). Standard clinical steps and protocols for the construction of an IOD and a cast RDP were followed. During the impression phase it was confirmed that the implants were divergent to one another and that an inter-implant angular discrepancy of over 40 degrees existed (Fig 10d). Therefore, the decision to use the CM LOC FLEX anchors was made. After the clinical verification of the wax trial dentures (Fig 11a), the maxillary definitive model and the teeth setup in wax were scanned by the digital dental lab technician. This information was essential for a digital design of the PEKK framework. A final design preview was then sent to the treating clinician for approval (Fig 11b). The PEKK framework was subsequently milled after design approval and then sent to the clinician. The framework was tried-in for fit and stability (Fig 11c). The teeth were then transferred onto this framework using a silicone key, exactly as the earlier approved setup. This setup on the framework was verified and approved by the patient before denture processing. The definitive maxillary IOD with a PEKK framework and a conventional cast RDP (Figs 11d to 12b) was then manufactured by a dental technician in a conventional dental lab. The housing spaces for the intraoral processing of the housings were already incorporated into the finished IOD by the technician (Fig 12a). The prostheses were tried-in intraorally and checked for retention, stability, fit, extensions, aesthetics, and occlusion.

The healing abutments were first removed from the implants (Figs 12c), and the case guides (Cendres+Métaux) were mounted for measuring the correct gingival cuff height (Figs 12d and 13a). The cuff heights were measured to be 1 mm for all the implants, and the appropriate FLEX abutment (GH1) was selected (Figs 13b to 13d). Pekkton housings with PEKK inserts were selected to be used in this case to keep the IOD metal-free. The abutment tightening and aligning were performed in the same manner as described in the previous case (Figs 14a to 15c). The housing space was
Fig 12  (a) Finished prosthesis with housing spaces. (b) Finished cast RPD. (c) Healing abutments being removed. (d) Case guides being positioned.

Fig 13  (a) Case guides in place showing implant divergences. (b) Selected abutment with 1-mm cuff height (GH1). (c, d) Hand tightening of abutments.
then verified (Fig 15d). An additional step was necessary during the processing of the housings in this case to facilitate the adhesion between the framework and the PMMA resin. The housing spaces were first sandblasted with aluminum oxide particles (Fig 16c). Then a PMMA and composite primer (Visio.link, Bredent) was applied on the Pekkton surfaces and light cured for 90 seconds (Fig 16d). Following this, the usual steps of processing...
the housings with autopolymerizing PMMA were followed (Figs 17a to 17c). The processing inserts were removed (Fig 17d) and replaced with yellow (extra-low retentive strength) inserts, as the retention strength was deemed sufficient initially both by the clinician and the patient (Figs 18a and 18b). After denture delivery, detailed postinsertion and hygiene instructions were given to the patient (Figs 18c and 18d).
DISCUSSION

In the past, bar attachments (splinted attachments) have often been used as the attachments of choice for situations where implants were not parallel to one another.\(^\text{25,27}\) However, bar attachments are cumbersome to fabricate, present problems with hygiene and gingival hyperplasia under the bar,\(^\text{36–38}\) are not easy to repair or remake,\(^\text{39}\) and may be too retentive for elderly individuals with poor manual dexterity. Finally, they are relatively expensive, especially concerning the initial cost.\(^\text{40}\)

Moreover, bar attachments require ideal inter-arch distances,\(^\text{34,35}\) the lack of which may compromise the esthetics or the functionality of the IOD. Even though some unsplinted anchorage systems are known to compensate for angular deviations to a certain degree, premature loss of retention, attachment, and insert wear, as well as an increased need for maintenance, have all been reported as frequent complications.\(^\text{19,30–33}\)

The compensatory mechanism provided by these unsplinted attachments are either via their geometric configurations, separate angulated options available in their midst, and/or purpose-built retentive inserts, none of which provide an actual alignment correction. The highlighted cases were examples where implants were either improperly positioned or where axial deviations were dictated by anatomical constraints and limitations concerning the invasiveness of the intervention. A lack of parallelism is frequently a cause for unsuccessful rehabilitation because of premature or rapid retention loss, inadequate retention, and poor stability, leading to excessive maintenance costs that often result in patient dissatisfaction, potentially even affecting the OHRQoL.

Attachments with true-alignment correction capabilities promise to sustain their intended retentive behavior even in situations of large inter-implant angular deviations.\(^\text{24}\) These unsplinted attachments should theoretically perform better than those unsplinted attachments without a true-alignment correction mechanism.\(^\text{24}\) However, this needs to be confirmed with well-designed clinical trials. Novel attachments such as the one described in this report seem highly advantageous, notably by providing solutions that remain within the spectrum of geriatric treatment concepts of remaining minimally invasive, as they may enable a reduction of treatment burden through avoiding bone grafting procedures. The demonstrated attachment highlights the possibility of providing a simple, efficient, and cost-effective solution. The entire procedure was completed in a single chairside visit, avoiding multiple patient visits.
and extensive clinical as well as laboratory procedures. In effect, the same existing prosthesis was used and corrected to provide a viable and satisfactory outcome. From a geriatric perspective, this is highly advantageous, especially for elderly patients with dependency and limited access to care. The attachment is fairly new, and mechanical problems encountered with this system have yet to be documented. Therefore, the frequency of the possible mechanical complications, such as wear of the attachment head and damage to the retention insert and/or the housing assembly, all may be important factors in clinical decision making when choosing to employ this system. Moreover, the use of unsplinted attachments in the maxilla has been documented to increase the probability of implant failure. This factor must be considered before using these attachments, and careful case selection is pertinent to avoid failure.

PEKK is a strong and durable polymer that displays both amorphous and crystalline material properties. Its unique property makes it an apt material for implant reconstructions. It can be milled and pressed with a surface that can be easily polished. Although it is strong, it is light in weight and metal-free, insulant to thermal and electrical conductivity, has no odor or taste, can be sterilized, and is radiopaque. Since it is metal-free, it can be used safely in patients with metal allergies. A huge advantage of this material is its compatibility with various different veneering materials. Its beige (ivory) color may present an esthetic and psychologic advantage. PEKK-reinforced IODs are lightweight and do not have the gray shadows that are usually seen in IODs with metal reinforcements. Another advantage of this material is that although it is strong, it can be easily trimmed and adjusted when required. The enumerated advantages thus make PEKK a suitable choice for a framework material in both fixed and removable implant reconstructions, but its clinical long-term performance remains to be evaluated.

CONCLUSIONS

- The CM LOC FLEX abutment has a true-alignment correction mechanism that can be advantageous in clinical situations where the inter-implant axial alignments are not parallel.
- In terms of its clinical manipulation, these attachments are simple to employ, but the manufacturer’s instructions must be strictly adhered to in order to avoid processing errors.
- PEKK frameworks are lightweight, strong, and can be esthetic substitutes for conventional metal frameworks.
- Well-designed clinical studies are further needed to assess the clinical performance, as well as the maintenance requirements, of the illustrated novel attachment and the PEKK framework before advocating them as validated and standard protocols.
- Although novel systems provide solutions to complex clinical situations, appropriate prosthetically driven implant planning along with a close working relationship between the surgeon and the prosthetodontist are cardinal to avoid poor implant positioning.

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REFERENCES

Rehabilitation of the Edentulous Mandible with an Immediately Loaded Full-Arch Fixed Prosthesis Supported by Three Implants: A 5-Year Retrospective Analysis

The purpose of this study was to evaluate the clinical and radiographic outcomes of full-arch mandibular rehabilitation with a fixed prosthesis supported by three immediately loaded implants at least 5 years of follow-up. The sample comprised 58 patients who underwent prosthetic treatment with immediate loading. Radiographic evaluation of bone loss was carried out in Adobe Photoshop CS5 by a single calibrated examiner using digitized panoramic radiographs. Clinical examination of the technical conditions of the prosthetic device assessed the condition of the acrylic resin base, dental occlusion, metal framework, presence of cover screws, screw fixation of the prosthesis and abutments, and length of cantilevers and resistance arms. Five implants in four patients failed for an overall success rate of 97.13%. Mean bone loss was 2.65 ± 1.06 mm around central implants and 2.11 ± 0.84 mm around distal implants. The most common complication was loss of abutment torque. Half of all patients in the sample experienced some prosthetic complication. There was no evidence of a statistically significant relationship of cantilever length with bone loss or prosthetic complications. The immediately loaded three-implant-supported fixed prosthesis protocol tested in this study proved to be a viable therapeutic strategy for mandibular rehabilitation in edentulous patients with favorable outcomes after 5 years of clinical and radiographic follow-up.

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2.

CM LOC® for CAD CAM milled mandibular implant overdenture supported by two soft tissue level implants

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CM LOC®

for CAD CAM milled mandibular implant overdenture supported by two soft tissue level implants

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INITIAL PRESENTATION

Intra-oral occlusal view of the completely edentulous maxilla

Intra-oral occlusal view of the completely edentulous mandible with two regular neck soft tissue level Straumann® implants.
EXISTING PROSTHESES

Upper conventional complete denture

Lower conventional complete denture converted from a previous removable cast partial denture.
PANORAMIC RADIOGRAPHS (OPT)

Pre-operative OPT

Immediate Post-Op
DEFINITIVE MASTER IMPRESSIONS

Upper and lower definitive impressions were made using thermoplastic stock trays and polyvinylsiloxane impression materials.
REGISTRATION OF JAW RELATIONS

Vertical and horizontal jaw relations were recorded using an anatomic measuring device (AMD) from AVADENT®
Verification of jaw relations was done with gothic arch tracing and then was registered with a bite registration material. Tooth size, form and shade were then selected.
A 3D scan of the AMD is made and exported to the milling centre
DIGITAL PREVIEW OF THE VIRTUAL TEETH SET UP

Upper Occlusal

Right Sagittal

Left Sagittal Anterior

Lower Occlusal

Anterior

Overjet
COMPLETED CAD CAM MILLED DENTURES

Pre-milled slots for the attachment housings in the lower denture
Intra-oral buccal view of the implants ready to be loaded

Occlusal view of the implants after removing the healing screws
ABUTMENT SELECTION

CM LOC® Case Guide for Straumann® RN 4.8

CM LOC® Case Guide mounted on the implant to select the correct abutment height

CM LOC® Abutment for Straumann RN 4.8 GH1 selected
Applying a chlorhexidine gel for disinfection of the implant screw channels before attachment fixation.
ABUTMENT INSERTION

Selected CM LOC® Abutment mounted on the screwdriver

CM LOC® Abutment being placed and first, hand fastened on the implant
CM LOC® Abutments tightened to 35Ncm on the implants (position 33, 43) using a CM ratchet and torque control device
CM LOC® Abutments in place as seen from the occlusal and buccal views ready for processing the female housings in the mandibular overdenture
INCORPORATING THE FEMALE PART HOUSING PEKKTON® IN THE LOWER IMPLANT OVERDENTURE

CM LOC® Basic Pekkton® set consisting of the female part housing Pekkton® and three retention inserts (yellow, red and green)

Female part housing Pekkton® with the processing insert (white)
Buccal and occlusal views of the implants prepared for the direct intraoral integration of the female housing into the mandibular implant overdenture.
POSITIONING THE FEMALE PART
HOUSING PEKKTONE®

Housing Pekkton® being correctly positioned and stabilised on the CM LOC® Abutment
SPACE VERIFICATION

Pre-milled processing slots in the overdenture

Verification procedure to check for adequate space in the overdenture for incorporating the female housings
DIRECT PROCESSING OF THE FEMALE PART HOUSING
PEKKTON®

Resin monomer being applied to prepare the surface of the milled slots

A thin layer of PMMA resin being applied on the housing.
Polymethylmethacrylate (PMMA) resin filled in the milled slots

CAD CAM milled dentures placed in the mouth and the patient was instructed to rest in occlusion till the resin completed its initial polymerisation phase.
Female part housing picked up intraorally by the PMMA resin. Excess PMMA resin trimmed and finished.
Removing the processing insert using the CM LOC® Multi-Tool with the side marked ‘OUT’
CHANGING THE RETENTION INSERT

Inserting the new retention insert (extra low) in the lower IOD using the CM LOC® Multi-Tool with the side marked ‘IN’
Implant overdenture processed with the female part housing Pekkton® and fitted with an extra-low (yellow) retention insert.

CAD CAM milled upper conventional complete denture and lower implant overdenture inserted.
3.

CM LOC® Case presentations

PD Dr. Murali SRINIVASAN /
Prof. Dr. med. Dent. Frauke MÜLLER
CM LOC®

Case Presentation - An esthetic indication.

Division of Gerodontology & Removable Prosthodontics
University Clinics of Dental Medicine,
University of Geneva, Geneva, Switzerland

Murali SRINIVASAN
Frauke MÜLLER
INITIAL PRESENTATION

Intra-oral buccal view of the existing removable partial dentures

Occlusal view
Intra-oral buccal view without the removable partial dentures

Straumann® Regular Neck Tissue level Implants placed in edentulous sites - 16, 34 & 44
CLINICAL STEPS

Implants ready for loading

Healing cap removed
ABUTMENT SELECTION

CM LOC® Case Guide for Straumann® RN 4.8

CM LOC® Case Guide mounted on the implant to select the correct abutment height

CM LOC® Abutment for Straumann RN 4.8 GH1 selected
ABUTMENT INSERTION

CM LOC® Screwdriver

CM LOC® Abutment mounted on the screwdriver

CM LOC® Abutment being fastened on the implant
ABUTMENT TIGHTENING

C+M Ratchet and torque control device

Torque set to 35Ncm on the device

CM LOC® Abutment being tightened to 35Ncm
Impression Making

Occlusal view showing the selected CM LOC® Abutments in place
CM LOC® Impression part

CM LOC® Impression part clipped on the abutment

Light body flow polyvinyl siloxane material first expressed on the impression cap

A pick-up impression made using a more viscous consistency.
LABORATORY STEPS

CM LOC® Analog correctly positioned in the impression before pouring the cast.
Master models with CM LOC® analogs
“Ideally a conventional palatal strap major connector would have been the design of choice, instead the above design was employed due to patient’s wishes and preference.”
CM LOC® female part housing Pekkton® with the processing insert

Finished RPDs with the CM LOC® female part housing Pekkton® containing processing retention inserts.
CHANGING the RETENTION INSERTS

CM LOC® Multi-Tool for changing the retention inserts made of Pekkton®

‘IN’ marked on the blunt ended side for placing the inserts

‘OUT’ marked on the semi-lunar shaped side for removing the inserts
Removing the processing insert the with CM LOC® Multi-Tool with the side marked ‘OUT’
Inserting the new Retention Insert (Medium) in the upper and lower RPDs using the CM LOC® Multi-Tool with the side marked ‘IN’
Inserting the new Retention Insert (Medium) in the upper and lower RPDs using the CM LOC® Multi-Tool with the side marked ‘IN’
PROSTHESES DELIVERY

Finished prostheses with the Retention inserts ready for delivery
4.

CM LOC® Product presentation
Prof. Dr. Norbert Enkling
The new Implant-Anchor


Norbert Enkling, Prof. Dr. med. dent. Dr. med. dent, MAS
CM LOC®

The New Implant Anchor for Implant-Overdentures in the Mandible and in the Maxilla

Prof. Dr. Norbert Enkling
Kreuztal - Bonn - Bern
The edentulous patient

Standard of care: 2 interforaminal implants in lower jaw


Effectiveness of mandibular IOD: 1990-2015

High scientific and clinical evidence:

It works & Benefit for the patients

Chewing function

Economic aspects
Attachments: *Current trend towards single-attachments*

**Single-attachment**
- **Ready-for-use**
  - Ball
  - Locator
  - SFI Anchor
  - CM-LOC
  - Magnet
  - SynCone
- **Customized**: Conical-Crowns

**BAR**
- **Ready-for-use**
  - SFI Bar
- **Customized**
  - Prefabricated parts: round/ egg-shape/ parallel
  - Individual: parallel-wall

**Combination**
Wear resistance of single attachments: Ball

Ball- Attachments: Wear at the male part in vivo and in-vitro (Ludwig et al. 2005)
In-vitro Study: Dalla Bona Plus - Best Female Part

**In-vitro**

Ball: Tima Matrix, Plus Matrix, Plastic inserts
Locator: Plastic insert

(Ludwig et al. 2005)
Ball-Attachments: Wear of the Matrix-Patrix System increases by enhanced divergences of the implant-axes
Zest Anchors, Escondido, USA

- No rigid IOD connection
- Easy maintenance
- But heavy wear,
  if implants are not inserted parallelly:

  up to 40% loss of retention force

→ Problem for patient-satisfaction (Abi Nader S 2011)
Wear at the Locator®

heavy wear

• At the female part
• At the male part

if implants are not inserted parallelly:

up to 40% loss of retention force

→ Problem for patient-satisfaction

(Abi Nader S 2011)
Wear at the Locator®

• At the female part
• At the male part

6 Months: Follow-up
Wear at the Locator®

heavy wear
- At the female part
- At the male part

4 Years Follow-up
Abrasive characteristics of plastic-materials
Abrasion due to rotational movements of the denture
The kind of plastic materials matters ...

Metall-free Pekkton Matrix-Housing and Matrix-Inserts

Fitting on CM-LOC and on Locator® (Zest-Anchors)

Two Matrices: up to 40°

1) Pekkton: extra-low, low, medium, strong

2) Gold: Elitor®: medium, strong, extra strong
→ ideal high precious alloy for overdenture attachments

Precise, long lasting retention
Implant systems with CM LOC®

Straumann: RN, RC, NNC
Nobel Biocare: Replace NP, RN
Astra Tech: 3.5 / 4.5 mm
Zimmer: 4.5 mm
Clinical Case: Mandible with 2 Implants
CM LOC®
Advantage: limited vertical height
→ Only 1.5mm
→ GH: 1, 2, 3, 4, 5 mm
Impression taking

Nobel:
35 Ncm
Gold Matrix: activatable retention
Oral Hygiene

Single-attachments are easier to clean than bars: Inflammatory mucosal proliferation at bar

Cave:
Plaque-retention at single-attachments

→ Advantage for the CM LOC®:
compact and round design with no sharp edges
Clinical Case: 4 Implants in the Maxilla: direct mounting of the female parts using umbrellas
Pekkton® - Female Parts: Direct mounting

Extra low

Low
Outlook: CM-LOC® Alignable Anchor

Like SFI Anchor® (for Straumann Implant System)

- Straight Anchor: region 41, 43
- Alignable Anchor: region 33

→ to compensate divergent implant axes
5.

CM LOC® FLEX Anchorage of maxillary removable dental prosthesis on 4 implants, indirect method. (Case 1)

Prof. Dr. med. Dent. Martin Schimmel
Clinical application of the CM LOC® FLEX
Case 1: 83 year old male patient, anchorage of maxillary removable dental prosthesis on 4 implants. Indirect method.

This report refers to the instructions for use (IFU) for the CM LOC® FLEX version 11.2015 as provided by Cendres+Métaux SA (Rue de Boujean 122, CH-2501 Biel/Bienne, Switzerland). The report aims to proof that a clinician (here: Prof. Dr. med. dent. Martin Schimmel, MAS Oral Biol; University of Bern, Switzerland) is able to follow the provided IFU of the above mentioned attachment system and thus to validate the before mentioned document.

Exemplary, a male 83 year-old edentulous patient was selected for this clinical procedure. He had received 4 Straumann Standard Implants® (SLA active surface, 8mm length, Regular Neck, 4.1mm diameter, Straumann, Basel, Switzerland) in March 2011. They were placed following the recommended surgical protocol for edentulous patients in the maxilla without augmentation procedures, but due to insufficient local alveolar bone mass they had been placed in an unfavorable angle for the subsequent prosthetic restoration. However, the implants osseointegrated uneventfully and were loaded after 3 months healing time using Locator® attachments (Zest Anchors, Escondido, CA, USA) to retain an implant supported overdenture (IOD). Subsequently, he lost the implant upper in the left quadrant region 4 (UL4), which was, then replaced by a new Straumann RN implant (Fig 1)

Fig. 1: Clinical scenario with mal-aligned implants and Locator® attachments and the freshly placed implant UL4.
It was then decided to change the IOD retaining attachments in order to establish sound mechanical and biological conditions.

At first the Locator® attachments were removed and the appropriate height of the CM LOC® FLEX abutments were selected (Fig 3). The converging angle between the implants was verified three-dimensionally using the CM LOC® FLEX Case Guide (Fig 4). It became evident, that the angle between the implants exceeded 10° but not >30°; therefore the CM LOC® FLEX was selected for this patient. The treatment plan aimed to arrange the abutments parallel to the occlusal plane to improve the clinical situation.

Fig. 2: Unfavorable position of the secondary parts of the Locator® attachments.

Fig. 3: The CM LOC FLEX® Case Guide helped determining the height of the future abutment. The mucosal height was read on the marks of the CM LOC FLEX® Case Guide, thus in the case of the UL4 a H5 abutment was selected.
Fig. 4: The CM LOC FLEX® Case Guide helped determining the angle between the future abutments in the sagittal and anterior plane.

The CM LOC® FLEX abutments were placed carefully into the implant and screwed in by using the CM LOC® FLEX screwdriver; the final torque of 35 Ncm was applied with the CM® torque wrench (Figs. 5, 6).

Fig. 5: The CM LOC FLEX® Abutments was carefully placed into the implant by hand using the CM LOC® Screw Driver.
Fig. 6: The final torque of 35 Ncm was applied on the CM LOC® FLEX with the CM® torque wrench.

Subsequently, the CM LOC® FLEX Aligners were placed onto the abutments and were firmly moved on to the fixed position, which is clinically well defined and within the axis of the implant (Fig. 7). It clicks when reaching the intended position. The correct seating of the aligners was controlled by verifying that the aligner’s filling funnel was properly seated in the central filling hole of the CM LOC® FLEX (Fig. 8).

Fig. 7: CM LOC® FLEX Aligners in place.
Fig. 8: Close-up picture of the UR4 CM LOC® FLEX Aligner. The filling funnel was properly seated in the central filling hole. The aligner is co-linear with the implant axis.

The next clinical step comprised the injection of composite bonding cement. In this case, RelyX® Unicem Self-Adhesive Universal Resin Cement (3M ESPE) was used. The injection cannula was placed on the first aligner, the cement was injected and it was well taken care of that the cement leaked out of the two vent holes on the top of the abutment (Fig. 9). Using the same RelyX®-capsule a second aligner was charged during the working time of the cement as described in the IFU (Fig. 10).

Fig. 9: Clinical picture of the injection process of the composite cement into the CM LOC® FLEX Aligner.
Fig. 10 The cement leaked out of the two vent holes on the top of the abutment. The working time of the proposed composite cement (according to the IFU) was sufficiently long to fill the aligner on a second abutment with the same capsule.

During the specified working time of the 3M ESPE RelyX™ Unicem, the alignment of the first two abutments was performed. Therefore, the CM LOC® FLEX Aligner was tipped into the opposite direction of the implant axis in order to find the movable position of the aligner. Subsequently, the abutments were aligned 1.) parallel to each other both in the buccal-lingual and mesial-distal planes and 2.) perpendicular to the occlusal plane. Subsequently, the remaining two CM LOC® FLEX Aligners were filled and aligned (Fig. 11).

Fig. 11: The CM LOC® FLEX Aligners were carefully moved into its second position which allows aligning the abutments. The alignment of the abutments was verified in all three dimensions.

After allowing complete curing of the cement, the aligners were removed (Fig. 12) and the abutments cleaned (Fig. 13). The procedure was performed uneventfully; it proofed to be simple and well described in the current version of the IFU.
The following steps of fixing the retentive parts into the existing denture are clinically well established and do not differ to other stud-type IOD-attachment systems. The first procedure required the removal of the Locator® housings from the denture, which was performed with the CM LOC® Housing Extractor. Subsequently the CM LOC® Impression part were placed onto the abutments (Fig. 14) and it was verified that there was sufficient space in the denture base for them to be incorporated (Fig. 15).
Fig. 14: The CM LOC® Impression parts were placed on the abutment to allow adjusting the denture base (mirrored view).

Fig. 15: The Locators housing were removed from the denture base and the space requirements for the CM LOC® abutments were respected.

As the placement of the CM LOC® Impression part would have required substantial removal of the metallic framework, it was decided to use the CM LOC® Housings with mounted CM LOC® Retention inserts for the relining impression employing Impregum™ Soft Polyether Impression Material (3M ESPE) (Fig. 16)
Fig. 16: The relining impression with CM LOC® Housings with mounted CM LOC® Retention inserts for further processing in the dental laboratory.

During the setting time of the Impregum™ Soft Polyether Impression Material the denture was placed into the mouth and the patient was asked to remain in central occlusion until the material was set. The impression was disinfected and sent to a dental laboratory for a reline and incorporation of the CM LOC® Pekkton® housings.

The IOD retained with CM LOC® FLEX abutments and housings with extra-low retention force inserts was delivered on the same day (Figs 17 and 18).

Fig. 17: The finished and polished denture base with the CM LOC® Housings with mounted CM LOC® Retention inserts (yellow, extra-low).
Fig. 18: Clinical picture of the IOD retained by CM LOC® FLEX abutments.
Applicability of the IFU (version 11.2015) for by CM LOC® FLEX Abutment

In the first part of the current documentation the feasibility of the clinical steps as described in the IFU for the CM LOC® FLEX abutment was demonstrated. This description refers, among others, to the chair-side alignment of the attachment and lab-based fixation of the housing in the denture base, which is from a clinician’s point of view the technically most demanding procedure.

The IFU defines very well the criteria for selecting the CM LOC® FLEX, thus the 3-dimensional orientation of the supporting implants. The CM LOC® FLEX abutment offers the clinician and the supporting dental technician a very wide spectrum of clinical applications.

Conclusion
The current IFU describes the clinical and technical procedures for the CM LOC® FLEX Abutment of Cendres+Métaux SA. I state that the IFU allowed me to apply the described procedures at first use after reading the IFU attentively. No deviation from the described procedures was necessary in order to achieve a highly satisfying clinical result.

Bern, 12th August 2016

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Clinical application of the CM LOC FLEX, Case 1: 4 endosseous oral implants in the maxilla
6.

**CM LOC® FLEX Anchorage of maxillary removable dental prosthesis on 4 implants, indirect method. (Case 2)**

Prof. Dr. med. Dent. Martin Schimmel
Clinical application of the CM LOC® FLEX
Case 2 : 67 year old male patient, anchorage of maxillary removable dental prosthesis on 4 implants.
Indirect method.

This report refers to the instructions for use (IFU) for the CM LOC® FLEX version 11.2015 as provided by Cendres+Métaux SA (Rue de Boujean 122, CH-2501 Biel/Bienne, Switzerland). The report aims to prove that a clinician (here: Prof. Dr. med. dent. Martin Schimmel, MAS Oral Biol; University of Bern, Switzerland) is able to follow the provided IFU of the above mentioned attachment system and thus to validate the before mentioned document.

Exemplary, a male 67 year-old edentulous patient was selected for this clinical procedure. He had received 6 Straumann Bone-Level Implants® (SLA active surface, 8-10 mm length, Regular Crossfit Connection RC, Straumann, Basel, Switzerland) in May 2015. They were placed following the recommended surgical protocol for edentulous patients in the maxilla with minor augmentation procedures, but due to insufficient local alveolar bone mass they had been placed in an unfavorable angle for the subsequent prosthetic restoration. The implants osseointegrated uneventfully and were loaded after 3 months healing time using CM LOC® FLEX (Cendres+Métaux SA (Rue de Boujean 122, CH-2501 Biel/Bienne, Switzerland) to retain an implant supported overdenture (IOD) on four of the six implants (Fig 1).

![Fig. 1: Clinical scenario with healing caps in situ. Anterior view.](image-url)
Fig. 2: Clinical scenario with healing caps in situ. Occlusal view.

At first the healing caps were removed and the appropriate height of the CM LOC® FLEX abutments were selected (Fig 3). The converging angle between the implants was verified three-dimensionally using the CM LOC® FLEX Case Guide (Fig 4). It became evident, that the angle between the implants exceeded 10° but not >30°; therefore the CM LOC® FLEX was selected for this patient. The treatment plan aimed to arrange the abutments parallel to the occlusal plane.

Fig. 3: The CM LOC FLEX® Case Guide helped determining the height of the future abutment. The mucosal height was read on the marks of the CM LOC FLEX® Case Guide, thus in the case of the UL4 a H1 abutment was selected.
Fig. 4: The CM LOC FLEX® Case Guide helped determining the height of the future abutment. The mucosal height was read on the marks of the CM LOC FLEX® Case Guide, thus in the case of the UR4 a H1 abutment was selected.

The CM LOC® FLEX abutments were placed carefully into the implant and screwed in by using the CM LOC® FLEX screwdriver; the final torque of 35 Ncm was applied with the CM® torque wrench (Figs. 5, 6).

Fig. 5: The CM LOC FLEX® Abutments was carefully placed into the implant by hand using the CM LOC® Screw Driver.
Fig. 6: The final torque of 35 Ncm was applied on the CM LOC® FLEX with the CM® torque wrench.

Subsequently, the CM LOC® FLEX Aligners were placed onto the abutments and were firmly moved on to the fixed position, which is clinically well defined and within the axis of the implant (Fig. 7). It clicks when reaching the intended position. The correct seating of the aligners was controlled by verifying that the aligner’s filling funnel was properly seated in the central filling hole of the CM LOC® FLEX (Fig. 8).

Fig. 7: CM LOC® FLEX Aligners in place.
Fig. 8: Close-up picture of the UR3 CM LOC® FLEX Aligner. The filling funnel was properly seated in the central filling hole. The aligner is co-linear with the implant axis.

The next clinical step comprised the injection of composite bonding cement. In this case, RelyX® Unicem Self-Adhesive Universal Resin Cement (3M ESPE) was used. The injection cannula was placed on the first aligner, the cement was injected and it was well taken care of that the cement leaked out of the two vent holes on the top of the abutment (Fig. 9). Using the same RelyX®-capsule a second aligner was charged during the working time of the cement as described in the IFU (Fig. 10).

Fig. 9: Clinical picture of the injection process of the composite cement into the CM LOC® FLEX Aligner.
Fig. 10 The cement leaked out of the two vent holes on the top of the abutment. The working time of the proposed composite cement (according to the IFU) was sufficiently long to fill the aligner on a second abutment with the same capsule.

During the specified working time of the 3M ESPE RelyX™ Unicem, the alignment of the first two abutments was performed. Therefore, the CM LOC® FLEX Aligner was tipped into the opposite direction of the implant axis in order to find the movable position of the aligner. Subsequently, the abutments were aligned 1.) parallel to each other both in the buccal-lingual and mesial-distal planes and 2.) perpendicular to the occlusal plane. Subsequently, the remaining two CM LOC® FLEX Aligners were filled and aligned (Figs. 11a and b).

Figs. 11a and b: The CM LOC® FLEX Aligners were carefully moved into its second position which allows aligning the abutments. The alignment of the abutments was verified in all three dimensions.

After allowing complete curing of the cement, the aligners were removed and the abutments cleaned (Fig. 12). The procedure was performed uneventfully; it proofed to be simple and well described in the current version of the IFU.
The following steps of fixing the retentive parts into the existing denture are clinically well established and do not differ to other stud-type IOD-attachment systems. First, the CM LOC® Housings together with the block-out spacer for chair side use was placed around the lower parts of the abutments (Fig. 14. This is a standard clinical procedure to prevent the polymethyl methacrylate (PMMA) resin from flowing into mechanical undercuts of the implant. Subsequently, it was verified that there was sufficient space in the denture base for them to be incorporated (Fig. 15).
Fig. 14: The CM LOC® Housings were placed on the abutments to allow adjusting the denture base. The Black-out spacers were already in place.

Fig. 15: The view onto the intaglio reveals sufficient space for abutments and housings.

The housing cavities in the denture base were subsequently filled with auto-polymerizing PMMA. The denture was then placed into the mouth and the patient was then requested to remain in centric occlusion until the resin set. After setting of the resin, the denture was removed from the mouth (Fig. 16), the excess resin then trimmed and a final polishing was done Fig. 17. s
Fig. 16: The prosthesis was removed from the mouth and the Block-out spacers were taken off the abutments. A round bur was used to remove excess resin.

Fig. 17: The finished and polished denture base with the CM LOC® Housings with mounted CM LOC® Retention inserts.
Fig. 18: Clinical picture of the IOD retained by CM LOC® FLEX abutments.
Applicability of the IFU (version 11.2015) for by CM LOC® FLEX Abutment

In the first part of the current documentation the feasibility of the clinical steps as described in the IFU for the CM LOC® FLEX Abutment was demonstrated. This description refers, among others, to the chair-side alignment of the attachment and the fixation of the CM LOC® housings in the denture base were performed chair side, which is from a clinician’s point of view the technically most demanding procedure. However, this procedure was well described in the current IFU and was performed uneventfully.

The IFU defines very well the criteria for selecting the CM LOC® FLEX, thus the 3-dimensional orientation of the supporting implants. The CM LOC® FLEX Abutment offers the clinician and the supporting dental technician a very wide spectrum of clinical applications.

Conclusion
The current IFU describes the clinical and technical procedures for the CM LOC® FLEX Abutment of Cendres+Métaux SA. I state that the IFU allowed me to apply the described procedures at first use after reading the IFU attentively. No deviation from the described procedures was necessary in order to achieve a highly satisfying clinical result.

Bern, 17th August 2016

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Clinical application of the CM LOC FLEX, Case 2 : 4 endosseous oral implants in the maxilla
CM LOC® FLEX Anchorage of mandibular removable dental prosthesis on 4 implants. New prostheses, indirect method. (Case 3)

Prof. Dr. med. Dent. Martin Schimmel
Clinical application of the CM LOC® FLEX
Case 3: 90 year old female patient, anchorage of mandibular removable dental prosthesis on 4 implants. New prostheses, indirect method.

This report refers to the instructions for use (IFU) for the CM LOC® FLEX version 11.2015 as provided by Cendres+Métaux SA (Rue de Boujean 122, CH-2501 Biel/Bienne, Switzerland). The report aims to proof that a clinician (here: Prof. Dr. med. dent. Martin Schimmel, MAS Oral Biol; University of Bern, Switzerland) is able to follow the provided IFU of the above mentioned attachment system and thus to validate the before mentioned document.

Exemplary, a male 90 year-old edentulous patient was selected for this clinical procedure. She had received 4 Straumann Standard Implants® (SLA surface, 10mm length, Regular Neck, 4.1mm diameter, Straumann, Basel, Switzerland) in 2006. They were placed following the recommended surgical protocol for edentulous patients in the interforaminal region of the mandible without augmentation procedures. She requested new dentures because she was unsatisfied with the retention. The implant supported overdenture (IOD) was retained by four Locator® attachments (Zest Anchors, Escondido, CA, USA), which showed extreme wear (Fig 1).

*Fig. 1: Clinical scenario with four Locator® attachments in the interforaminal region to retain an overdenture. The attachment showed signs of several wear.*
Clinical application of the CM LOC FLEX, Case 3 : 4 endosseous oral implants in the maxilla

Fig. 2: *The retention was assured with Novaloc® housings.*

The treatment plan comprised the replacement of the worn attachment with CM LOC® FLEX abutments and the fabrication of new prostheses in both jaws.

At first the Locator® attachments were removed and the appropriate height of the CM LOC® FLEX abutments were selected (Fig 3). The converging angle between the implants was verified three-dimensionally using the CM LOC® FLEX Case Guide (Fig 4). It became evident, that the angle between the implants exceeded 10° but not >30°; therefore the CM LOC® FLEX was selected for this patient. The treatment plan aimed to arrange the abutments parallel to the occlusal plane to improve the clinical situation.

Fig. 3: *The CM LOC FLEX® Case Guide helped determining the height of the future abutments. The mucosal height was read on the marks of the CM LOC FLEX® Case Guide, thus H1 and H2 abutments were selected.*
Fig. 4: The CM LOC FLEX® Case Guide helped determining the angle between the future abutments in the sagittal and anterior plane.

The CM LOC® FLEX abutments were placed carefully into the implant and screwed in by using the CM LOC® FLEX Screw Driver; the final torque of 35 Ncm was applied with the CM® torque wrench (Figs. 5, 6).

Fig. 5: The CM LOC FLEX® Abutments was carefully placed into the implant by hand using the CM LOC® Screw Driver and the CM torque wrench attached to the RN connection.
Fig. 6: The final torque of 35 was applied Ncm on the CM LOC® FLEX with the CM® torque wrench.

Subsequently, the CM LOC® FLEX Aligners were placed onto the abutments and were firmly moved on to the fixed position, which is clinically well defined and within the axis of the implant (Fig. 7). It clicks when reaching the intended position. The correct seating of the aligners was controlled by verifying that the aligner’s filling funnel was properly seated in the central filling hole of the CM LOC® FLEX (Fig. 8).

Fig. 7: CM LOC® FLEX Aligners in place.
Fig. 8: Close-up picture of the LR CM LOC® FLEX Aligner. The filling funnel was properly seated in the central filling hole. The aligner is co-linear with the implant axis.

The next clinical step comprised the injection of composite bonding cement. In this case, RelyX® Unicem Self-Adhesive Universal Resin Cement (3M ESPE) was used. The injection cannula was placed on the first aligner, the cement was injected and it was well taken care of that the cement leaked out of the two vent holes on the top of the abutment. Using the same RelyX®-capsule a second aligner was charged during the working time of the cement as described in the IFU (Fig. 9).

Fig. 9: Clinical picture of the injection process of the composite cement into the CM LOC® FLEX Aligner.
Fig. 10: In a second step, the remaining two aligners in the LR quadrant were filled with cement and aligned to the aligners on the opposing side.

During the specified working time of the 3M ESPE RelyX™ Unicem, the alignment of the first two abutments was performed. Therefore, the CM LOC® FLEX Aligner was tipped into the opposite direction of the implant axis in order to find the movable position of the aligner. Subsequently, the abutments were aligned 1.) parallel to each other both in the buccal-lingual and mesial-distal planes and 2.) perpendicular to the occlusal plane. Subsequently, the remaining two CM LOC® FLEX Aligners were filled and aligned (Fig. 10).

Fig. 11: Clinical situation after curing of the cement and removal of the aligners.

After allowing complete curing of the cement, the aligners were removed (Fig. 12) and the abutments cleaned (Fig. 13). The procedure was performed uneventfully; it proofed to be simple and well described in the current version of the IFU.
The following steps of making functional impression for the fabrication of new dentures do not differ to other stud-type IOD-attachment systems. In the dental laboratory, functional impression trays were prepared. Subsequently the CM LOC® Impression part were placed onto the abutments (Fig. 14) and it was verified that there was sufficient space in the impression tray.
Fig. 14: The CM LOC® Impression parts were placed on the abutment to allow adjusting the functional impression tray.

Fig. 15: The final impression with simultaneously mounted central bearing point to distribute occlusal forces equally on the impression.

A solid impression material was used for picking up the impression parts in the functional impression. Care was taken that no material has flowed into the impression part and that the impression material was fully distributed around it (Fig. 15).
**Fig. 16**: The impression was taken in occlusion to compress the denture bearing areas slightly.

During the setting time of the impression material the denture was placed into the mouth and the patient was asked to remain in central occlusion until the material was set (Fig. 16). The impression was disinfected and sent to a dental laboratory. An individual reinforcement framework was fabricated from PEKKTON® using the CM LOC®. CM LOC® Pekkton housings were incorporated in the IOD (Fig. 17, 18a,b).

**Fig. 17**: The finished and polished denture base with the CM LOC® Housings with mounted CM LOC® Retention inserts (yellow, extra-low). The reinforcement framework was made of PEKKTON® material.
Fig. 18a and 18b: The finished IOD was easily incorporated and well accepted by the patient.
Applicability of the IFU (version 11.2015) for by CM LOC® FLEX Abutment

In the first part of the current documentation the feasibility of the clinical steps as described in the IFU for the CM LOC⁺ FLEX Abutment was demonstrated. This description refers, among others, to the chair-side alignment of the attachment and the fabrication of a new denture.

The IFU defines very well the criteria for selecting the CM LOC⁺ FLEX, thus the 3-dimensional orientation of the supporting implants. The CM LOC⁺ FLEX abutment offers the clinician and the supporting dental technician a very wide spectrum of clinical applications.

Furthermore, the IFU describes very well the technical steps for the dental technician to incorporate the anchorage system into a new prosthesis.

Conclusion
The current IFU describes the clinical and technical procedures for the CM LOC⁺ FLEX Abutment of Cendres+Métaux SA. I state that the IFU allowed me to apply the described procedures at first use after reading the IFU attentively. No deviation from the described procedures was necessary in order to achieve a highly satisfying clinical result.

Bern, 18th August 2016

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8.

CM LOC® FLEX Anchorage of maxillary removable dental prosthesis on 4 implants, indirect method. (Case 4)

Prof. Dr. med. Dent. Martin Schimmel
Clinical application of the CM LOC® FLEX
Case 4: 55 year old male patient, anchorage of maxillary removable dental prosthesis on 4 implants. Indirect method.

This report refers to the instructions for use (IFU) for the CM LOC® FLEX version 11.2015 as provided by Cendres+Métaux SA (Rue de Boujean 122, CH-2501 Biel/Bienne, Switzerland). The report aims to prove that a clinician (here: Dr. med. dent. Philipp Müller; University of Bern, Switzerland) is able to follow the provided IFU of the above mentioned attachment system and thus to validate the before mentioned document.

Exemplary, a male 55 year-old edentulous patient was selected for this clinical procedure. He had received 3 Replace Select® (Nobel Biocare, Göteborg, Sweden) Implants approximately and another Straumann Standard Implants® (SLA active surface, 8mm length, Regular Neck, 4.1mm diameter, Straumann, Basel, Switzerland) in the region of the upper left 4 (UL4) over the past 10 years prior to the current intervention. As for the circular bony atrophy of the maxilla, the implants had been placed in an unfavorable angle for the subsequent prosthetic restoration. Therefore, they had been loaded with implant-bars. These splinted attachment showed extreme signs of wear and material failure; therefore exhibited a retentive capacity (Fig. 1).

Fig. 1: The bar in the upper right quadrant broke and the bar on the opposite side showed signs of severe wear.
Fig. 2: Because of an implant failure, two different implant system were present in one jaw (UR3, UR2, UL4: Replace select (Nobel Biocare) and ULS Straumann RN Standard Implant).

It was then decided to change the IOD retaining attachments in order to establish sound mechanical and biological conditions (Fig. 2).

At first the old attachments were removed and Standard CM LOC® Abutments of the appropriate height were placed into the implants positions UR3, UR2, UL4. The treatment plan comprised the use of a CM LOC® FLEX Abutment to restore the implant ULS5, because it was severely convergent to the remainder implants (Fig. 3).

Fig. 3: The implant ULS5 was severely maligned in respect to the path of insertion; it was therefore decided to employ CM LOC® FLEX Abutment.

The converging angle between the implants was verified three-dimensionally using the CM LOC® FLEX Case Guide (Fig 4). It became evident, that the angle between the implants exceeded 10° but
not >30°; therefore the CM LOC® FLEX was selected for this patient. The treatment plan aimed to arrange the abutment parallel co-linear to the path of insertion to improve the clinical situation.

*Fig. 4: The CM LOC FLEX® Case Guide helped determining the angle between the future abutments in the sagittal and anterior plane.*

The CM LOC® FLEX Abutment UL5 was placed carefully into the implant and screwed in by using the CM LOC® FLEX Screw Driver; the final torque of 35 Ncm was applied with the CM® torque wrench (Figs. 5, 6).

*Fig. 5: The CM LOC FLEX® Abutment UL5 was carefully placed into the implant.*
Fig. 6: The final torque of 35 was applied Ncm on the CM LOC® FLEX with the CM® torque wrench.

Subsequently, the CM LOC® FLEX Aligners were placed onto the abutments and were firmly moved on to the fixed position, which is clinically well defined and within the axis of the implant (Fig. 7). It clicks when reaching the intended position. The correct seating of the aligner was controlled by verifying that the aligner’s filling funnel was properly seated in the central filling hole of the CM LOC® FLEX (Fig. 8).

Fig. 7: CM LOC® FLEX Aligner in place, implant UL5.
The next clinical step comprised the injection of composite bonding cement. In this case, RelyX® Unicem Self-Adhesive Universal Resin Cement (3M ESPE) was used. The injection cannula was placed on the first aligner (Fig. 9), the cement was injected and it was well taken care of that the cement leaked out of the two vent holes on the top of the abutment (Fig. 10).

**Fig. 8:** Close-up picture of the UR4 CM LOC® FLEX Aligner. The filling funnel was properly seated in the central filling hole. The aligner is co-linear with the implant axis.

**Fig. 9:** Clinical picture of the injection process of the composite cement into the CM LOC® FLEX Aligner.
**Fig. 10** The cement leaked out of the two vent holes on the top of the abutment, indicating a sufficient amount of cement was injected into the abutment.

During the specified working time of the 3M ESPE RelyX™ Unicem, the alignment of the first two abutments was performed. Therefore, the CM LOC® FLEX Aligner was tipped into the opposite direction of the implant axis in order to find the movable position of the aligner (Fig. 11). Subsequently, the abutment was aligned parallel to the other three CM LOC® Abutments both in the buccal-lingual and mesial-distal plane (Fig. 12).

**Fig. 11:** The CM LOC® FLEX Aligner was carefully moved into its second position which allows aligning the abutment. The working time of the proposed composite cement (according to the IFU) was sufficiently long for this procedure.

After allowing complete curing of the cement, the aligners were removed and the abutments cleaned (Fig. 13). The procedure was performed uneventfully; it proofed to be simple and well described in the current version of the IFU.
Fig. 12: Clinical situation after setting of the cement; subsequently the alignment of the abutments was verified in all three dimensions.

Fig. 13: The abutment was carefully cleaned to remove excess cement.

The following steps of fixing the retentive parts into the existing denture are clinically well established and do not differ to other stud-type IOD-attachment systems. The first procedure required the removal of redundant bar-clips from the denture. Subsequently the CM LOC® Housings were placed onto the abutments (Fig. 14) and it was verified that there was sufficient space in the denture base for them to be incorporated (Fig. 15).
Fig. 14: The CM LOC® Impression parts were placed on the abutment to allow adjusting the denture base (mirrored view).

Fig. 15: It was made sure, that there was sufficient space the CM LOC® Abutments with mounted housings.

As the placement of the CM LOC® Impression part would have required substantial removal of the metallic framework, it was decided to use the CM LOC® Housings with mounted CM LOC® Retention inserts for the relining impression employing Impregum™ Soft Polyether Impression Material (3M ESPE) (Fig. 16)
During the setting time of the Impregum™ Soft Polyether Impression Material the denture was placed into the mouth and the patient was asked to remain in central occlusion until the material was set. The impression was disinfected and sent to a dental laboratory for a reline and incorporation of the CM LOC® Pekkton® housings.

The IOD retained with CM LOC® FLEX Abutments and housings with extra-low retention force inserts was delivered on the same day (Figs 17 and 18).

**Fig. 16:** The relining impression with CM LOC® Housings with mounted CM LOC® Retention inserts for further processing in the dental laboratory. A secondary impression from alginate material was added.

**Fig. 17:** The finished and polished denture base with the CM LOC® Housings with mounted CM LOC® Retention inserts (brown, low retention).
Applicability of the IFU (version 11.2015) for by CM LOC® FLEX Abutment

In the first part of the current documentation the feasibility of the clinical steps as described in the IFU for the CM LOC® FLEX Abutment was demonstrated. This description refers, among others, to the chair-side alignment of the attachment and lab-based fixation of the housing in the denture base, which is from a clinician’s point of view the technically most demanding procedure.

The IFU defines very well the criteria for selecting the CM LOC® FLEX, thus the 3-dimensional orientation of the supporting implants. The CM LOC® FLEX Abutment offers the clinician and the supporting dental technician a very wide spectrum of clinical applications.

Conclusion
The current IFU describes the clinical and technical procedures for the CM LOC® FLEX Abutment of Cendres+Métaux SA. I state that the IFU allowed me to apply the described procedures at first use after reading the IFU attentively. No deviation from the described procedures was necessary in order to achieve a highly satisfying clinical result.
Clinical application of the CM LOC FLEX, Case 4: 4 endosseous oral implants in the maxilla
CM LOC® FLEX Anchorage of maxillary removable dental prosthesis on 4 implants, indirect method. (Case 5)

Prof. Dr. med. Dent. Martin Schimmel
**Clinical application of the CM LOC® FLEX**

Case 4: 67 year old female patient, anchorage of maxillary removable dental prosthesis on 4 implants. Indirect method.

This report refers to the instructions for use (IFU) for the CM LOC® FLEX version 11.2015 as provided by Cendres+Métaux SA (Rue de Boujean 122, CH-2501 Biel/Bienne, Switzerland). The report aims to proof that a clinician (here: Prof. Dr. med. dent. Martin Schimmel, MAS Oral Biol; University of Bern, Switzerland) is able to follow the provided IFU of the above mentioned attachment system and thus to validate the before mentioned document.

Exemplary, a male 67 year-old patient with an edentulous upper jaw was selected for this clinical procedure. She had received 4 Straumann Standard Implants® (SLA active surface, 8mm length, Regular Neck, 4.1mm diameter, Straumann, Basel, Switzerland) in March 2011. They were placed following the recommended surgical protocol for edentulous patients in the maxilla without augmentation procedures, but due to insufficient local alveolar bone mass they had been placed in an unfavorable angle for the subsequent prosthetic restoration. One implant in the region of the upper left 2 (UL2) was lost (Fig. 1) and another implant was placed in the region in September 2015. The implants were loaded using Locator® attachments (Zest Anchors, Escondido, CA, USA) to retain an implant supported overdenture (IOD).

![Clinical scenario with mal-aligned implants and Locator® attachments; the implant UL 2 was already lost. The attachment showed severe signs of wear and needed to be replaced.](image)

**Fig. 1:** Clinical scenario with mal-aligned implants and Locator® attachments; the implant UL 2 was already lost. The attachment showed severe signs of wear and needed to be replaced.
Fig. 2: Unfavorable position of the secondary parts of the Locator® attachments. They were removed with the appropriate counter-torque.

It was then decided to change the IOD retaining attachments in order to establish sound mechanical and biological conditions.

At first the Locator® attachments were removed (Fig 2) and the appropriate height of the CM LOC® FLEX Abutments were selected (Fig 3). The converging angle between the implants was verified three-dimensionally using the CM LOC® FLEX Case Guide (Fig 4). It became evident, that the angle between the implants exceeded 10° but not >30°; therefore the CM LOC® FLEX was selected for this patient. The treatment plan aimed to arrange the abutments parallel to the occlusal plane to improve the clinical situation.

Fig. 3: The CM LOC FLEX® Case Guide helped determining the orientation and height of the future abutment. In the present picture, the Case Guides were co-linear with the implant, indicating a significant divergence. The mucosal height was read on the marks of the CM LOC FLEX® Case Guide.
Fig. 4: The CM LOC FLEX® Case Guide helped determining the angle between the future abutments in the sagittal and anterior plane.

The CM LOC® FLEX Abutments were placed carefully into the implant and screwed in by using the CM LOC® FLEX Screw Driver (Figs. 5a, b). The final torque of 35 Ncm was applied with the CM® torque wrench (Fig. 6).

Fig. 5: a.) The CM LOC FLEX® Abutments was carefully placed into the implant by hand using the CM LOC® Screw Driver. b.) the minimum distance of 1mm between mucosa and active part of the abutment was respected to avoid trauma of the peri-implant soft tissue.
Fig. 6: The final torque of 35 Ncm was applied on the CM LOC® FLEX with the CM® torque wrench.

Subsequently, the CM LOC® FLEX Aligners were placed onto the abutments and were firmly moved on to the fixed position, which is clinically well defined and within the axis of the implant (Fig. 7). It clicks when reaching the intended position. It was planned to first align the two central abutments and to align the remaining abutments in a second step, as the capsules of the employed cement contain only enough cement for two abutments.

Fig. 7: CM LOC® FLEX Aligners in place.
The correct seating of the aligners was controlled by verifying that the aligner’s filling funnel was properly seated in the central filling hole of the CM LOC® FLEX (Fig. 8).

![Fig. 8: Close-up picture of the UR4 CM LOC® FLEX Aligner. The filling funnel was properly seated in the central filling hole. The aligner is co-linear with the implant axis.](image)

The next clinical step comprised the injection of composite bonding cement. In this case, RelyX® Unicem Self-Adhesive Universal Resin Cement (3M ESPE) was used. The injection cannula was placed on the first aligner, the cement was injected and it was well taken care of that the cement leaked out of the two vent holes on the top of the abutment (Fig. 9). Using the same RelyX®-capsule a second aligner was charged during the working time of the cement as described in the IFU (Fig. 10).

![Fig. 9: Clinical picture of the injection process of the composite cement into the CM LOC® FLEX Aligner.](image)
Fig. 10 The cement leaked out of the two vent holes on the top of the abutment. The working time of the proposed composite cement (according to the IFU) was sufficiently long to fill the aligner on a second abutment with the same capsule.

During the specified working time of the 3M ESPE RelyX™ Unicem, the alignment of the first two abutments was performed. Therefore, the CM LOC® FLEX Aligner was tipped into the opposite direction of the implant axis in order to find the movable position of the aligner. Subsequently, the abutments were aligned 1.) parallel to each other both in the buccal-lingual and mesial-distal planes and 2.) perpendicular to the occlusal plane. Subsequently, the remaining two CM LOC® FLEX Aligners were filled and aligned (Figs. 11a, b).

Figs. 11a, b.: The CM LOC® FLEX Aligners were carefully moved into its second position which allows aligning the abutments.

The exact same steps were repeated to align the implants in the regions UR4 und UL4 parallel to the central aligners. The alignment of the abutments was verified in all three dimensions (Fig. 12)
Clinical application of the CM LOC FLEX, Case 5: 4 endosseous oral implants in the maxilla

Fig. 12: Clinical situation after removal of the aligner at the UL quadrant.

After allowing complete curing of the cement, the aligners were removed (Fig. 13a) and the abutments cleaned (Fig. 13b). The procedure was performed uneventfully; it proved to be simple and well described in the current version of the IFU.

Fig. 13: Clinical situation after cleansing of the abutments at the UL quadrant.

The following steps of fixing the retentive parts into the existing denture are clinically well established and do not differ to other stud-type IOD-attachment systems. The first procedure required the removal of the Locator® housings from the denture, which was performed with the CM LOC® Housing Extractor (Fig. 14).
Fig. 14: The Locators housing were removed from the denture base and the space requirements for the CM LOC® Abutments were respected.

Subsequently the CM LOC® Impression part were placed onto the abutments and it was verified that there was sufficient space in the denture base for them to be incorporated (Fig. 15a). As the placement of the CM LOC® Impression part would have required substantial removal of the metallic framework, it was decided to use the CM LOC® Housings with mounted CM LOC® Retention inserts for the relining impression (Fig. 15b)

Fig. 15: a.) The CM LOC® Housings were placed on the abutment to allow adjusting the denture base. b.) As there was unsifficient space in the metal-framework of the IOD, the housings were used instead of the impression parts.

The reline impression was used employing Impregum™ Soft Polyether Impression Material (3M ESPE) (Fig. 16 )
Fig. 16: The relining impression with CM LOC® Housings with mounted CM LOC® Retention inserts for further processing in the dental laboratory.

During the setting time of the Impregum™ Soft Polyether Impression Material the denture was placed into the mouth and the patient was asked to remain in central occlusion until the material was set. The impression was disinfected and sent to a dental laboratory for a reline and incorporation of the CM LOC® Pekkton® Housings.

The IOD retained with CM LOC® FLEX Abutments and housings with extra-low retention force inserts was delivered on the same day (Figs 17 and 18).

Fig. 17: The finished and polished denture base with the CM LOC® Housings with mounted CM LOC® Retention inserts (yellow, extra-low).
Applicability of the IFU (version 11.2015) for by CM LOC® FLEX Abutment

In the first part of the current documentation the feasibility of the clinical steps as described in the IFU for the CM LOC® FLEX Abutment was demonstrated. This description refers, among others, to the chair-side alignment of the attachment and lab-based fixation of the housing in the denture base, which is from a clinician’s point of view the technically most demanding procedure.

The IFU defines very well the criteria for selecting the CM LOC® FLEX, thus the 3-dimensional orientation of the supporting implants. The CM LOC® FLEX Abutment offers the clinician and the supporting dental technician a very wide spectrum of clinical applications.

Conclusion
The current IFU describes the clinical and technical procedures for the CM LOC® FLEX Abutment of Cendres+Métaux SA. I state that the IFU allowed me to apply the described procedures at first use after reading the IFU attentively. No deviation from the described procedures was necessary in order to achieve a highly satisfying clinical result.

Fig. 18: Clinical picture of the IOD retained by CM LOC® FLEX Abutments.
Bern, 21st August 2016

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Ende!

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