

# Retrospective analysis of complications in anterior cervical discectomy and fusion (ACDF) with use of plate at medium-term follow up

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## Abstract

**Background:** Anterior cervical discectomy and fusion with plate implementation represents one of the most used procedure for the treatment of single- and multilevel cervical degenerative disc disease. Since few information are reported about clinical complication related to the use of plate, the aim of this retrospective study is to evaluate qualitatively and quantitatively the intra-operative and post-operative complications.

**Methods:** Fifty-five (55) patients (23 males and 32 females, mean age 49.8 years/old) who underwent cervical fusion by intervertebral TiPEEK cage, and 3 cervical plate were retrospectively reviewed for clinical and radiological outcomes.

**Results:** Cervical spinal fusion was performed at one level in 24 patients (43.6%), at two levels in 26 patients (47.3%), and at three levels in 5 patients (9.1%). The computed tomography scan of two patients included in this retrospective analysis was not available after one year from surgery (3.6%). The remaining 53 patients (96.4%) had a complete proven fusion. At a mean follow-up of 38.6 months, the clinical outcomes were “excellent”, “very good” or “good” for 47.3%, 27.3% and 16.4% of patients respectively. Only 9.1% reported a “poor” outcome. No adverse effects were observed after the use of cervical Mecta-C plates.

**Conclusions:** This retrospective study showed no clinical complication or adverse event after anterior cervical discectomy and fusion with plate implementation demonstrating the safety of Mecta-C cervical plate as an effective support of the TiPEEK cage.

## Introduction

Anterior cervical discectomy and fusion (ACDF) is among the most frequent and successful procedures to treat symptomatic cervical disease such as intervertebral degenerative disc disease, traumatic cervical diseases, or cervical spondylosis [1-3].

Introduced for the first time by Smith and Robinson in the mid-50s [4], this technique is characterized by an anterior approach that is less invasive, minimally interfering on the spinal canal and avoiding relevant muscle dissection [4], and by a superior fusion rate than the traditional posterior technique [5].

After its introduction ACDF has been subjected to some modifications but it generally consists in the removal of the intervertebral disc by dissection, discectomy and then replacement with a cage and a bone graft. Initially, autologous bone from the iliac crest was mainly used as interbody graft, but currently allograft bone and other bone graft substitutes are preferably used with greater success.

The use of screw and plate for the internal fixation has been proposed over time both to promote the fusion rate in single-level or multilevel ACDF and to preserve or restore segmental lordosis and stability when cervical fusion occurs. Indeed, in addition to improve implant stability and to enhance autograft healing, the plate implementation ensures the intraoperative correction obtained by the surgical intervention even in cases of spinal deformity or misalignment, while reducing the time of post-operative immobilization. Moreover, the use of plate was demonstrated to be effective even in the treatment of radiculopathy and myelopathy caused by disc herniation and spondylosis [6].

Initially, plates were fixed with unlocked screws, therefore the bicortical anchoring in the vertebral body was required to obtain a stable fixation of the implant. Then, the introduction of locked screw-plate constructs has guaranteed a direct transfer of applied forces, improving the pull-out strength besides increasing stability [7].

Among different devices, Mecta-C Anterior Cervical Plate System can be used in both single and multilevel applications for anterior interbody screw/plate fixation from C2 to T1. It is characterized by different sizes of plates and variables as well as fixed angled screws which guarantee a high adaptability to the patients' profile. In fact, this system can be applied in patients with degenerative disc disease, trauma (including fractures), tumours, deformity (defined as kyphosis, lordosis, or scoliosis), pseudarthrosis, and/or failed previous fusions.

Although ACDF has been used in clinic for a long time, few evidences are reported in literature on the possible complications and risk associated to the use of plate in this surgical intervention [8].

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For this reason, the aim of the present study is to assess quantitatively and qualitatively all the possible intra-operative and post-operative complications associated to the use of Mecta-C Anterior Cervical Plate System in ACDF surgical procedure.

## Methods

Between March 2015 and January 2017, 55 patients who underwent a cervical fusion with an intervertebral TiPEEK cage (Medacta International SA, Switzerland) and a Mecta-C cervical plate (Medacta) at the Spine Clinic at Monica Hospital, Antwerp, Belgium were included in this retrospective study. The study was approved by the Monica Hospital Ethics Committee (OG 106).

An investigator retrospectively reviewed the clinical and radiological outcomes of patients. Data processing was performed anonymously.

**Patients:** Patients of both sexes older than 18 years who underwent cervical fusion with Mecta-C cervical plate device at the Spine Clinic at Monica Hospital were considered eligible. Patients capable to understand and will, and who signed the ethics committee-reviewed and approved informed consent form were enrolled in the retrospective study.

**Implants:** All the patients included in this retrospective analysis underwent ACDF with Mecta-C cervical plate device (Figure 1). They all had a TiPEEK cage made of osteo-conductive Titanium coated polyetheretherketone (PEEK), and Mecta-C Cervical plate to stabilize and promote bone fusion. Single and multilevel plates, up to three, were used to stabilize the cervical spine. The plates used had lengths between 22 and 61 mm. Mectagel® (βTCP+HA) (Teknimed, l'Union, France), a synthetic resorbable bone graft substitute consisting of nanoparticulate hydroxyapatite was used too.

**Surgical technique:** All the patients were operated by the same experienced spine surgeon. Briefly, an anterolateral incision from the left or the right side of the cervical spine based on the segment level(s) that needed to be treated was performed. For each level interested by degeneration, the disc was removed and replaced by the cage with the addition of screws and plate utilizing bone graft, following the modified

Smith-Robinson technique [4]. The access to the vertebral body above and below the graft site allowed to place the plate, available in different lengths, into the suitable position. Then it was longitudinally placed on the anterior aspect of the cervical vertebral body and fixed with screws in order to stabilize the segment/s.

All the patients followed the same standard rehabilitation procedures as per clinical routine at the Spine Clinic at Monica Hospital.

**Radiographical and clinical assessment:** The pre-operative planning included a magnetic resonance imaging (MRI) to evaluate indication and diagnosis, as well as to choose the most appropriate type/size of the implants in order to match the patient's anatomy. Postoperatively, the bone fusion after one year from surgery was evaluated by computed tomography (CT) scan. All the patients at one-year follow-up the patients expressed their satisfaction after the surgical treatment.

**Statistical analysis:** No formal calculations were made to determine the sample size, as the nature of this study is purely observational with retrospective data. Demographical data are expressed as mean ± standard deviation.

## Results

### Patients and surgical interventions

A total of 55 patients (23 males and 32 females) were included in this retrospective study. The mean age of patients at surgery was 49.8 years (range 30.9–75.5 years, SD 9.8). Brachialgia was identified in 10 patients (18.2%) as well as cervicobrachialgia in 32 patients (58.2%) and myelopathy in 3 patients (5.5%).

Cervical spinal fusion was performed at one level in 24 patients (43.6%), at two levels in 26 patients (47.3%), and at three levels in 5 patients (9.1%) (Table 1). According to the different cases, different sizes and types of plates were implanted (Table 2).

After reviewing the pre-operative MRI, the technical indications of the patients analyzed were divided in different categories (Table 3).

### Radiographical and clinical outcomes

The CT scan of two patients included in this retrospective analysis was not available after one year from surgery (3.6%). The remaining 53 patients (96.4%) had a complete proven fusion according to Bridwell et al's criteria [9].

At a mean follow up of 38 months (range 29-51, SD 5) the clinical outcome was "excellent" for 26 patients (47.3%), "very good" for 15 patients (27.3%) and "good" for 9 patients (16.4%). Only 5 patients (9.1%) reported a "poor" outcome. No adverse effects included dysphagia and dysphonia were observed after the use of cervical Mecta-C plates.

## Discussion

This retrospective study reporting the data of 55 patients who underwent anterior cervical discectomy and fusion by implantation of TiPEEK cage and Mecta-C cervical plate confirms the effectiveness of the technique with no adverse events.

The ACDF has been applied over the last decades for the treatment of cervical degenerative diseases with satisfactory results described in several clinical studies with short, medium and long follow-up [4,10-12] that makes it a gold standard in the surgical practice. The firstly developed stand-alone cage application has been widely used



Figure 1. Mecta-C anterior cervical plate system

**Table 1.** Vertebral level treated with the related frequency and percentage (C= cervical, T=thoracic)

Level	Frequency	%
C3-4, C4-5, C5-6	2	3.6
C3-4, C4-5	1	1.8
C4-5	2	3.6
C4-5, C5-6	8	14.5
C4-5, C5-6, C6-7	3	5.5
C5-6	14	25.4
C5-6, C6-7	16	29.2
C6-7	8	14.6
C6-7, C7-T1	1	1.8
<b>Total</b>	<b>55</b>	<b>100</b>

**Table 2.** Plate description with the related frequency and percentage

Description	Frequency	%
CERVICAL PLATE L1x22MM	11	20.0
CERVICAL PLATE L1x24MM	2	3.6
CERVICAL PLATE L1x26MM	1	1.8
CERVICAL PLATE L2x37MM	14	25.4
CERVICAL PLATE L2x40MM	9	16.4
CERVICAL PLATE L2x43MM	3	5.5
CERVICAL PLATE L3x55MM	1	1.8
CERVICAL PLATE L3x58MM	4	7.3
CERVICAL PLATE L3x61MM	1	1.8
CERVICAL PLATE STERIL L1x20MM	9	16.4
<b>Total</b>	<b>55</b>	<b>100</b>

**Table 3.** Distribution of treated levels, with the related frequency, percentage and clinical indications of each patients. ADD=Anterior disc degeneration

Technical indication	Frequency (%)	Total frequency (%)
Disc herniation	11 (20)	18 (32.7)
— and discopathy	7 (12.7)	
Foraminal stenosis	3 (5.5)	10 (18.2)
— and discopathy	7 (12.7)	
Spinal stenosis	4 (7.3)	10 (18.2)
— and discopathy	2 (3.6)	
— and myelomalacy	3 (5.5)	
— and disc herniation	1 (1.8)	
Discopathy	7 (12.7)	8 (14.5)
— and myelum compression	1 (1.8)	
ADD (Anterior Disc Degeneration)		6 (10.8)
— above and under previous fusion	1 (1.8)	
— above previous fusion	1 (1.8)	
— under previous fusion	3 (5.4)	
— and pseudarthrosis	1 (1.8)	
Instability	1 (1.8)	1 (1.8)
Pseudarthrosis	2 (3.6)	2 (3.6)
<b>Total</b>	<b>55</b>	<b>100</b>

in the clinical practice demonstrating satisfactory clinical outcomes. However, this approach is potentially compromised by the occurrence of complications such as the collapse of the bone graft, the development of pseudo-arthritis, kyphosis, and graft donor site morbidity [13].

The use of cages in combination with additional plates was then introduced and reported to significantly reduce possible complications as fracture or resorption of the implant [14]. More recently, it was reported also that the addition of anterior plates determines the increase of the stability respect to the use of stand-alone cages, confirmed by radiologic evaluation that often-revealed better outcomes in term of fusion and maintenance of lordosis. Overall, better surgical, clinical and radiologic outcomes have been obtained in ACDF with anterior plate fixation at the final follow-up [15,16]. This data is in accordance with what observed in this study, where the clinical outcome of the patients was very satisfactory in almost 75% of the patients (47.3% and 27.3% of evaluated as “excellent” and “very good”, respectively).

However, some surgeons believe that the use of an additional anterior plate can be associated with various intra-operative and post-operative complications, such as loosening of screws or breakage of the fixation screw, displacement of the plate associated to soft-tissue damage, chronic dysphagia and adjacent segment degeneration [17-19]. Above all, dysphagia is a well-known complication resulting from ACDF even if the exact pathophysiologic process of its occurrence is still not well understood. Among the possible hypotheses, dysphagia is most likely caused by the irritation of the esophagus due to the anterior positioning of the locking plate [20,21]. Several studies reported this adverse event especially at long-term follow-up (35.1% of patients are affected by chronic dysphagia) [22]. However, it is also well-established that the thickness of the plate deeply influences the rate of incidence of dysphagia, where thinner plates are better accepted with a lower incidence of this post-operative complication [23].

In our data, no dysphagia or any other adverse reaction was observed at follow-up, suggesting that the Mecta-C cervical plate are well accepted by patients and provide satisfactory clinical outcomes.

Moreover, the application of plates are also seen as an additional device increasing the cost of the whole procedure. However, in our opinion the demonstrated benefits in term of durability and stability of the fusion deriving from the use of plate in ACDF well justify this additional cost, especially if compared to the possible economic burden represented by the surgical failures in this category of patients.

The retrospective nature of the evaluations as well as the mid-term follow-up period represent the main limitation of the study. Further evaluations in a prospective randomized study considering long-term evaluations will be required to further confirm these data.

## Conclusion

In cervical anterior fusion with additional plating most of the plate-related complications occurred early. Nevertheless, the retrospective analysis at a mid-term follow-up of 55 patients who underwent ACDF with Mecta-C cervical plate showed no clinical complication or adverse event, demonstrating that Mecta-C cervical plate can be used as additional safe and effective support to the TiPEEK cage in patients affected by different clinical indications.

## Conflict of interest

All authors declare no conflict of interest.

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