Effectiveness of the carbon composite cage* in cervical corpectomy.
Retrospective analysis of 50 cases.

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Carbon composite cervical corpectomy

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Introduction

Cervical corpectomies remain a challenge to reconstruct the anterior column and maintain stability. Tricortical iliac grafts or fibular struts are biologically satisfactory, but remain a source of morbidity and pain at the harvest site. Metallic implants achieve primary stability, but their radio-opaqueness makes the visualization of the osseous fusion difficult. Furthermore metal is an isotropic material with a mechanical property unlike anisotropic bone.

Objective

We present a cervical corpectomy series using a carbon composite (ostaPek®) cage, which provides primary stability, space for autologous bone graft, radiolucency to permit objective evaluation of fusion and above all, anisotropic elasticity which is closer to the biomechanical properties of the vertebral body.

Materials and Methods

Cervical corpectomies were performed in three centers on fifty patients. All cages were constructed in long carbon fiber ostaPek with the predominant orientation of the fibers in sagittal plane. This is similar to the orientation of the trabeculae in a vertebral body. Cage size variation ranged from 17.6mm to 25.1mm in height. Cases were either single level, associated with discetomy above or below, and at times with an additional ACIF disc cage in ostaPek. (See table indications) In three cases the corpectomy was performed at two levels, i.e., C4 and C6. Fifty-three ostaPek corpectomy cages were used. All were filled with autologous bone from corpectomy fragments and/or cancellous iliac fragments (minimalist approach) depending on the bone quality, the patient's age and the corpectomy technique used. Additional anterior cervical plates were used for 31 patients.

Indications

- Cervico-arthrosic myelopathy
- Brachialgia, either cervico-brachial neuralgia with two symptomatic levels or significant discopathy adjacent to a single symptomatic level
- Burst fractures
- Tumors
- Hypertrophic pseudarthrosis

Fusion evaluations

Lateral and AP x-rays were used to evaluate fusion. It was defined as an observed continuous bone bridge spanning from the superior to inferior vertebral end plate, through the composite implant. For this series mean follow up is 12 months. X-rays were performed on days 1, 8, 30, 60, 90, 180, 360 post-op. CT and MRI were done between days 90 and 180 post op.

Results

All patients demonstrated a radiographic fusion through the entire implant at 90 days regardless of the graft source or additional plates. Neurology improved for all myelopathy cases. Cervico-bracial neuralgia cases improved, except one failure, which required a revision due to insufficient decompression. For the burst fracture cases, good mobility without pain was achieved. Bone formation was stable at subsequent follow ups.

Complications

Two patients operated for brachialgia complained of persistent arm pain were revised with an increasing foraminotomy. No cage migration was observed. Four cages settled into the inferior endplate due to either osteoporosis or perhaps excessive distraction.

Conclusion

The ostaPek corpectomy cage constructs achieved primary stability of the anterior column, utilizing small fragments of bone, which reduces trauma at the graft harvest site. Bone bridging was observed through the implant in the standard x-ray. Initial fusion was achieved on all patients. The implant seemed satisfactory for the following reasons:

- The biomaterial's long carbon fibers are aligned in the sagittal plan, according to the normal trajectory of the dominant bone trabeculae, and the load that both a vertebral body and cage must bear.
- This provides primary anterior column support.
- Radio transparency with no artifact for MRI and minimal artifact for Scanner.
- Ample space for morcelized autologous bone. A large segment of the iliac crest, with its known complications, is not required.
- A convincing bone fusion through the cage can be observed, leaving a live bone bridge at the anterior column.
- Long carbon fiber is flexible and should allow physiological load of the bone tissue over time.

Further follow up is required to see how these grafted segments will evolve.

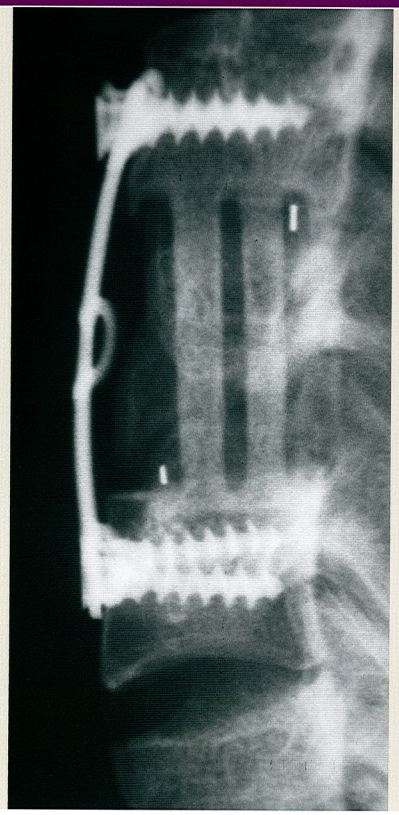
*Composite cages in ostaPek®, long carbon fiber reinforced PEKEKK. coLigne AG, Zurich Switzerland.

Population studied

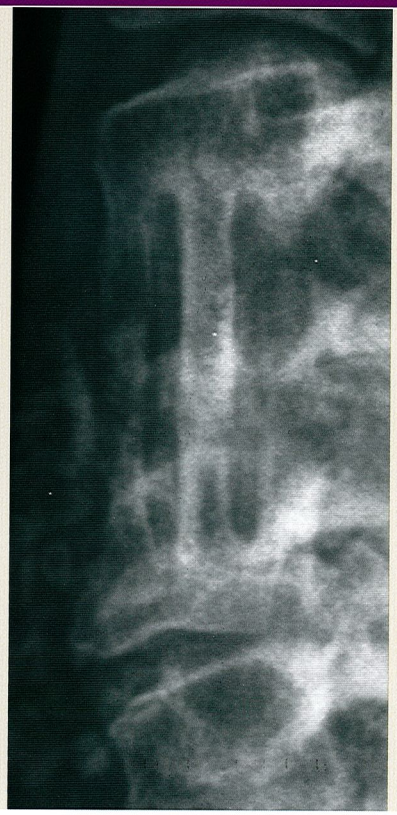
Series		Indications		Construct	
Cases	**50**	**Degenerative myelopathy**	**24/50 cases**	Patients with additional plates	31
Men	33	Single level corpectomy	14 cases	Patients withouth plates	19
Women	17	Single level corpectomy with adjacent discectomy	7 cases		
Age		Double level corpectomy	3 cases		
Range	18 - 77 years	This allowed the removal of bulging disc and osteophytes at 1 to 4 levels.			
Mean	51.6 years	Note: Seven patients received a secondary laminectomy to treat congenital stenosis of the cervical canal.		**Autologous bone source**	
Follow up		**Brachialgia**	**15/50 cases**	Illiac crest alone	6 cases
Range	41 - 1425 days	Either: 2 symptomatic levels or important discopathy next to a symptomatic level		Cervical vertebral body & illiac crest	3 cases
Mean	377 days	**Burst fractures**	**8/50 cases**	Cervical vertebral body alone	41 cases
		Note: Three patients with neurological signs			
		Tumors	**2/50 cases**		
		Hypertrophic pseudarthrosis	**1/50 cases**		

Myelopathy

Cage filled with autologous bone graft

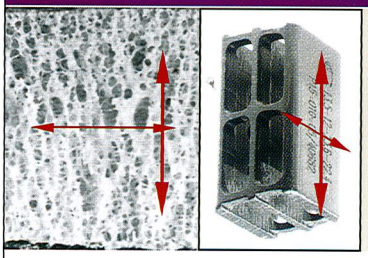


Patient one:
Post-op myelopathy > 1 year with plate



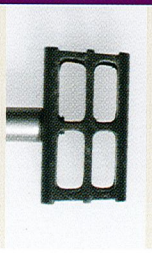
Patient two:
Post-op myelopathy > 4 years without plate

Cervical cage in long carbon fiber composite oriented to trabeculae

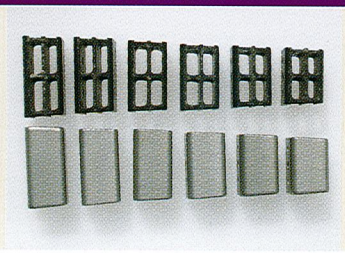


Long carbon fiber orientation to trabeculae (lumbar)

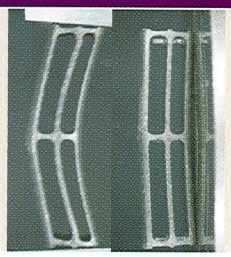
Panjabi MM, White AA Clinical Biomechanics of the Spine Figure 1-26 (A) Page: 41



Cage empty

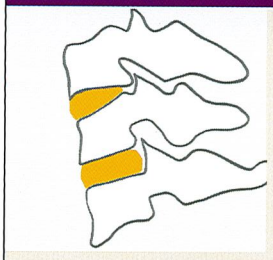


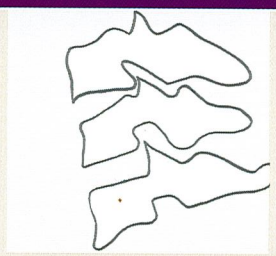
Cage inventory tested
25.1mm - 17.6mm cages

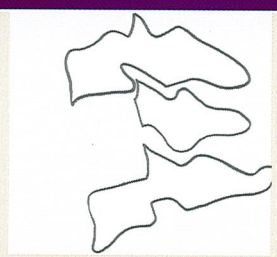


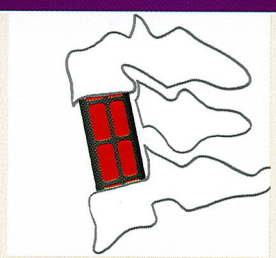
50mm cage specimen under 500kg static load.
Cage after static load

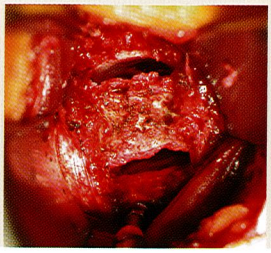
Surgical technique



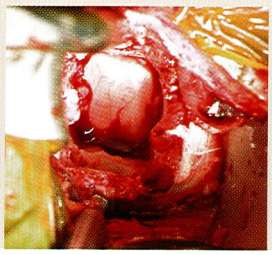




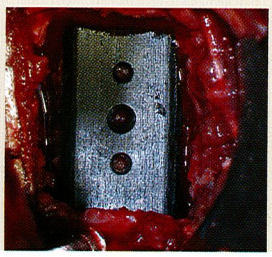




Cervical Spine



Discectomies



Corpectomy

Cage in place

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