

# TOTAL CERVICAL DISK REPLACEMENT WITH A PRESTIGE LP® PROSTHESIS: CLINICAL AND FUNCTIONAL OUTCOMES

ARTROPLASTIA TOTAL DO DISCO CERVICAL COM PRÓTESE PRESTIGE LP®:  
RESULTADOS CLÍNICOS E FUNCIONAIS

ARTROPLASTIA TOTAL DEL DISCO CERVICAL CON PRÓTESIS PRESTIGE LP®:  
RESULTADOS CLÍNICOS Y FUNCIONALES

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## ABSTRACT

**Objective:** To determine the clinical and functional results of short- and medium-term cervical arthroplasty with the Prestige LP® prosthesis for the treatment of compressive myelopathy, radiculopathy and axial pain with radiculopathy. **Methods:** This retrospective study, conducted from 2009 to 2012, included 18 patients. Only 16 were found for the second stage of research, conducted in 2011 and 2012. Pre- and postoperative assessments were carried out using the CSOQ (Cervical Spine Outcomes Questionnaire). Odom criteria were used only in the postoperative evaluation. Both were translated and adapted to the local culture. **Results:** There was no postoperative radiculopathy or other complications requiring prolonged hospitalization. In most patients, there was a significant improvement in axial pain and radiculopathy, and there was only one indication of conversion to fusion. **Conclusions:** In selected cases of cervical degenerative disc disease, herniated cervical disc and compressive myelopathy, cervical arthroplasty proved to be an effective and safe treatment in the short and medium terms.

**Keywords:** Arthroplasty; Arthrodesis; Discectomy; Spinal cord compression; Radiculopathy.

## RESUMO

**Objetivo:** Investigar os resultados clínicos e funcionais a curto e médio prazo da artroplastia cervical total com a prótese Prestige LP® para tratamento da mielopatia compressiva, radiculopatia e dor axial com radiculopatia. **Métodos:** Estudo retrospectivo realizado no período de 2009 a 2012, incluindo 18 pacientes. Somente 16 foram localizados e participaram da segunda etapa da pesquisa, realizada em 2011 e 2012. Foram feitas avaliações pré e pós-operatórias utilizando-se o questionário CSOQ (Cervical Spine Outcomes Questionnaire). Os critérios de Odom foram utilizados somente na avaliação pós-operatória. Ambos foram traduzidos e adaptados para a cultura local. **Resultados:** Não houve radiculopatia pós-operatória ou qualquer outra complicação que exigisse hospitalização prolongada. Na maioria dos pacientes, observou-se grande melhora da dor axial e da radiculopatia, constatando-se somente um caso de indicação de conversão para artrodese. **Conclusão:** Em casos bem selecionados de discopatia cervical degenerativa, hérnia de disco cervical e mielopatia compressiva, a artroplastia cervical mostrou-se um tratamento eficaz e seguro a curto e médio prazo.

**Descritores:** Artroplastia; Artrodese; Discotomia; Compressão da medula espinal; Radiculopatia.

## RESUMEN

**Objetivo:** Investigar los resultados clínicos y funcionales en el corto y mediano plazo de la artroplastia cervical total con la prótesis LP Prestige® prótesis para el tratamiento de la mielopatia compresiva, radiculopatia y dolor axial con radiculopatia. **Métodos:** Este estudio retrospectivo se llevó a cabo desde 2009 hasta 2012, incluyendo 18 pacientes. Sólo 16 fueron encontrados para participar de la segunda etapa de la investigación realizada del 2011 al 2012. Se realizaron evaluaciones pre y postoperatorias mediante el cuestionario CSOQ (Cervical Spine Outcomes Questionnaire). Se utilizaron los criterios de Odom sólo en la evaluación postoperatoria. Ambos fueron traducidos y adaptados a la cultura local. **Resultados:** No hubo radiculopatia postoperatoria u otras complicaciones que necesitaron hospitalización prolongada. En la mayoría de los pacientes, se observó una mejoría significativa en el dolor axial y radiculopatia, encontrándose sólo un caso con indicación de conversión a la artrodese. **Conclusión:** En los casos cuidadosamente seleccionados de la enfermedad degenerativa de disco cervical, hernia de disco cervical y mielopatia compresiva, la artroplastia cervical demostró ser un tratamiento eficaz y seguro a corto y medio plazo.

**Descriptores:** Artroplastia; Artrodese; Discectomía; Compresión de la médula espinal; Radiculopatia.

## INTRODUCTION

Anterior cervical arthrodesis (ACA) is considered the gold standard technique for treatment of cervical discopathies with radiculopathy and/or myelopathy. Despite the excellent outcomes from ACA, studies indicate a change in the kinematics of the levels adjacent to the arthrodesis, which causes earlier onset of disc generation.<sup>1-12</sup> Hilibrand *et al*<sup>5</sup> reported adjacent degeneration rates of 2.9% per year and 25.6% over ten years following anterior arthrodesis, with 2/3 of these patients having undergone additional surgery.

Seeking to preserve the physiological kinematics of the cervical spine, replacement is an option for the treatment of cervical disc di-

seases, and safe insertion and clinical success have been reported in several studies.<sup>13,14</sup>

This study describes our experience with cervical replacement using the Prestige LP® prosthesis (Medtronic Sofamer Danek, USA), a prosthesis with two ceramic and titanium components, and evaluates the improvement to the quality of life and the level of patient satisfaction.

## MATERIALS AND METHODS

A retrospective study was conducted, which included 18 patients in the period from 2009 to 2012. Two patients could not be

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Study conducted at the Centro da Coluna Vertebral (CECOL), Rio de Janeiro, RJ, Brazil.

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located for participation in the second phase of the study. All had undergone anterior approach cervical replacement with a Prestige LP® prosthesis.

Inclusion criteria<sup>15</sup>: Symptomatic patients with radiculopathy or myelopathy; degeneration of one or two levels between C3 and C7; no prior cervical surgery; and with cervical mobility.

Exclusion criteria<sup>15</sup>: Active infection; osteoporosis; tumors; radiological evidence of mechanical instability or lack of mobility at the treatment level confirmed in preoperative dynamic flexion-extension radiographies; cervical facet joint arthritis; solitary axial pain; and those patients who could not be located for the second phase of the interview.

**Surgical technique**

An anterior Smith-Robinson approach to the left of the cervical spine was performed. The median line and the level were identified and marked, and vertebral distraction pins were placed to perform the discectomy, resection of the posterior longitudinal ligament, and bilateral neuroforaminal decompression.

The endplates were prepared so that they were parallel, taking care to preserve as much cortical bone as possible. A rasp was used to assist in the preparation of the endplate to improve the fit of the implant. The template was positioned in the disc space and the size of the prosthesis was verified, taking care not to distract the articulations or the disc space. The rail cutter guide was used to form the four parallel fixation channels in the endplates. The rails of the Prestige LP® prosthesis were aligned with the endplate channels for the insertion of the prosthesis.

Intraoperative anterior posterior and lateral fluoroscopes were performed to verify the correct placement.

For the evaluation, we used the CSOQ (Cervical Spine Outcomes Questionnaire)<sup>16,17</sup> because it is more specific for the evaluation of both pre- and postoperative pain and functionality related to cervical diseases. Odom's Criteria<sup>18</sup> were used only postoperatively.

The age range of the 16 patients varied from 27 to 50 years. There were eight male and eight female patients.

Odom's Criteria were applied as follows:

**Odom's Criteria**

Excellent: Improvement of most (at least 80%) of the preoperative signs and symptoms, with little deterioration (not more than 10%). No complaints related to cervical disc disease. Daily tasks are performed without limitations;

Good: Improvement of some (at least 70%) of the preoperative signs and symptoms, with some deterioration (not more than 15%). Intermittent discomfort related to cervical disc disease. Daily tasks are performed without significant limitations;

Fair: Improvement of at least 50% of the preoperative signs and symptoms, with some deterioration (not more than 20%). Subjective improvement, but physical activities are significantly limited;

Poor: Improvement of a few (less than 50%) of the preoperative signs and symptoms, or significant deterioration (more than 20%). No changes or worse as compared to the situation prior to the operation.

Used constantly in scientific articles, Odom's Criteria are highly specific for the assessment of cervical pathologies as regards pain and the performance of daily activities. The CSOQ was selected to analyze other parameters (physical symptoms, psychology evaluation, and the need for medication, among others).

The CSOQ is a specific tool for the assessment of cervical pain and the results of treatment, providing information about the severity of the pain, functional measurements, psychological distress, physical symptoms, and the measurement of health care. It is easy to understand and highly reliable. (Attachment 1)

**CSOQ assessment**

Each score was converted into a number from 0-100. Higher numbers indicate greater bodily dysfunction in addition to: I – gre-

ater severity of cervical pain; II – severity of shoulder and arm pain; III – greater functional limitation; IV – tendency towards more stress, depression; V – higher frequency of physical symptoms other than pain; VI – high frequency of the use of health care mechanisms.

**RESULTS**

According to Odom's Criteria, 62% of the patients had excellent results, 13% good results, 19% fair results, and 6% poor results. (Figure 1)

In most cases, there was no postoperative radiculopathy or any other complication requiring extended hospitalization. There was a significant improvement in axial and radicular pain, enabling a return to work, personal and leisure activities, and even sports. Sexual function was only slightly impacted by the disease, and improved following surgery.

In one of our cases, there was a failure in the fixation of the prosthesis with anterior migration. Conversion to an ACA was indicated.

The results of the CSOQ (Cervical Spine Outcomes Questionnaire) scores are shown in Figures 2 to 10.

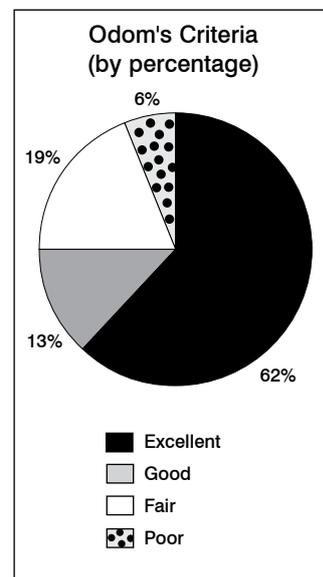


Figure 1. Odom's Criteria (by percentage).

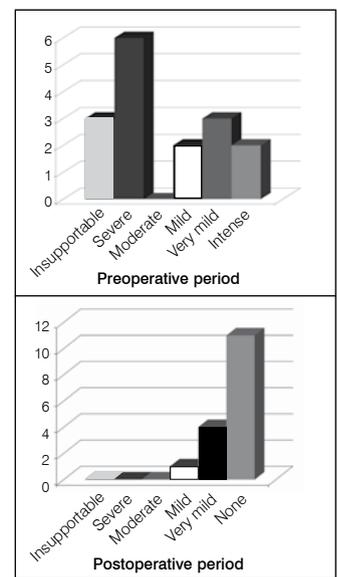


Figure 2. Severity of the cervical pain (by absolute number of patients).

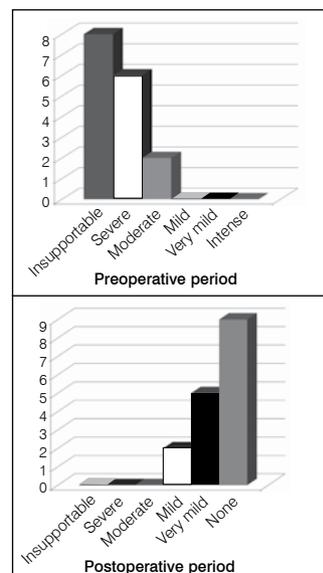


Figure 3. Severity of shoulder/arm pain (by absolute number of patients).

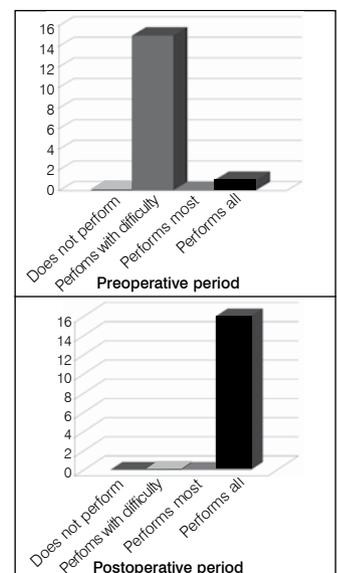
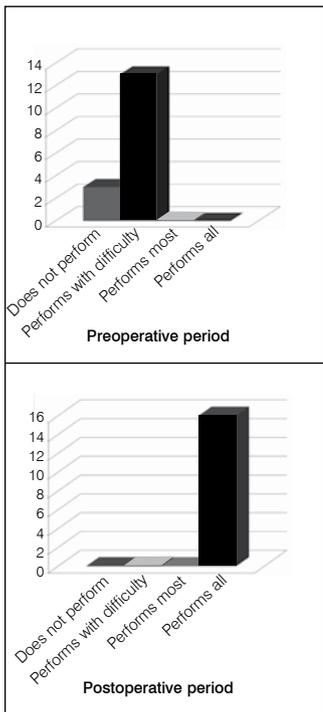
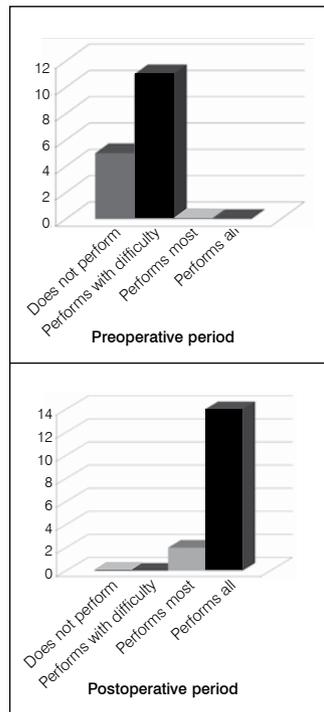


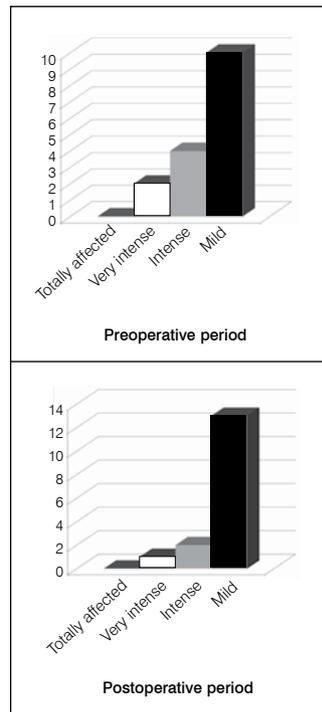
Figure 4. Functional measurement of personal care (by absolute number of patients).



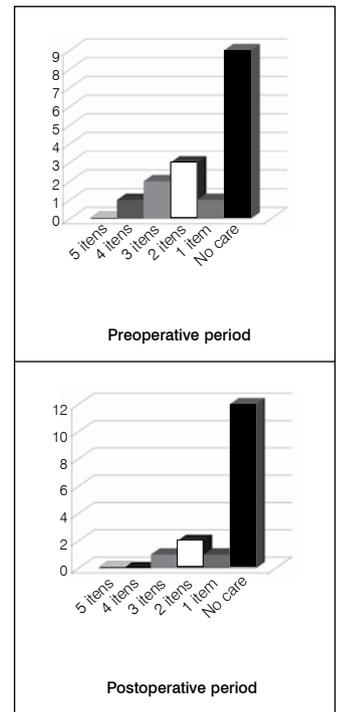
**Figure 5.** Functional measurement of work at home (by absolute number of patients).



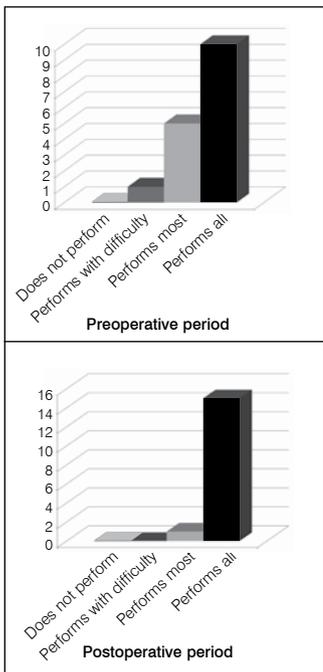
**Figure 6.** Functional measurement of recreation (by absolute number of patients).



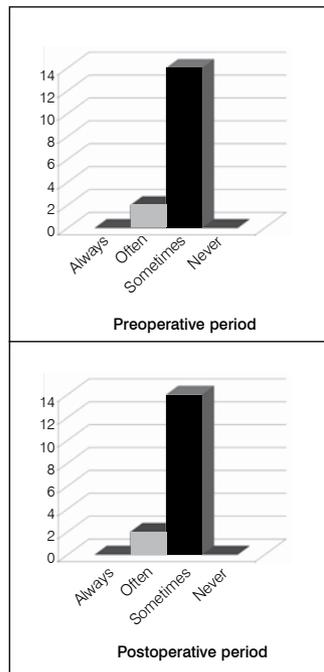
**Figure 9.** Measurement of physical symptoms (by absolute number of patients).



**Figure 10.** Measurements of health care (by absolute number of patients).



**Figure 7.** Functional measurement of sexual activity (by absolute number of patients).



**Figure 8.** Measurement of psychological distress (by absolute number of patients).

**DISCUSSION**

Cervical replacement promotes the preservation of kinematics closest to the physiological standard<sup>19-21</sup> and is a possible long-term solution for the problem of adjacent discopathy encountered in patients who have undergone arthrodesis.<sup>5</sup> In our study, we had a very short period of time to evaluate the incidence of adjacent discopathy.

There are several types of prostheses, classified by number of components, material, and biomechanical design.<sup>22</sup>

The Prestige LP® prosthesis has two-hinged titanium and ceramic components and a ball-in-trough biomechanical design that allows anterior posterior translation coupled with flexion/extension movement in a combination that is very close to normal.<sup>23</sup>

Fixation of the Prestige LP® prosthesis in the vertebral body is achieved through tracks that allow a smaller anterior prominence in the profile of the prosthesis, in addition to reducing fractures of the vertebra, common in the insertion of prostheses with keels.<sup>23</sup>

According to Swiss Spine<sup>24</sup>, the aspects that most influence patient recovery are the intensity of preoperative pain, the quality of life prior to surgery, and the preoperative use of psychotropic medications. The greater the intensity of the preoperative pain, the greater the improvement of symptoms. Patients with a highly compromised quality of life tend to have better outcomes. The prior use of psychotropic drugs was associated with unsatisfactory results.

Given the amount of the time and experience with knee and hip replacements, other complications, like breakage of implants due to fatigue, loosening of the bone-implant interface, sinking of the endplate, and infection can be observed. These complications were not observed in the short or medium term. However, this can only be confirmed over time, with the long-term monitoring of these patients.

Further studies will be necessary to confirm the promising results of cervical replacement.

**CONCLUSION**

We observed similarities between the results obtained in this study and in several current studies, and conclude that total cervical replacement is a safe and effective method for short- and medium-term treatment when indicated in cases of degenerative discopathy, disc herniation, and myelopathy.

All authors declare no potential conflict of interest concerning this article.

## REFERENCES

- Cherubino P, Benazzo F, Borromeo U, Perle S. Degenerative arthritis of the adjacent spinal joints following anterior cervical spinal fusion: clinicoradiologic and statistical correlations. *Ital J Orthop Traumatol.* 1990;16(4):533-43.
- Clements DH, O'Leary PF. Anterior cervical discectomy and fusion. *Spine (Phila Pa 1976).* 1990;15(10):1023-5.
- Döhler JR, Kahn MR, Hughes SP. Instability of the cervical spine after anterior interbody fusion. A study on its incidence and clinical significance in 21 patients. *Arch Orthop Trauma Surg.* 1985;104(4):247-50.
- Goffin J, van Loon J, Van Calenbergh F, Plets C. Long-term results after anterior cervical fusion and osteosynthetic stabilization for fractures and/or dislocations of the cervical spine. *J Spinal Disord.* 1995 Dec;8(6):500-8.
- Hilibrand AS, Carlson GD, Palumbo MA, Jones PK, Bohlman HH. Radiculopathy and myelopathy at segments adjacent to the site of a previous anterior cervical arthrodesis. *J Bone Joint Surg Am.* 1999;81(4):519-28.
- Matsunaga S, Kabayama S, Yamamoto T, Yone K, Sakou T, Nakanishi K. Strain on intervertebral discs after anterior cervical decompression and fusion. *Spine (Phila Pa 1976).* 1999;24(7):670-5.
- Pospiech J, Stolke D, Wilke HJ, Claes LE. Intradiscal pressure recordings in the cervical spine. *Neurosurgery.* 1999;44(2):379-84.
- Woesner ME, Mitts MG. The evaluation of cervical spine motion below C2: a comparison of cinerentgenographic and conventional roentgenographic methods. *Am J Roentgenol Radium Ther Nucl Med.* 1972;115(1):148-54.
- Goffin J, Van Calenbergh F, van Loon J, Casey A, Kehr P, Liebig K, et al. Intermediate follow-up after treatment of degenerative disc disease with the Bryan Cervical Disc Prosthesis: single-level and bi-level. *Spine (Phila Pa 1976).* 2003;28(24):2673-8.
- Sears W. Bryan cervical disc arthroplasty: 12 month minimum follow-up in 14 patients. *J Bone Joint Surg Br.* 2004;86(Supplement 4):461.
- Theisen IJ, Theisen DM, Oliveira MAA, Berwanger CGW. Comparação de quatro técnicas cirúrgicas para discectomia cervical anterior e artrodesse. *Coluna/Columna.* 2004;3(3):117-21.
- Anderson PA, Rouleau JP, Bryan VE, Carlson CS. Wear analysis of the Bryan Cervical Disc prosthesis. *Spine (Phila Pa 1976).* 2003;28(20):S186-94.
- Goffin J, Casey A, Kehr P, Liebig K, Lind B, Logroscino C, et al. Preliminary clinical experience with the Bryan Cervical Disc Prosthesis. *Neurosurgery.* 2002;51(3):840-5.
- Wang MY, Leung CH, Casey AT. Cervical arthroplasty with the Bryan disc. *Neurosurgery.* 2005;56(1 Suppl):58-65.
- Unnanuntana A. Cervical instrumentation: anterior and posterior. In: Herkowitz HN, Garfin SR, Eismont FJ, Bell GR, Balderston RA, editors. 6th ed. *Rothman-Simeone the spine.* Philadelphia: Saunders/Elsevier; 2011. p. 427-30.
- BenDebba M, Heller J, Ducker TB, Eisinger JM. Cervical spine outcomes questionnaire: its development and psychometric properties. *Spine (Phila Pa 1976).* 2002;27(19):2116-23.
- Lafuent J. El implante discal cervical como alternativa a la artrodesis em el tratamiento quirúrgico de la cervicartrosis [tesis] Barcelona: Universitat Autònoma de Barcelona; 1994.
- Clark C. Surgical management of cervical radiculopathy in the cervical spine (The Cervical Spine Research Society). 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2004. p.1039.
- Sasso RC, Smucker JD, Hacker RJ, Heller JG. Artificial disc versus fusion: a prospective, randomized study with 2-year follow-up on 99 patients. *Spine (Phila Pa 1976).* 2007;32(26):2933-40.
- Heidecke V, Burkert W, Brucke M, Rainov NG. Intervertebral disc replacement for cervical degenerative disease—clinical results and functional outcome at two years in patients implanted with the Bryan cervical disc prosthesis. *Acta Neurochir (Wien).* 2008;150(5):453-9.
- Sun Y, Zhao YB, Zhou FF, Liu ZJ. [The application of cervical spine arthroplasty with Bryan disc and mid-term clinical and radiological follow-up results]. *Zhonghua Wai Ke Za Zhi.* 2008;46(5):333-7.
- Lazaro BC, Yucesoy K, Yuksel KZ, Kowalczyk I, Rabin D, Fink M, et al. Effect of arthroplasty design on cervical spine kinematics: analysis of the Bryan Disc, ProDisc-C, and Synergy disc. *Neurosurg Focus.* 2010;28(6):E6.
- Peng CW, Yue WM, Basit A, Guo CM, Tow BP, Chen JL, et al. Intermediate Results of the Prestige LP Cervical Disc Replacement: Clinical and Radiological Analysis With Minimum Two-Year Follow-up. *Spine (Phila Pa 1976).* 2010;35(2):E105-11.
- Schlusmann E, Aghayev E, Staub L, Moulin P, Zweig T, Röder C, et al. SWISSpine: the case of a governmentally required HTA-registry for total disc arthroplasty: results of cervical disc prostheses. *Spine (Phila Pa 1976).* 2010;35(24):E1397-405.

## Attachment 1. CSOQ (Cervical Spine Outcomes Questionnaire).

Severity of pain (Melzack/Torgerson)		Measurement of physical symptoms (V):	
0 - None	3 - Intense (moderate)	1 - Difficulty swallowing	
1 - Mild (very mild)	4 - Very intense (severe)	1 - Headaches related to cervical pain	
2 - Uncomfortable (mild)	5 - Unsupportable (very severe)	1 - Sensation or motor changes in arms/hands	
<b>Valid for the evaluation of neck pain (I) and shoulder/arm pain (II)</b>		1 - Sensation or motor changes in legs/feet	
		1 - Difficulty sleeping (insomnia) due to cervical and/or shoulder/arm pain	
<b>Functional measurement (III) to evaluate 4 parameters:</b>		0 to 5 points: 1 point each	
- Personal care		<b>Measurement of health care (VI):</b>	
- Work at home		<b>Drugs that you have taken to alleviate pain, and frequency of use:</b>	
- Recreation		<b>Analgesics/narcotics:</b>	<b>Psychoactives (antidepressants, anxiolytics, hypnotics):</b>
- Sexual activity		1 – use > 2 times/week	1 – use > 2 times/week
0 - Performs all (without difficulty)	2 - Performs with difficulty (some)	0 – use < 2 times/week	0 – use < 2 times/week
1 - Performs most (little difficulty)	3 - Does not perform (none)	<b>Questions about cervical pathology:</b>	
<b>Measurement of psychological distress (IV): during the past month have you felt agitation, anxiety, tension, worry about your physical health, apathy, sadness, lack of energy, lethargy?</b>		Have you sought out a professional to care for your cervical disease?	
0 - Never	2 - Often	1- yes      0- no	
1 - Sometimes	3 - Always	Did you receive conservative treatment?	
		1- yes      0- no	
		Did you receive surgical treatment?	
		1- yes      0- no	
<b>Total score of VI varies from 0 to 5.</b>			