J. Phys. Ther. Sci. 30: 185–189, 2018

The Journal of Physical Therapy Science

Case Study

Relief of exertional dyspnea and spinal pains by increasing the thoracic kyphosis in straight back syndrome (thoracic hypo-kyphosis) using CBP® methods: a case report with long-term follow-up

Joseph W. Betz[1)], Paul A. Oakley[2)*], Deed E. Harrison[3)]

[1)] *Private Practice, USA*
[2)] *Private Practice, Canada*
[3)] *CBP NonProfit, Inc., USA*

Abstract. [Purpose] To present the clinically significant improvement of straight back syndrome (SBS) in a patient with spinal pain and exertional dyspnea. [Subject and Methods] A 19 year old presented with excessive thoracic hypokyphosis and other postural deviations. A multimodal CBP® mirror image® protocol of corrective exercises, traction procedures and spine/posture adjusting were given over an initial 12-week course of intensive treatment followed by a 2.75 year follow-up with minimal supportive treatment. [Results] The patient had significant postural improvements in all postural measures and specifically a 14° increase in the thoracic kyphosis that was maintained at long-term follow-up. The postural improvements were consistent with relief of exertional dyspnea and pain, as well as increases in both antero-posterior thoracic diameter and the ratio of antero-posterior to trans-thoracic diameter, measurements critical to the wellbeing of patients with SBS. [Conclusion] Long-term follow-up confirmed stable improvement in physiologic thoracic kyphosis in this patient. Nonsurgical correction in thoracic hypokyphosis/SBS can be achieved by mirror image traction procedures configured to flex the thoracic spine into hyperkyphosis as well as corrective exercise and manipulation as a part of CBP technique protocols.
Key words: CBP, Straight back syndrome, Exertional dyspnea

(This article was submitted Jul. 18, 2017, and was accepted Oct. 30, 2017)

INTRODUCTION

Straight back syndrome (SBS) was first described by Rawlings in 1960[1, 2]. It is the congenital loss of the normal physiologic mid-upper thoracic kyphosis. This thoracic deformity biomechanically decreases the distance between the spine and sternum, compressing the internal structures, namely the heart. As Raggi et al. states: “the heart appears trapped in a chest cavity too small for its size, and its anatomic architecture is seemingly altered in an attempt to accommodate these insufficient dimensions[3].”

SBS mimics congenital heart disease as it rarely presents without either false heart enlargement or mechanical heart murmurs[2]. The false enlarged cardiac sign on the PA chest radiograph, the so-called ‘pancake’ cardiac silhouette configuration simulates cardiomegaly[4], and the systolic murmurs can mimic atrial septal defect, idiopathic pulmonary artery dilation, or mild pulmonary stenosis[5]. Thoracic spine imaging including lateral thoracic radiography[6, 7] or thoracic CT scanning[3, 5] are diagnostic for SBS.

Although the diagnostic features of systolic murmur consistently present in patients with SBS and are considered benign in nature[8], Spapen et al. has suggest that its association with mitral valve prolapse, a condition associated with significant morbidity and mortality may be underestimated[9]. The incidence of SBS is not known but is thought to be ‘not rare’[6].

*Corresponding author. Paul A. Oakley (E-mail: docoakley.icc@gmail.com)

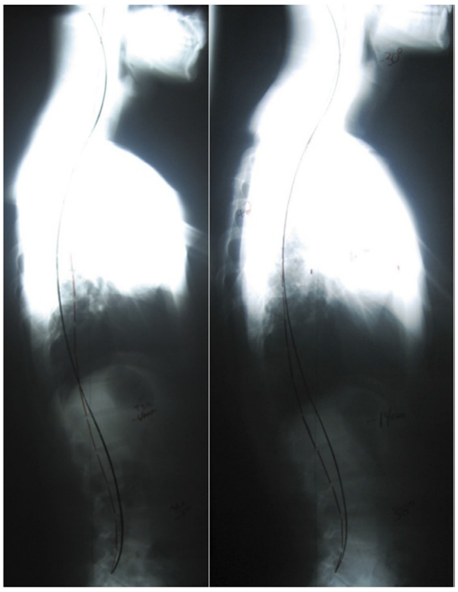

Fig. 1. Lateral full spine radiography.
Left: Initial view. Note straight back syndrome/thoracic hypokyphosis; Right: 12-week follow-up. Note the restoration of spinal curves. Red (dashed) line highlights patient posterior vertebral body positions; black line indicates normal/ideal alignment (CBP® Seminars, Inc.).

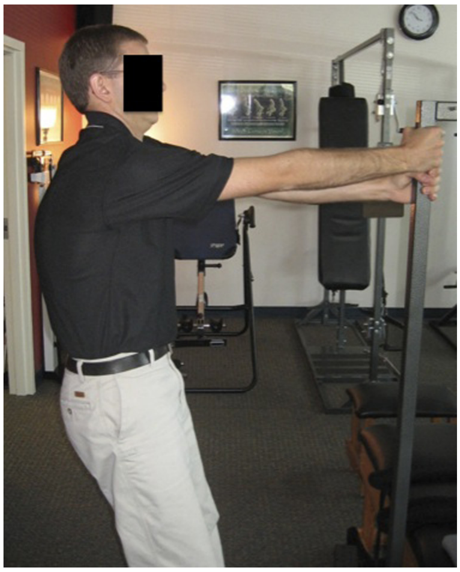

Fig. 2. Thoracic hyperkyphosis exercise.
Patient was instructed to translate their thorax posteriorly and hold for 30 seconds and repeat.

The surgical correction of thoracic hypokyphosis (lordotic thoracic kyphosis) has been described in the literature[10–12] where it is only recommended for those having cardiopulmonary symptoms with severe structural thoracic lordosis of greater than 25–30°[10]. The nonsurgical correction of thoracic hypokyphosis is very rare and we could only identify one case in the literature[13]. Brooks et al.[13] reported on the nonsurgical improvement in increasing thoracic kyphosis in a female patient having concomitant scoliosis. Treatment was over several years and involved deep tissue massage, outpatient psychological therapy, daily exercise focusing on mobilization of the chest wall, and manipulation. There was a 16° improvement in thoracic kyphosis and a greater than 10° reduction in scoliosis over a 4 year time span.

This report documents the increase in thoracic kyphosis in a patient having hypokyphosis/SBS and the improvement of various symptoms related to having thoracic and other spinal/postural deviations.

SUBJECT AND METHODS

A male patient aged 19 presented to a spine clinic in Boise, Idaho, USA. He reported to have a primary complaint of exertional dyspnea and a history of several lung collapses with surgical interventions. The patient also reported having neck, middle and lower back pain.

All directions of range of motion for the cervical and lumbar spine were decreased. There was a visual obvious 'flat back' throughout the thoracic spine that made the scapulae stick out. A full spine radiographic series was performed (Fig. 1). All radiographs were analyzed using the Harrison posterior tangent method for analysis of lateral images[14–16] and the modified Risser-Ferguson method for the AP images[17]. These methods are reliable and repeatable as is standing posture[14–18].

The patient was determined to have a complete loss of the normal cervical lordosis (C2–C7: −1° vs. normal −34 to −42°[19, 20]), a reduced atlas plane line (APL) (−7° vs. normal −24 to −29°[19]), thoracic hypokyphosis (T3–T12: 14° vs. normal 37°[21]), lumbar hypolordosis (L1–L5: −28° vs. normal −40°[22]), reduced sacral base angle (SBA) (24° vs. normal 40°[22]) (Table 1). The patient also had a decreased antero-posterior diameter (APD) of the thorax (80 mm vs. normal 142mm[4]) and a reduced APD to transthoracic diameter ratio (APD:TTD: 27% vs. normal 47%[4]) (Table 1).

The patient was treated with Chiropractic BioPhysics® (CBP®) technique[23–26]. This technique involves the use of the mirror image® concept developed by Dr. Don Harrison[23]. 'Corrective' exercises, adjustments, and traction procedures are utilized stressing the patient in the mirror image, or opposite to the presenting posture and spinal pattern. Specifically, the patient was trained to perform thoracic hyperkyphosis exercises, where he was to posteriorly translate his thorax and hold for 30 seconds, taking 10 seconds break and repeating for 10 minutes (Fig. 2). The patient was treated in three different traction set-ups for 10 minutes each. The patient was put in a hyperkyphosis positioned traction due to the thoracic hypokyphosis

Table 1. Postural sagittal curves, vertical axis, and thoracic diameter values as measured initially, at 3 months and at 2.75 months follow-up

Values	Normal	Initial	3 m° follow-up	2.75 yr follow-up
APL	−29[19]	−7°	−28°	−28°
ARA (C2–C7)	−(34–42)°[19, 20]	−1°	−30°	−22°
Tz (C2–C7)	0−15 mm[19]	13 mm	0 mm	4 mm
ARA (T3–T10)	37°[21]	14°	28°	27°
ARA (L1–L5)	−40°[22]	−28°	−38°	−29°
Tz (T12–S1)	0 mm	4 mm	−14 mm	−16 mm
SBA	40°[22]	24°	40°	40°
APD	142 mm[4]	80 mm	92 mm	110 mm
APD: TTD	47%[4]	27%	35%	48%

APL: atlas plane line; ARA: absolute rotation angle; Tz: horizontal translation; SBA: sacral base angle; APD: antero-posterior diameter; APD:TTD: ratio of antero-posterior to trans-thoracic diameters.

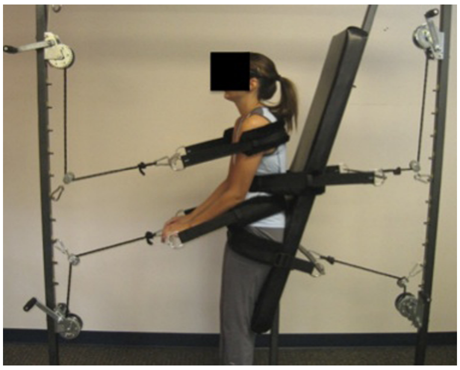

Fig. 3. Thoracic hyperkyphosis traction. Thoracic spine is forced into hyperkyphosis.

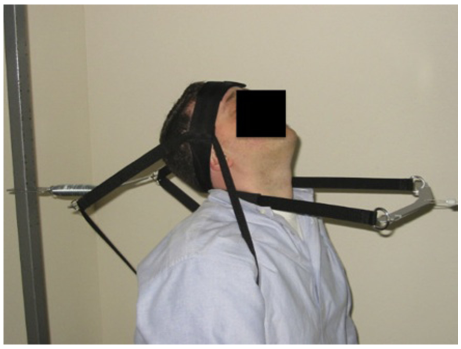

Fig. 4. Cervical extension traction. Cervical spine is hyper-extended while purposefully flexing the upper thorax.

Fig. 5. Lumbar extension traction Lumbar is extended with a 20° angle of pull from the vertical.

(Fig. 3); a hyperlordosis positioned cervical extension traction due to the straight neck[25, 27] (Fig. 4); and a lumbar hyperlordosis extension traction due to the lumbar hypolordosis[26, 28–31] (Fig. 5). Spinal manipulation and mirror image posture adjustments were also performed.

The patient received 37 treatments over approximately 3 months. Following this, the patient continued at approximately 1 time per month for a year before discontinuing care. A follow-up assessment was also performed at 2 years and 9 months after initial presentation, and the patient consented to publication.

RESULTS

Upon re-assessment after 37 treatments over the course of 12 weeks, the patient reported substantial decreases in pain throughout the back and neck as well as significant improvement in the primary complaint of exertional dyspnea.

The patient also demonstrated improvements in virtually all posture measurements as measured from radiographs (Fig. 1; Table 1). The patient had a 14° increase in thoracic kyphosis (28° vs. 14°), a 29° increase in cervical lordosis (−30° vs. −1°), an increase in APL (−28° vs. −7°), a decrease in forward head posture (0 mm vs. 13 mm), a 10° increase in lumbar lordosis (−38° vs. −28°), and an increase in SBA (40° vs. 24°). The measures directly related to SBS both improved, the APD increased by 12 mm (92 mm vs. 80 mm), and the APD:TTD ratio improved by 8% (35% vs. 27%).

The long-term 2 year, 9 month follow-up after twelve further treatments demonstrated that symptomatic improvements were stable as the patient remained well. Follow-up radiographic assessment showed a general maintenance of most postural measures with the exception of some loss of lumbar lordosis (Table 1). Of note, the APD and APD:TTD ratio continued to improve (Table 1).

DISCUSSION

This report demonstrates the improvement in thoracic hypokyphosis in a patient having many postural and spine deviations including SBS suffering from back and neck pains and exertional dyspnea.

Considering the lack of literature on SBS disorder and the even greater lack of evidence of nonsurgical correction of this disorder[13)], this case reveals that a posture-specific intensive program of mirror image directed traction, exercises, and adjustments may be successful in correcting thoracic hypokyphosis in a subgroup of SBS cases. Several recent reports have revealed that Harrison's mirror image approach to postural disorders are successful at correcting many postural faults including lumbar hypolordosis[28–31)], cervical hypolordosis[27, 32–35)], and thoracic hyperkyphosis[36–38)].

The 2.75 year follow-up assessment revealed that virtually all of the postural measures were maintained with minimal treatment, particularly the increase in thoracic kyphosis. Of note was the continued improvements in both the APD and the ratio of APD:TTD. Thus, human posture seems relatively stable as has been demonstrated in several clinical trials[27–34)]. Further, the continued improvements in thoracic dimensions may indicate that once an individual's posture is corrected to within a certain threshold, homeostasis and healing will continue.

Although surgical procedures are available for excessive thoracic lordosis[10–12)], it is suggested that nonsurgical approaches be employed when there is obvious thoracic hypokyphosis that precipitates surgical urgency. Harrison's mirror image application of corrective exercises and postural traction procedures may be the panacea for postural disorders as postural-specific treatments are now showing superiority over generalized treatments for the same patient population including treatment for correction of scoliosis[39, 40)], cervical lordosis[33, 34)], and lumbar lordosis[29–31)].

Long-term follow-up confirmed stable improvement in physiologic thoracic kyphosis in this patient. Nonsurgical correction in thoracic hypokyphosis/SBS was achieved by traction procedures configured to flex the thoracic spine into hyperkyphosis as well as exercise and manipulation as a part of CBP technique methods. One important aspect of this case is that the adjacent and opposite curves of the spine, cervical and lumbar lordoses were simultaneously treated along with increasing the thoracic kyphosis; this may be an essential element to achieve success in changing the thoracic alignment in those with SBS.

The limitations to this study are that it is a single case; there was no CT scan data that would have offered more detailed information related to SBS; finally, several procedures were performed including exercise, traction and manipulation. Manipulation has been shown to not affect the spinal configuration[41, 42)]. Exercise, particularly custom, patient-specific exercise may have contributed to the correction achieved, as well as the traction. Further studies should be done to verify the results obtained in this case and to distinguish the contribution of the exercise from the contribution of traction.

Conflict of interest

PAO is paid by CBP NonProfit for writing the manuscript. DEH teaches chiropractic rehabilitation methods used and sells products to physicians for patient care used in this manuscript.

REFERENCES

1) Rawlings MS: The "straight back" syndrome, a new cause of pseudoheart disease. Am J Cardiol, 1960, 5: 333–338. [Medline] [CrossRef]
2) Rawlings MS: Straight back syndrome: a new heart disease. Dis Chest, 1961, 39: 435–443. [Medline] [CrossRef]
3) Raggi P, Callister TQ, Lippolis NJ, et al.: Is mitral valve prolapse due to cardiac entrapment in the chest Cavity? A CT view. Chest, 2000, 117: 636–642. [Medline] [CrossRef]
4) Deleon AC Jr, Perloff JK, Twigg H, et al.: The straight back syndrome. Clinical cardiovascular manifestations. Circulation, 1965, 32: 193–203. [Medline] [CrossRef]
5) Tokushima T, Utsunomiya T, Ogawa T, et al.: Contrast-enhanced radiographic computed tomographic findings in patients with straight back syndrome. Am J Card Imaging, 1996, 10: 228–234. [Medline]
6) Datey KK, Deshmukh MM, Engineer SD, et al.: Straight back syndrome. Br Heart J, 1964, 26: 614–619. [Medline] [CrossRef]

7) Esser SM, Monroe MH, Littmann L: Straight back syndrome. Eur Heart J, 2009, 30: 1752. [Medline] [CrossRef]
8) Serratto M, Kezdi P: Absence of the physiologic dorsal kyphosis. Cardiac signs and hemodynamic manifestations. Ann Intern Med, 1963, 58: 938–945. [Medline] [CrossRef]
9) Spapen HD, Reynaert H, Debeuckelaere S, et al.: The straight back syndrome. Neth J Med, 1990, 36: 29–31. [Medline]
10) Bradford DS, Blatt JM, Rasp FL: Surgical management of severe thoracic lordosis. A new technique to restore normal kyphosis. Spine, 1983, 8: 420–428. [Medline] [CrossRef]
11) Winter RB, Lonstein JE: The surgical correction of thoracic and lumbar hyperlordosis deformities. Iowa Orthop J, 1998, 18: 91–100. [Medline]
12) Winter RB, Lovell WW, Moe JH: Excessive thoracic lordosis and loss of pulmonary function in patients 200 with idiopathic scoliosis. J Bone and Joint Surg, 1975, 57A: 972–977. [CrossRef]
13) Brooks WJ, Krupinski EA, Hawes MC: Reversal of childhood idiopathic scoliosis in an adult, without surgery: a case report and literature review. Scoliosis, 2009, 4: 27. [Medline] [CrossRef]
14) Harrison DE, Harrison DD, Cailliet R, et al.: Cobb method or Harrison posterior tangent method: which to choose for lateral cervical radiographic analysis. Spine, 2000, 25: 2072–2078. [Medline] [CrossRef]
15) Harrison DE, Cailliet R, Harrison DD, et al.: Reliability of centroid, Cobb, and Harrison posterior tangent methods: which to choose for analysis of thoracic kyphosis. Spine, 2001, 26: E227–E234. [Medline] [CrossRef]
16) Harrison DE, Harrison DD, Cailliet R, et al.: Radiographic analysis of lumbar lordosis: centroid, Cobb, TRALL, and Harrison posterior tangent methods. Spine, 2001, 26: E235–E242. [Medline] [CrossRef]
17) Harrison DE, Holland B, Harrison DD, et al.: Further reliability analysis of the Harrison radiographic line-drawing methods: crossed ICCs for lateral posterior tangents and modified Risser-Ferguson method on AP views. J Manipulative Physiol Ther, 2002, 25: 93–98. [Medline] [CrossRef]
18) Harrison DE, Harrison DD, Colloca CJ, et al.: Repeatability over time of posture, radiograph positioning, and radiograph line drawing: an analysis of six control groups. J Manipulative Physiol Ther, 2003, 26: 87–98. [Medline] [CrossRef]
19) Harrison DD, Harrison DE, Janik TJ, et al.: Modeling of the sagittal cervical spine as a method to discriminate hypolordosis: results of elliptical and circular modeling in 72 asymptomatic subjects, 52 acute neck pain subjects, and 70 chronic neck pain subjects. Spine, 2004, 29: 2485–2492. [Medline] [CrossRef]
20) McAviney J, Schulz D, Bock R, et al.: Determining the relationship between cervical lordosis and neck complaints. J Manipulative Physiol Ther, 2005, 28: 187–193. [Medline] [CrossRef]
21) Harrison DE, Janik TJ, Harrison DD, et al.: Can the thoracic kyphosis be modeled with a simple geometric shape? The results of circular and elliptical modeling in 80 asymptomatic patients. J Spinal Disord Tech, 2002, 15: 213–220. [Medline] [CrossRef]
22) Harrison DD, Cailliet R, Janik TJ, et al.: Elliptical modeling of the sagittal lumbar lordosis and segmental rotation angles as a method to discriminate between normal and low back pain subjects. J Spinal Disord, 1998, 11: 430–439. [Medline] [CrossRef]
23) Harrison DD, Janik TJ, Harrison GR, et al.: Chiropractic biophysics technique: a linear algebra approach to posture in chiropractic. J Manipulative Physiol Ther, 1996, 19: 525–535. [Medline]
24) Oakley PA, Harrison DD, Harrison DE, et al.: Evidence-based protocol for structural rehabilitation of the spine and posture: review of clinical biomechanics of posture (CBP) publications. J Can Chiropr Assoc, 2005, 49: 270–296. [Medline]
25) Harrison DE, Harrison DD, Haas JW: Structural rehabilitation of the cervical spine. Evanston, WY: Harrison CBP® Seminars, 2002.
26) Harrison DE, Betz JW, Harrison DD, et al.: CBP Structural rehabilitation of the lumbar spine: Harrison Chiropractic Biophysics Seminars, 2007.
27) Harrison DE, Harrison DD, Betz JJ, et al.: Increasing the cervical lordosis with chiropractic biophysics seated combined extension-compression and transverse load cervical traction with cervical manipulation: nonrandomized clinical control trial. J Manipulative Physiol Ther, 2003, 26: 139–151. [Medline] [CrossRef]
28) Harrison DE, Cailliet R, Harrison DD, et al.: Changes in sagittal lumbar configuration with a new method of extension traction: nonrandomized clinical controlled trial. Arch Phys Med Rehabil, 2002, 83: 1585–1591. [Medline] [CrossRef]
29) Moustafa IM, Diab AA: Extension traction treatment for patients with discogenic lumbosacral radiculopathy: a randomized controlled trial. Clin Rehabil, 2013, 27: 51–62. [Medline] [CrossRef]
30) Diab AA, Moustafa IM: Lumbar lordosis rehabilitation for pain and lumbar segmental motion in chronic mechanical low back pain: a randomized trial. J Manipulative Physiol Ther, 2012, 35: 246–253. [Medline] [CrossRef]
31) Diab AA, Moustafa IM: The efficacy of lumbar extension traction for sagittal alignment in mechanical low back pain: a randomized trial. J Back Musculoskeletal Rehabil, 2013, 26: 213–220. [Medline] [CrossRef]
32) Harrison DE, Cailliet R, Harrison DD, et al.: A new 3-point bending traction method for restoring cervical lordosis and cervical manipulation: a nonrandomized clinical controlled trial. Arch Phys Med Rehabil, 2002, 83: 447–453. [Medline] [CrossRef]
33) Moustafa IM, Diab AA, Taha S, et al.: Addition of a sagittal cervical posture corrective orthotic device to a multimodal rehabilitation program improves short- and long-term outcomes in patients with discogenic cervical radiculopathy. Arch Phys Med Rehabil, 2016, 97: 2034–2044. [Medline] [CrossRef]
34) Moustafa IM, Diab AA, Harrison DE: The effect of normalizing the sagittal cervical configuration on dizziness, neck pain, and cervicocephalic kinesthetic sensibility: a 1-year randomized controlled study. Eur J Phys Rehabil Med, 2017, 53: 57–71. [Medline]
35) Wickstrom BM, Oakley PA, Harrison DE: Non-surgical relief of cervical radiculopathy through reduction of forward head posture and restoration of cervical lordosis: a case report. J Phys Ther Sci, 2017, 29: 1472–1474. [Medline] [CrossRef]
36) Jaeger JO, Oakley PA, Colloca CJ, et al.: Non-surgical reduction of thoracic hyper-kyphosis in a 24-year-old music teacher utilizing chiropractic BioPhysics® technique. Br J Med Med Res, 2016, 11: 1–9. [CrossRef]
37) Miller JE, Oakley PA, Levin SB, et al.: Reversing thoracic hyperkyphosis: a case report featuring mirror image(®) thoracic extension rehabilitation. J Phys Ther Sci, 2017, 29: 1264–1267. [Medline] [CrossRef]
38) Fortner MO, Oakley PA, Harrison DE: Treating 'slouchy' (hyperkyphosis) posture with chiropractic biophysics(®): a case report utilizing a multimodal mirror image(®) rehabilitation program. J Phys Ther Sci, 2017, 29: 1475–1480. [Medline] [CrossRef]
39) Noh DK, You JS, Koh JH, et al.: Effects of novel corrective spinal technique on adolescent idiopathic scoliosis as assessed by radiographic imaging. J Back Musculoskeletal Rehabil, 2014, 27: 331–338. [Medline] [CrossRef]
40) Monticone M, Ambrosini E, Cazzaniga D, et al.: Active self-correction and task-oriented exercises reduce spinal deformity and improve quality of life in subjects with mild adolescent idiopathic scoliosis. Results of a randomised controlled trial. Eur Spine J, 2014, 23: 1204–1214. [Medline] [CrossRef]
41) Plaugher G, Cremata EE, Phillips RB: A retrospective consecutive case analysis of pretreatment and comparative static radiological parameters following chiropractic adjustments. J Manipulative Physiol Ther, 1990, 13: 498–506. [Medline]
42) Hurwitz EL, Aker PD, Adams AH, et al.: Manipulation and mobilization of the cervical spine. A systematic review of the literature. Spine, 1996, 21: 1746–1759, discussion 1759–1760. [Medline] [CrossRef]