Student body posture in Brazilian studies

Investigação da postura corporal de escolares em estudos brasileiros

La investigación sobre la postura corporal de estudiantes en estudios brasileños

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ABSTRACT | To identify and characterize the profile of Brazilian reports that have examined body posture of students, between 6 and 18 years old, the methods used and the results found. The research has been made on the SciELO, LILACS, PubMed and in the physiotherapy national journal, through the words in portuguese and english: posture, posture assessment, student and child. The research was taken from july 2012 to december 2013, taking into account the following inclusion criteria: national studies, with students between 6 and 18 years old, developed in schools that evaluated at least two body segments. Have been selected 28 students, from 68 found. The age range of 10 years old has been the most examined (24). The amount of students assessed was 5.334. There has been objective evaluation predominance (50.0%), in which photographic records have been used in 12 evaluations. Software was used in 8 evaluations in order to analyze the asymmetries. The Southeast stood out with 16 publications. The main body changes that appeared: lumbar hyperlordosis, thoracic hyperkyphosis, valgus knee and protrusion and/or uneven shoulders. From the ages of 7 and 8, the hyperlordosis and the valgus knee prevailed. Was concluied than the variability of methods used on the researches, as well as the age range diversity, has limited the characterization of these studies related to the prevalence of alterations in this group.
Keywords | Child; Adolescent; Literature Review as Topic; Process Assesment (Health Care).

RESUMO | O objetivo deste estudo foi identificar e caracterizar o perfil das publicações brasileiras que investigaram a postura corporal de escolares, na idade de 6 a 18 anos. Os artigos analisados foram encontrados nas bases de dados eletrônicas SciELO, LILACS, PubMed e em periódicos nacionais de fisioterapia, por meio das seguintes palavras, suas combinações e correspondências na língua inglesa: postura, avaliação postural, escolar e criança. O período de busca foi de julho de 2012 a dezembro de 2013. Foram incluídos os estudos nacionais que avaliaram, no ambiente escolar, a postura de no mínimo dois segmentos corporais em crianças e adolescentes. Selecionaram-se 28 estudos dos 68 encontrados. A idade dos 10 anos foi a mais investigada (24). O total de escolares avaliados foi de 5.334. Houve predominância de avaliações objetivas (50,0%), das quais 12 foram realizadas com registros fotográficos. Para a análise das assimetrias, 8 utilizaram software. No Sudeste, houve 16 investigações. As principais alterações verificadas foram: hiperlordose lombar, hipercifose torácica, joelho valgo e protrusão e/ou desnível de ombros. Prevaleceram a hiperlordose e o joelho valgo, com escolares entre 7 e 8 anos. Concluiu-se que as publicações sobre investigações da postura dos escolares são recentes. A variabilidade de métodos utilizados e também a diversidade das faixas etárias estudadas limitou a caracterização das alterações.
Descritores | Criança; Adolescente; Postura; Literatura de Revisão como Assunto; Avaliação de Processos (Cuidados de Saúde).

RESUMEN | En este artículo se buscó identificar y categorizar el perfil de las publicaciones brasileñas que investigaron la postura corporal de estudiantes entre los 6 hasta los 18 años de edad. Se hizo una búsqueda de los artículos en las bases de datos electrónicas SciELO, LILACS, PubMed y en revistas nacionales de fisioterapia, utilizándose las palabras con sus combinaciones y correspondencias en lengua inglesa, "postura", "evaluación postural", "escuela" y "niño", en el período de julio del 2012

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hasta diciembre del 2013. Para eso tuvo en cuenta los siguientes criterios: estudios nacionales desarrollados en las escuelas, que evaluaron, al menos, dos segmentos corporales con estudiantes de 6 hasta los 18 años de edad. De los 68 estudios encontrados, se eligieron 28. La franja de edad más investigada fue de 10 años encontrándose 24 publicaciones. El total de estudiantes evaluados fue de 5.334. Se predominaron las evaluaciones objetivas con un 50%, siendo registradas a través de fotos 12 evaluaciones. Para el análisis de las asimetrías se utilizaron en ocho el software. Entre las regiones estudiadas, el Sureste alcanzó

16 investigaciones. Se obtuvieron las principales alteraciones: la hiperlordosis lumbar, la hipercifosis torácica, la rodilla en valgo y la protrusión y/o hombros desnivelados, prevaleciendo la hiperlordosis y la rodilla en valgo en los estudiantes de los 7 y 8 años de edad. Se concluyó que son recientes las publicaciones sobre las investigaciones de sus posturas. Sin embargo, la variedad de los métodos utilizados y la diversidad de las franjas etarias limitaron la caracterización de las alteraciones.

Palabras clave | Niño; Adolescente; Postura; Literatura de Revisión; Evaluación de Procesos y Resultados; Atención a la Salud.

INTRODUCTION

Brazil's *Estatuto da Criança e do Adolescente* - ECA (Children and Adolescents' Act)[1] sees children as people younger than 12 years of age, and adolescents as the ones between 12 and 18 years. During the childhood and adolescence, the growth period, many psychological, affective, social, and physical transformations take place, and they are important to the development of individuals[2].

In Brazil, the basic education is organized by age ranges. Childhood education covers ages up to five years; elementary school, from 6 to 14 years, and high school, from 15 to 17 years[3]. In that school period, the musculoskeletal system has not reached its maturity, and using improper furniture, carrying excessive loads, and staying still for long periods are risk factors to body development, and they may also cause discomfort, pain, or functional disabilities with physical-motor alterations[4,5].

Thus, routine exams are fundamental to early diagnose growth malformations[6]. Posture assessment uses low-cost technologies which are easily applied in the diagnosis and control of posture alterations[7,8]. In it, individuals are seen as orthostatic in coronal and sagittal planes, in subjective or objective ways. In the subjective assessment, the posture inspection is conducted by the eyes of the therapist, who checks tilting and asymmetries[7], depending only on his/her skill and experience to interpret results, which may lead to mistakes[9]. In the objective assessments, photographic[4,10] or radiologic[11] images are used. Photographs, besides being more practical, ensure better accuracy in results when they are associated with softwares that measure and analyze angles and distances[12].

In that sense, it is fundamental to know the national methodologies that are used in studies which deal with body posture assessment in that phase, when posture habits are being established, in order to thus gather and produce discussion about the assessment types that are generally used, the existing protocols to assess posture, and the instruments which help professionals perform that activity. Thus, it is possible to observe how complex and significant this subject is and also the way it has been developed in Brazil. Considering that, this study aimed to characterize and identify the profiles of Brazilian publications which investigated the body posture of students, used methods, and obtained results.

METHODOLOGY

This descriptive, bibliographical research investigated body posture assessment in children and adolescents. The Brazilian scientific production was studied through SciELO, LILACS, PubMed databases, and also through national physical therapy periodic publications, regardless of the year they were published. Searches were independently conducted by three investigators, between July 2012 to December 2013, through the following words, their combinations, and corresponding terms in English: posture, posture assessment, school, and child.

The aim was to identify the subject in titles and/or abstracts of articles, considering the following inclusion criteria: being developed in Brazil, with 6 to 18-year old students; evaluating more than two body segments; and performing their posture assessments at schools. The validation of instruments, reviews, case studies, theses, papers, load-submitted posture analyses, and studies

with special populations (obese people, athletes, mouth breathers, and people with special needs) was excluded, when they did not have a control group. In the studies with special populations and control groups[10,13-20], that was the only sample share that was considered.

Initially, 68 studies were found. Out of those, 17 were duplicate, 8 were excluded, and 8 were added. After articles were fully read, another 23 articles were excluded, so 28 studies were obtained for analysis (Figure 1).
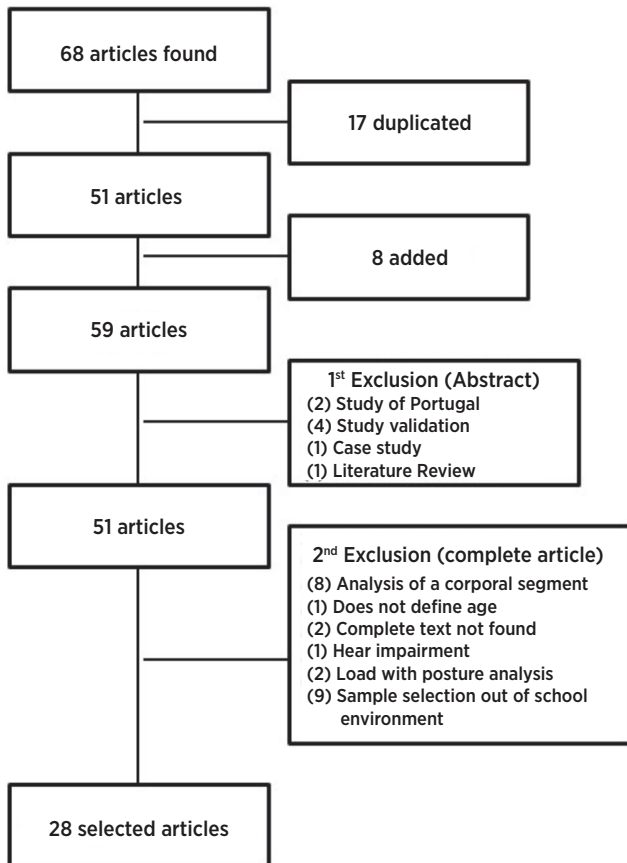

Figure 1. Article selection flowchart

The sample profile was designed according to the articles and the years they were published, types of study, cities, and regions were investigations were conducted, sample sizes, age ranges, and genders. The methods and resources used in the assessments were verified, and the obtained results were compiled according to age ranges and genders.

RESULTS AND DISCUSSION

The Brazilian body posture investigation on children and adolescents resulted in 28 studies, the first one of

which from 1986. Two articles are from that decade and another two from the following decade. Six publications were found between 2001 and 2006. That research evolved, and 2007 stands out, as five articles were obtained from that year. Between 2013 and 2013, another 13 studies were published (Figure 2). That demonstrates the increased interest in the subject, even though it has not been very explored.

Some qualified periodicals have been bringing up this subject, which shows its importance. Brazilian Journal of Physical Therapy magazine published four of those studies. Revista Paulista de Pediatria (São Paulo's Pediatrics Magazine) has three publications, and Revista Fisioterapia e Pesquisa (Physical Therapy and Research Magazine) and Revista Brasileira de Ciência e Movimento (Brazilian Science and Movement Magazine) have two publications each (Table 1).
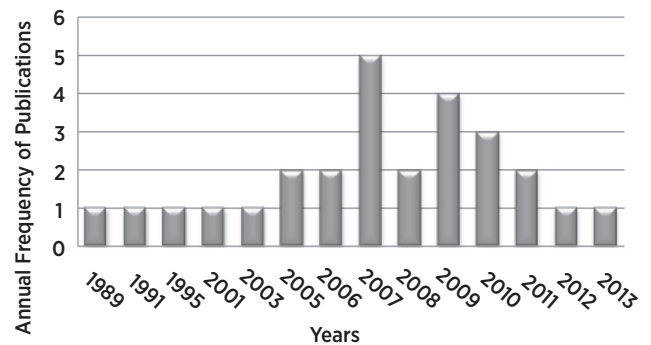

Figure 2. Annual frequency of publications

Most studies had transverse designs (92.9%), and only two were longitudinal. A large part of the studies (78.6%) comprised descriptive ones, analytical research appearing in smaller numbers (21.4%) – both of them had observational approaches.

In regards to their division in regions, investigations were focused in the southeastern region (57.2%), with 14 studies in São Paulo, one in Rio de Janeiro, and another one in Minas Gerais. In the southern region (35.7%), five studies took place in Santa Catarina, four in Rio Grande do Sul, and one in Paraná. The northeast region (7.1%) has one study in Piauí and another one in Pernambuco (Table 1).

Many studies used postural analysis grid charts – with and without plumb lines – to support exams, both in subjective (10) and in objective studies (5). Detsch and Candotti[2] consider their use as a good adjuvant in the investigation of postural deviations, and when combined with other methods, such as

goniometry, confirmation indices are high. In regards to the observed planes, only two studies evaluated posture in one plane only. The remaining studies did it in two planes.

Among objective assessments (50.0%), most of them were conducted through photographic records (12); one of them was conducted through Moiré topography[23] and another one through the New York Posture Rating[18]. Six studies used body markers through photography. In order to analyze and interpret asymmetries, eight studies used softwares - Corel Draw®, Posture Assessment Softwares (SAPO)®, or Posturograma®.

Iunes et al.[36] and Souza et al.[37] found higher results and reliability in objective assessments when they compared inter-rater agreements between postural inspection and photogrammetry[36], and also when they analyzed the inter-rater reliability of biophotogrammetry[37].

Adam's forward bend test, which is performed to check for deviations and/or twisting of the spine[12] - as indicative of scoliosis, was only conducted in five subjective studies. Karachalios et al.[38] found 84.4% sensitivity and 93.4% specificity for that test. Some authors[2,12,39,40] consider it a simple and reliable procedure to preventively investigate scoliosis.

Table 1. Characterization of articles according to: identification, year, and periodical of publication, Capes qualis (set of criteria used by CAPES – Coordination for the Improvement of Undergraduate Personnel - to classify studies), sample, gender, and study location

ID	Ano	Periodic	Qualis Capes*	Sample	Masc.	Fem.	Study Place
1[21]	1986	Rev Bras Ciênc Esporte	B1	201	91	110	Rio Claro - SP
2[13]	1989	Rev Bras Ciênc Mov	B2	60**	27	33	São Caetano do Sul - SP
3[22]	1991	Rev Bras Ciênc Mov	B2	791			Florianópolis - SC
4[23]	1995	Rev Bras Ativ Fís Saúde	B2	229	118	111	Florianópolis - SC
5[2]	2001	Movimento	A2	154	0	154	Novo Hamburgo - RS
6[24]	2003	Fisioter Pesqui	B1	186	98	88	Uberaba - MG
7[25]	2005	Braz J Phys Ther	A2	72			Barra Mansa - RJ
8[4]	2005	Clinics	-	132	0	132	São Paulo - SP
9[26]	2006	Rev Paul Pediatr	B1	13	6	7	São José dos Campos - SP
10[27]	2006	Rev Bras Epidemiol	B1	344			Tangará - SC
11[5]	2007	Rev Panam Salud Pública	B1	495	0	495	São Leopoldo - RS
12[14]	2007	Fisioter Mov	B1	40**			São Paulo - SP
13[15]	2007	Fisioter Pesqui	B1	42**	17	25	São Paulo e Guarulhos - SP
14[16]	2007	Braz J Phys Ther	A2	48**	0	48	São Paulo - SP
15[17]	2007	Cinergis	B4	40**	14	26	Araraquara - SP
16[28]	2008	Braz J Phys Ther	A2	191	77	114	São Paulo - SP
17[29]	2008	Fit Perf J	B3	47	31	16	Terezinha - PI
18[8]	2009	Rev Paul Pediatr	B1	247	131	116	Jaguariúna - SP
19[30]	2009	Conscientiae Saúde	B2	465	205	260	Descalvado - SP
20[31]	2009	Braz J Phys Ther	A2	44	15	29	Tubarão - SC
21[32]	2009	J Manipulative Physiol Ther	A2	230	100	130	Amparo - SP
22[33]	2010	Interfaces	B4	31	0	31	Alto do Tiete – SP
23[18]	2010	Pró-fono.	A2	58**	24	34	Santa Maria - RS
24[34]	2010	Ter Man	B2	186	93	93	Florianópolis - SC
25[19]	2011	Braz J Otorhinolaryngol	A2	62**	23	39	Campinas - SP
26[10]	2011	Rev Bras Cineantropom Desempenho Hum	B1	18**	9	9	Paraná - PR
27[20]	2012	Fisioter Mov	B1	44**	22	22	Caruaru - PE
28[35]	2013	Rev Paul Pediatr	B1	864	441	423	Caxias do Sul - RS
Total				5.334	1.542	2.545	

ID: Identification. Ref.: Reference. * It was considered the highest rating recorded in the areas Interdisciplinary and Physical Education, year 2013. ** It was considered only a sample of the control group. Ÿ The study did not show the sample divided by sex.

The body posture investigations of the 28 studies involved 5,334 subjects. The smallest sample size was 13, and the largest one, 864. In regards to the ages, the most investigated one was 10 years (24), and the most varied sample involved 6 to 17-year old subjects. Some only analyzed children (9); others, only teenagers (2); and most of them, both groups (17) (Figure 3). In regards to genders, 19 studies evaluated both; 5 of them only studied girls, and 4 did not specify whether results were from males or females. Girls are observed to be more engaged in the studies (2,545) than boys (1,542) (Table 1), which was justified by the authors[2,4,5,18], as girls are more prone to have posture alterations.

When evaluating the posture of students, some studies have not considered the peculiarities and specificities that are related to genders (4) and to age ranges (12) (Table 1 and Figure 3). The collective analysis of data from children and adolescents compromises the interpreting of results, in which natural body changes may be pointed out as problems. The importance of specifying ages and genders in studies is due to the fact that postural patterns constantly vary in children, because they are always seeking new ways to react to gravity.

However, during late adolescence, patterns are not defined anymore, and they may or may not be considered satisfactory[4,39].

It is important to remember that the growth peak in puberty takes place earlier in girls, and it lasts from ages 9 to 13, with its apex at year 11. In turn, for boys, it takes place between ages 11 and 15, peaking at 13. In both, growth can happen in a slower way for some more years[39,40].

As per Asher[39], posture varies according to growth stages and body segments. The author also considers that physiological lumbar hyperlordosis in children of six years of age is associated with anterior pelvic tilt, as a way to seek body balance, and it must decrease with their development. The valgus knee, which arises at the 2nd or 3rd year of life, tends to correct itself from ages 5 to 7, and it may last around the growth peak due to development interferences, with a higher prevalence in girls of ages 10 to 14. Knee hyperextension takes place from ages 6 to 11, due to the anti-gravitational balance that is required in order to keep an erect posture. Thus, those alterations are still present during adolescence, and they vary according to the genders, due to puberty.
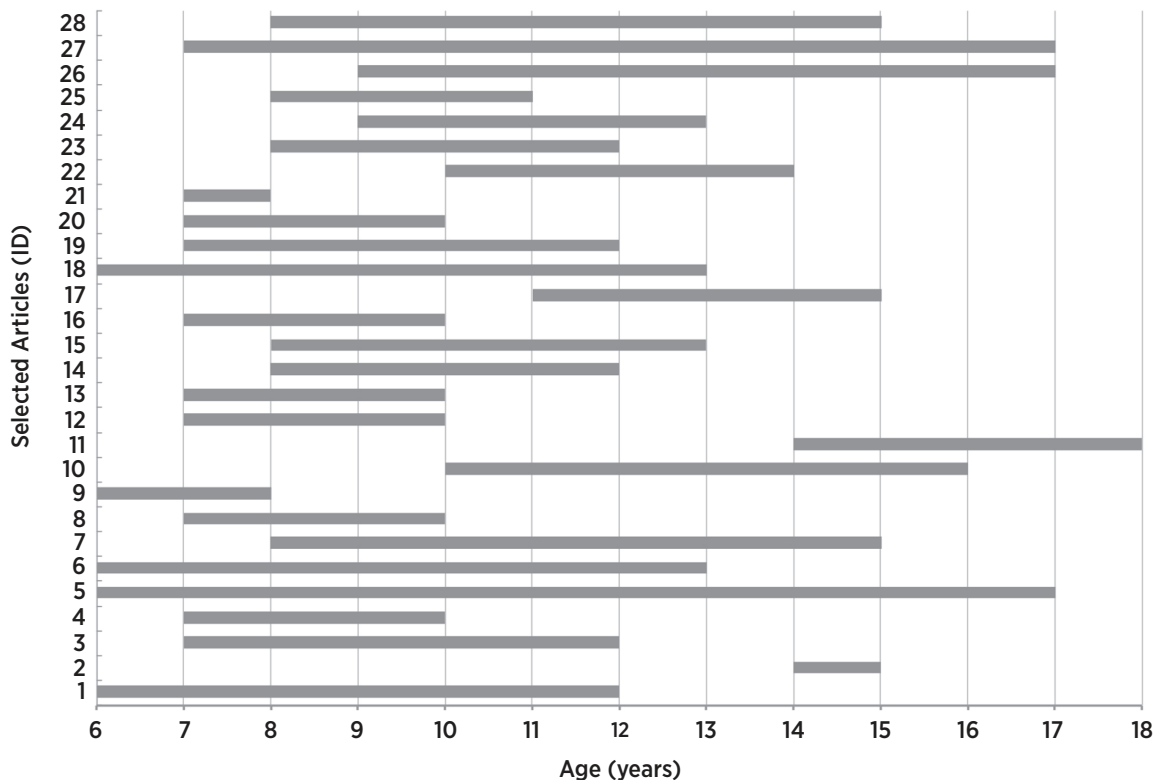
ID: identification according to Table 1
Figure 3. Coverage of age ranges per selected study

In the sample of this review, the segments of the spine, shoulder girdle, and lower limbs were the ones which were found to have more alterations pointed out. Out of the 18 articles which investigated lumbar hyperlordosis, 7 of them limited themselves to ages 10 and below, which points out great prevalence variability (from 15.3% to 78.0%). Detsch and Candotti[2] found high lumbar hyperlordosis indices in the age range from 10 to 11 years, whereas Martelli and Traebert[27] verified its presence from ages 10 to 16. Also, Bach, and Lima[31] associated hyperlordosis, cervical straightening, and protruding heads with breathing problems.

Thoracic hyperkyphosis was verified in 16 studies; 6 of them were limited to 10 years and found prevalences from 9.0% to 53.8%. In girls it generally takes place as a way to conceal breast development[2]; for boys, in turn, there is no defined pattern[41].

The presence of scoliosis was analyzed in 14 studies, covering the age range from 6 to 17 years, with prevalences for girls from 12.0% to 52.0%; and for boys, from 13.9% to 48.0%. Karachalios et al.[38] consider that the great differences that were found for scoliosis prevalence (1.0% to 21.0%) were due to the variability of criteria that were used for that diagnosis. However, in the sample of this review, that fact is believed to have taken place due to the lack of criteria for differentiating scoliotic attitude, postural scoliosis, and structural scoliosis. Also, Penha et al.[32] state that identifying scoliosis through photographic records may lead to errors, due to the locations of anatomic points as defined by softwares.

In the shoulder girdle, shoulder protrusions or asymmetries in children and adolescents were highlighted by 11 authors, with prevalences which ranged from 19.4% to 74.8%; whereas shoulder blade abduction was pointed out by 3 of them, with prevalences of 40.3%[4], 52.17%[16], and 80.51%[2] in female samples. Some authors[41,42] used the term winged scapula to qualify an alteration in that structure; however, as that is a disorder that is characteristic of damage in the long thoracic nerve, with specific pathological signs[41,42], those data were disregarded.

In the bottom limbs, the articulation that was shown to have more alterations pointed out was the knee. Valgus deformities were verified in 11 studies, with prevalences from 4.5% to 81.2%. Some studies separated their results by body mass index or by age, finding a higher prevalence among obese subjects[10,15] and among ages 7 and 8[4,8,23]. However, the researchers have not defined the criteria they used to determine valgus knees, which may justify the great variability of those results. The prevalence of valgus knees was from 21% to 43%, verified in the age range from 7 to 15 years of age, in five studies. Finally, knee hyperextension was the one that was verified the most in children, ranging from 19% to 26%, and some authors[8,23,31] found a higher prevalence at ages 7 and 8.

The posture alteration prevalence differences among students with the same age, gender, height, and body mass arise from the growth and development levels, and also from the improper furniture in the school environment[43]. Conversely, some authors[5,27] consider that the age range differences in samples and the methodologies used in posture assessments account for the great variation in the results.

Asher[39] points out that growth-related changes must be respected. To Kendall[7], corrective measures in children are unnecessary most times, as the correction of physiological posture patterns may lead to the presence of problems which are more difficult to be treated. Thus, the use of more objective methodologies is considered to be required in order to analyze body posture.

However, there is a consensus that posture assessment leads to the identification of posture problems which follow the normal growth patterns. That way, the earlier investigation is started, the more possibilities for success will exist, with great chances of preventing problems from progressing and keeping pathologies from getting worse in the adult phase[27,33].

CONCLUSION

The articles analyzed in this review demonstrated that national publications on body posture investigation are recent. Many authors were also observed not to distinguish, for posture analysis, the growth phases of children and adolescents, nor have they mentioned that posture alterations take place according to genders and age ranges.

The variability of methods used in posture investigations, lack of strict compliance to methodologies, and the diversity of studied age ranges limited the characterization of studies in regards to the predominance of alterations in the selected sample. Thus, a more specific protocol for those exams is noticed to be needed, as well as further discussion on the subject.

ACKNOWLEDGMENTS

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