

A diachronic study of the language of chiropractic

Brian S. Budgell, DC, PhD¹
 Alice Kwong, Hons BScKin²
 Neil Millar, PhD³

This study investigates how the language of chiropractic has changed over time. A collection of material, published up until approximately 1950 and consisting of textbooks, monographs and lecture notes from Canadian Memorial Chiropractic College, was analyzed to identify commonly occurring words and phrases. The results were compared to a corpus of recent articles from the Journal of the Canadian Chiropractic Association. This permitted the identification of words which were over-represented in the historical literature and therefore likely have become somewhat archaic or represent themes which are of less import in the modern chiropractic literature. Words which were over-represented in the historical literature often referred to anatomical, pathological and biomechanical concepts. Conversely, words which were comparatively over-represented in the modern chiropractic literature often referred to concepts of professionalism, the clinical interaction and evidence-based care. A detailed analysis

Cette étude examine l'évolution du langage de la chiropratique au fil du temps. Une collection de documents, publiés jusqu'à environ 1950 et comprenant des manuels, des monographies et des notes de cours du Canadian Memorial Chiropractic College, a été analysée pour relever les mots et expressions fréquemment rencontrés. Les résultats ont été comparés aux corpus d'articles récents du Journal de l'Association chiropratique canadienne. Cela a permis de détecter des mots qui étaient surreprésentés dans la documentation ancienne, et, donc, susceptibles de devenir quelque peu archaïques ou de représenter des thèmes qui sont moins importants dans la documentation chiropratique moderne. Les mots qui étaient surreprésentés dans la documentation ancienne se rapportaient souvent à des concepts anatomiques, pathologiques et biomécaniques. À l'inverse, les mots qui ont été relativement surreprésentés dans la documentation chiropratique moderne se rapportaient souvent aux concepts du professionnalisme, de l'interaction clinique et des soins factuels. Une analyse détaillée des tendances

¹Graduate Education and Research Programmes, Canadian Memorial Chiropractic College

²Canadian Memorial Chiropractic College

³Department of English, University of Birmingham

Corresponding Author:

Brian Budgell, Canadian Memorial Chiropractic College

6100 Leslie St., Toronto, Ontario, Canada M2H 3J1

Tel 416 482-2340 ext 151

Email: bbudgell@cmcc.ca

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is presented of trends in the use of the conceptually important terms *subluxation* and *adjustment*.

KEY WORDS: chiropractic, corpus linguistics, diachronic, lexicon, subluxation, adjustment

Introduction:

A number of linguistics studies have examined the modern language of diverse disciplines in biomedicine and health including nursing¹, public health², midwifery³ and chiropractic⁴. A common finding of these studies is that the language of biomedicine and health is more complex than that of general English and employs an esoteric vocabulary.⁵ Furthermore, each of the disciplines studied appears to have its own distinctive lexicon and conventions of expression. By way of example, and not surprisingly, the language of midwifery is characterized by frequent reference to the mother and child, and the experience of childbirth.³ Perhaps less intuitive, is the overabundance of female references in the modern nursing literature¹ versus the dominance of male references in the modern Canadian chiropractic literature⁴.

With regard to the modern Canadian chiropractic literature, we have previously reported that there is a high prevalence of words related to the clinical environment; words such as *treatment*, *pain*, *care* and *patient*. Words which might be regarded as conceptually important to chiropractic, such as *subluxation* and *adjustment*, had relatively low prevalences, although, as might be expected, they occur significantly more often in the chiropractic literature than in the literature of other health care professions.⁴ On the other hand, examination of the original data set (<http://www.bmhlinguistics.org/joomla2/chiropractic>) shows that specific physiological and pathological terms, such as names of diseases, are relatively uncommon. It is not certain whether the findings of the above study can be extrapolated to the literature of the profession in other countries, nor whether the rather heavy clinical weighting

de l'utilisation des termes importants sur le plan conceptuel, *subluxation* et *ajustement*, est présentée.

MOTS CLÉS : chiropratique, linguistique de corpus, diachronique, lexique, subluxation, ajustement

of the modern literature is a recent phenomenon. Thus, the present study was undertaken to compare the lexicon of the modern Canadian chiropractic literature with the core literature of the educational curriculum of approximately a half century ago.

Methods:

A corpus, an electronic archive of texts, was created by digitizing a selection of textbooks, monographs and teaching notes employed at Canadian Memorial Chiropractic College from 1946 until the early 1950s (Table 1). The electronic files were reviewed to correct errors in the digitizing process and were saved as XML files. We refer to this corpus herein as the 'historical chiropractic corpus.' The historical chiropractic corpus was analyzed using the software programme WordSmith Tools V5.0 (Oxford University Press). The results of the analysis are expressed in terms of *tokens* and *types*, where a *token* may be thought of as each word on a page, whereas a *type* is each unique word regardless of its number of occurrences in the text. For example, in the sentence 'the doctor treated the patient,' there are 5 *tokens* but only 4 *types*, since the *type* 'the' occurs twice.

The frequency of each type was calculated and compared to the frequency of the same type in a corpus derived from the 2005-2008 volumes of the Journal of the Canadian Chiropractic Association.⁴ This permitted identification of types in the historical chiropractic corpus which occurred significantly more often than would be expected based on their frequency in modern chiropractic literature. Such over-represented types are referred to in linguistics as 'keywords'.⁶ The historical corpus was then

Table 1.
Texts comprising the historical chiropractic corpus.

Title/Publisher/Year of Publication	Genre/Author	Tokens
Autonomics in Chiropractic – The Control of Autonomic Imbalance/ The Chiro Publishing Company; Toronto, Canada/1954	Textbook/ R.O. Muller	28,568
Chiropractic Principles and Technic/National College of Chiropractic; Chicago, Illinois/1939	Textbook/ W.A. Biron, B.F. Wells, R.H. Houser	140,236
Chiropractic Symptomatology/James N.Firth; Davenport, Iowa/1921	Textbook/J.A. Firth	147,350
Chiropractic Textbook/Palmer School of Chiropractic; Davenport, Iowa/1948	Textbook/R.W. Stephenson	112,731
Sacro-Occipital Technic of Spinal Therapy/National College of Chiropractic; Chicago, Illinois/1939	Textbook/M/B. DeJarnette	178,719
The Chiropractor/Beacon Light Printing Company; Los Angeles, California/1914	Textbook/D.D. Palmer	47,701
The Chiropractor in Canada/The Dominion Council of Canadian Chiropractors/1953	Monograph/D. McPhail, H.A.Yates	4,225
The Science and Logic of Chiropractic/J.Robinson Verner/1947	Textbook/J.R. Verner	68,397
The Science, Art and Philosophy of Chiropractic/Portland Printing House Company; Portland, Oregon/1910	Textbook/D.D. Palmer	391,187
Assorted Teaching notes from CMCC 1946-1950	Teaching notes/Various authors	20,932

searched for exemplars of usage of the most prevalent keywords in order to resolve how they were used in context. More detailed analyses were conducted of two conceptually important keywords, *subluxation* and *adjustment*. Specifically, using the collocation function in WordSmith Tools, the types most commonly associated with *subluxation* and *adjustment* were identified. Additionally, using the concordancer function, all instances were extracted in context and processed to construct ‘word trees’ which model use of these two keywords.

Results:

All data sets referred to in this article may be accessed as Excel worksheets through the project worksite at <http://www.bmhlinguistics.org/joomla2/chiropractic>

The historical chiropractic corpus consisted of 1,140,046 tokens (the total ‘word count’) made up of 28,694 types (unique words). The complete list of words may be accessed through the project URL listed above.

The corpus of modern Canadian chiropractic lit-

erature consisted of approximately 280,000 tokens (the total ‘word count’). In comparison to the corpus of modern Canadian chiropractic, 463 types were significantly over-represented⁷ in the historical chiropractic corpus (log-likelihood of >15.13, $p < 0.01$), i.e. were ‘keywords’⁶. The most prevalent keywords are displayed in Figure 1, wherein font size is proportional to the relative prevalence of each type. The original data on which this figure is based may be accessed through the project URL listed above.

The 10 most prevalent types in the historical chiropractic corpus were *the*, *of*, *and*, *is*, *to*, *a*, *in*, *or*, *are* and *that*. In linguistics, such words which have a role in sentence structure, but contain little meaning in and of themselves, are called function words. The 10 most prevalent content (‘meaningful’) words (and their % prevalence in the corpus) were *body* (0.32%), *nerve* (0.32%), *nerves* (0.26%), *spinal* (0.24%), *chiropractic* (0.21%), *side* (0.22%), *patient* (0.21%), *normal* (0.20%), *disease* (0.19%) and *system* (0.17%). All of these words were keywords in the



Figure 1. The 100 most prevalent keywords in the historical chiropractic corpus in comparison to the corpus of modern Canadian chiropractic. Font size is proportional to prevalence in the corpus.

sense that their percentage prevalence was significantly higher in the historical chiropractic corpus than in the reference corpus of modern Canadian chiropractic. Other keywords (in comparison to the corpus of modern Canadian chiropractic) of somewhat lower prevalence included *pain, tissue, position, cause, adjustment, pressure, muscles, nervous, vertebra(e), lumbar, blood, condition, anterior, function(s), symptoms, posterior, part, cervical, lesion* and *contact*.

Although 100 years is a relatively short period of time for diachronic language studies, we observe differences which correspond to general patterns of language change documented in the literature. Masculine pronouns (*he, him, himself*) were significantly more prevalent in the historical data, while in current day chiropractic literature feminine pronouns (*she, her, herself*) and gender-neutral terms of reference (e.g. *patients, subjects*) are more frequent (see ⁸ for comparable findings) – changes which

likely reflect wider social shifts. Our data also support established grammatical patterns of language change. For example, the modal verb *must* appears to have become less frequent, while the modal verb *can* appears to have increased in frequency (see ⁹ and ¹⁰). Also, the preposition *of* and the definite article *the* are significantly less frequent in the modern Canadian chiropractic literature. Differences in the relative frequencies of these two grammatical words may, in part, result from a movement towards a shorter more compact noun phrase structure – for example, “the muscles of the back” (historical chiropractic corpus) vs. “the back muscles” (modern chiropractic corpus). Such changes may well be part of a general tendency to compact more meaning into a smaller number of words – what has been described in the literature as ‘information densification’.¹¹

Words derived from the root *adjust*, including *adjustment(s), adjusting, adjusted* and *adjuster* had a col-

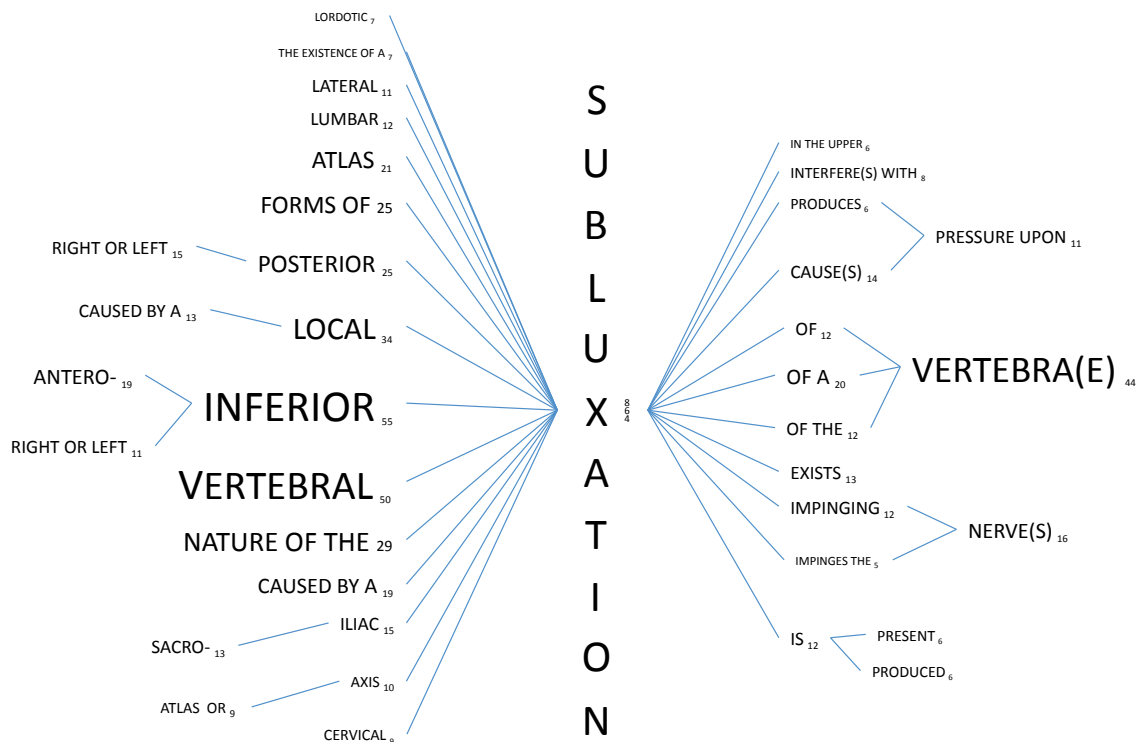


Figure 2. Word tree representing the most common contexts for the token *subluxation*. Subscripts show number of occurrences in the corpus.

lective prevalence of 0.31% versus 0.05% in the corpus of modern Canadian chiropractic. *Subluxation* and *subluxations* had a combined prevalence of 0.12%, compared with 0.04% in the corpus of modern Canadian chiropractic.

In the historical literature, the term *subluxation* was presented as an established and tangible entity which was a cause of disease and which could be effectively treated by *adjustment*. The types with which *subluxation* was most commonly associated (and the number of their occurrences in the corpus) were: *vertebrale* (87), *inferior* (67), *caused* (61), *vertebral* (52), *local* (44), *atlas* (38), *nerves* (38), *posterior* (36), *right* (34) and *left* (31). The nuances of *subluxation* are revealed to a degree in Figure 2, constructed from all 864 instances of use of the type *subluxation* (i.e. excluding other members of the word family, such as *subluxations*) in the historical chiropractic corpus. This word tree presents only 'branches' which

include a content word which occurred at least 5 times in the entire corpus. Font size is scaled to represent relative prevalence. In Figure 2, the subscript following each term or phrase indicates the absolute number of occurrences in the entire corpus. The original data set on which this figure is based can be accessed through the project URL listed above.

The types with which *adjustment* was most commonly associated (and the number of their occurrences in the historical chiropractic corpus) were: *vertebrale* (71), *chiropractic* (52), *spinal* (51), *first* (39), *patient* (39), *specific* (35), *contact* (29), *lumbar* (27), and *indicated* (26). Figure 3 presents a word tree constructed from 1482 instances of the use of the type *adjustment* (i.e. excluding other members of the word family, such as *adjustments*) in the historical chiropractic corpus. As above, font size is scaled to be representative of relative prevalence and the subscript following each term or phrase indicates the absolute num-

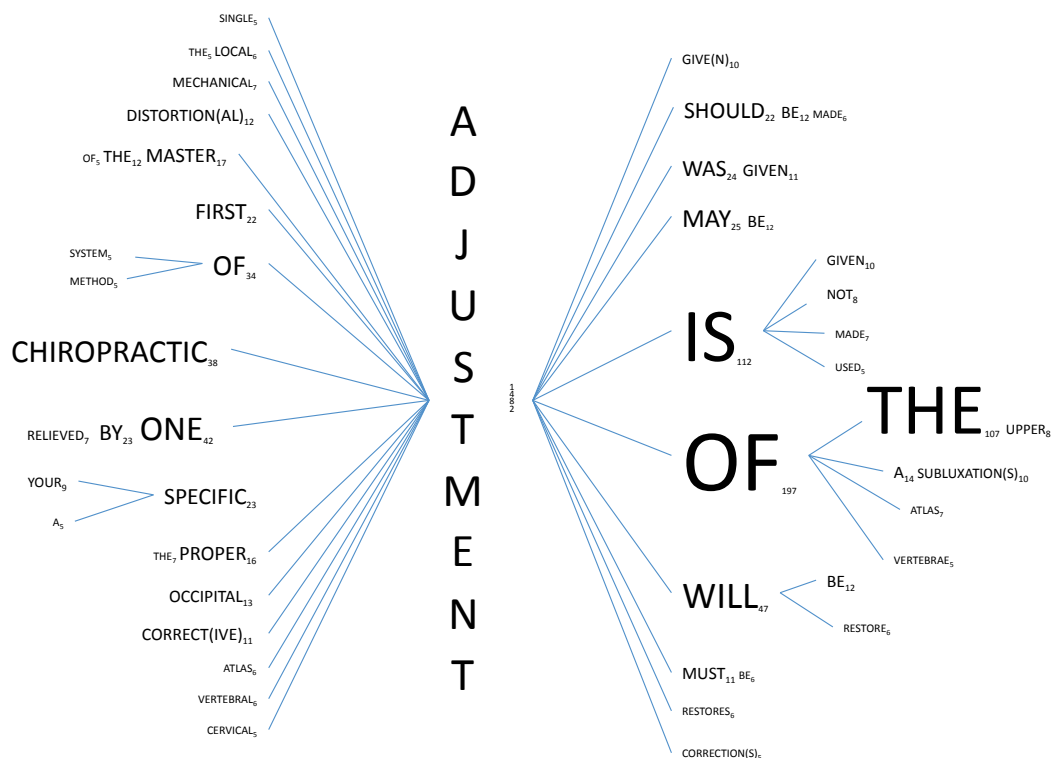


Figure 3. Word tree representing the most common contexts for the token *adjustment*. Subscripts show number of occurrences in the corpus.

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Discussion:

The corpus of historical chiropractic literature created for this study provides a sampling of the written language used within the profession around the time that Canadian Memorial Chiropractic College (CMCC) was established and the profession was undergoing growth and maturation following the Second World War. Thus, while the earliest texts in our corpus date from the beginning of the 20th century, they were included in the curriculum when CMCC was established in 1946. The comparison corpus comprised the 2005-2008 volumes of the Journal of the Canadian Chiropractic Association.⁴ Thus the texts compared were separated by a maximum of approximately a century.

For the most part, differences between the two cor-

pora seem to reflect shifts in salient professional themes. Whereas the lexicon of the modern Canadian chiropractic literature is dominated by terms related to the clinical encounter, research and professionalism, the historical chiropractic corpus is heavily weighted with terms pertaining to the structure of the human body and the relationship between structure and health. In particular, words related to posture, balance and the nervous system were highly prevalent.

The important concepts of *subluxation* and *adjustment* have been subject to the effects of fashion. These two words and their derived terms (e.g. *subluxations*, *adjustments*) were highly prevalent in the historical literature. In the modern literature *subluxation* and *subluxations* may have been displaced by the types *restriction* and *restrictions* which approximately quadrupled in prevalence. In the modern literature the word family of *adjustment* has been displaced to a degree by *manipulation* and *mobilization*. In the corpus of historical chiropractic, there were

12 instances (prevalence: 0.0011%) of *mobilize* and its derived terms versus 117 instances (prevalence: 0.041%) of *mobilize*, or some variation thereof, such as *mobilization*, *mobilizations*, in the corpus of modern Canadian chiropractic. *Manipulation* and its derived terms occurred 64 times (prevalence: 0.0056%) in the historical chiropractic corpus, versus 405 occurrences of *manipulation* or some variation thereof (prevalence: 0.142%) in the corpus of modern Canadian chiropractic literature. Thus, the evolution of language in the chiropractic literature mirrors certain established trends in modern English, such as shifts in the use of modal verbs^{9,10}, noun phrase structure¹¹ and gendered terms⁸. Additionally, there have been changes which may reflect the evolution in the biomedical and health sciences in general. These would include increased attention to evidence-based and patient-centred care. Finally, there are language changes which are likely particular to chiropractic, and reflect a movement toward a lexicon which is shared across manual medicine professions rather than chiropractic-specific. This hypothesis could be tested by comparing the corpus of modern Canadian chiropractic literature⁴ to a corpus of literature from another of the manual medicine professions, such as osteopathy.

In conducting this analysis, it is acknowledged that differences between the two bodies of literature may be due not only to evolution through time, but also due to the differences in the types of literature analyzed. The corpus of modern chiropractic literature comprised articles from a professional journal, whereas the corpus of historical chiropractic literature consisted overwhelmingly of textbooks, since there was no comparable body of research literature during the earlier period.

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