Bones for Life® — A Study of its Bone Health Benefits from a Fascial Perspective

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SUMMARY

Objectives

- To study the benefits derived from the practice of *Bones for Life*®
- To assess how and how much regular practice of *Bones for Life*® could help to improve bone health or slow bone loss
- To evaluate the impact on study participants' perceptions of physical and overall well-being after incorporating the method into daily life
- To investigate links between the fascial system and bone health benefits from the practice of *Bones for Life*®

Structure

Two groups of women volunteers in Brazil and England, predominantly postmenopausal, were instructed in, and regularly practiced *Bones for Life* over a fourteen-month period. Six Brazilian participants undertook bone density tests on the lumbar region, femoral heads and femur at the start and end of the research time-window, providing a limited set of *quantitative* data. All participants also provided *qualitative* assessments of associated changes in their perceived physical and overall well-being. The study reviewed a number of related scientific studies that support the hypothesis of a connection between fascial health and bone health. The fascial perspective contributes to an enriched analysis of how *Bones for Life* benefits both bone health and general well-being.

This current **summary** briefly describes the *Bones for Life* method; the program undertaken; and the findings regarding quantitative and qualitative benefits. A longer, technical discussion from a fascial perspective comes at the end of this summary.

The **full text** of the study is available here.* Further related information can be found posted on websites run by the Foundation for Movement Intelligence [FMI] at https://movementintelligence.org/bones-for-life/ and Movement Intelligence UK https://movementintelligence.co.uk.

* https://drive.google.com/file/d/1-3da5vjX5Cpc6l4KggNdoaXsCsLShGtS/view

Introduction

This study describes the *Bones for Life* method, and the findings of a program which explored the benefits that derive from its practice. The study also provides some background information on osteoporosis, and presents a small sample of quantitative results along with sets of more extensive qualitative findings. A review of related studies and literature, with particular regard to fascia, indicates how the movements proposed by Ruthy Alon's *Bones for Life* method can benefit bone tissue health. This introductory section addresses the process of bone tissue remodeling at the cellular level, and the metabolism of osteogenic cells.

Findings

The ***quantitative*** tests on six volunteers showed bone density *gains* among several of them, and better outcomes for most of them, compared with the progressive degeneration expected due to aging and hormonal changes in postmenopausal women. Positive results were mainly observed in the lumbar region, where five volunteers showed improvement in bone mineral density; two volunteers showed improvement in the femoral neck. This limited observation set provides encouragement for further research.

The ***qualitative*** aspect of the study identified some of the main benefits, including developing more refined body awareness and improved postural alignment. Participants also noted better coordination, reduced pain, better quality of sleep, increased circulatory efficiency, and an improved sense of confidence and well-being. The discussion section explores plausible explanations for how *Bones for Life* benefits bone health, drawing from studies on fascia. Firstly, the specialized parts of fascia that cover and penetrate the bones (periosteum and endosteum) are responsible for nourishing bone tissue and supplying new osteogenic cells, essential for bone growth and repair. A number of processes (or lessons) in the *Bones for Life* method effectively benefit fascial tissue health, and stimulate the production of collagen by specialized cells in this tissue. Collagen is a fundamental element that provides flexibility and resistance to the skeleton, and both enables the perception of body movements by osteogenic cells and stimulates bone remodeling.

Cyclical, multidirectional, and low-intensity stretching, found in various processes of the method, have a positive effect in this regard. Percussive processes that are also integral to *Bones for Life* provide important impact stimuli to osteogenic cells. Processes that involve visualization and relaxation serve to activate the parasympathetic nervous system, which in turn is linked to bone formation. Improved body awareness, and refined attention to postural alignment and movement are strongly emphasized by Alon throughout her program, underpinning movement safety, and transmitting impact and movement stimuli efficiently through the bones.

Many benefits derive from the re-education of movement in *Bones for Life,* which encourages students to be more conscious, safe, and efficient. For individuals who are sedentary — whether due to pain, insecurity, fear of falling, motor coordination, or weakness — *Bones for Life* can promote bone health by introducing movement that respects the limits of each body while cultivating self-awareness and safe movement exploration. For others, the program can provide a solid foundation for performing movement with better postural alignment and without undue effort or strain during sports practice and other activities. This helps to avoid injuries, posture-related overloads, and joint wear-and-tear that may lead to future complications.

When integrated and incorporated into daily life, greater self-awareness and dynamic movement flowing freely through the body — "as Nature meant" — can bring lasting benefits. An enhanced vitality, feelings of wellbeing, and readiness for movement promote what Ruthy Alon calls "Biological Optimism."

About the *Bones for Life*® Method

Bones for Life is an educational movement program developed by Ruthy Alon [1930–2020]. It includes over 90 "processes" (lessons, or movement explorations) aimed at improving postural alignment and reducing bone deterioration. Moshe Feldenkrais [1904–1984] created the *Feldenkrais Method*®. Ruthy Alon participated in his first training course in 1967 and worked directly with him for many years.

Intrigued by the high incidence of osteoporosis in the West, Alon explored within the *Feldenkrais Method* possible solutions to the process of bone deterioration. She faced the challenge of reconciling the basic protocols of building bone — through impact — with the slow, small movements that characterize the Feldenkrais Method's *Awareness Through Movement*® (*ATM*) lessons — typically conducted in a supine position (laying on the back). To foster bone strength, Alon devised strategies to be enacted in the vertical plane, dealing with gravity, and to incorporate movements with moderate impact, e.g., bouncing, vibration, percussion, walking, running in place, and jumping. These were to be performed gently, and taught in progressive steps, to instill safety and self-confidence, and to refine one's awareness when performing them.

Bones for Life emphasizes postural alignment so that downward forces of gravity and upward forces from the ground [GRF] are transmitted cleanly and effectively in a streamlined manner throughout the entire skeleton. Postural awareness and self-exploration are at the core of these various processes, which are practiced in multiple directions, and proportionately — in order to distribute the range of motion and effort (with up to 20% effort) evenly across the joints and other involved parts. This prioritizes safe exploration of one's range of movement, especially for individuals with compromised bone strength; who are unaccustomed to exercising; or who feel vulnerable when practicing impactful movement. Some processes use the wall as support for a more objective sensory perception of verticality, as well as to offer resistance. Body awareness is stimulated in some processes by using a "Wrap" — a fabric of up to seven meters in length that is wrapped about the body to promote a sense of support and greater joint stability.

The Program to Explore the Benefits of *Bones for Life*

Our study originated in 2019 following a *Bones for Life* teacher training course in Brazil led by Silvia Gray, with shared enthusiasm among Flávia de Souza and Dr. Emerson Freitas to explore the benefits of the method. Silvia and Flávia then committed to teaching the *Bones for Life* method to two groups of women — 15 in England and 8 in Brazil, respectively — over a 14-month program from November 2019 to December 2020. Both groups received weekly instruction, structured into five modules drawn from Ruthy Alon's teachings, which progressively covered a wide range of movement processes that encompassed all possible positions, directions, and regions of the body to be addressed. Instruction was initially in-person, but became virtual in 2020 due to the Covid-19 pandemic. Participants committed to practicing the processes for 15 to 20 minutes, six times per week, and to registering and sharing impressions about their practice, as requested for this project.

Most of the Brazilian group underwent blood tests and bone densitometry of the right femoral neck and lumbar spine — both before and after their 14 months of practice — to provide a small sample of quantitative data[1]. Brazilian volunteers also completed a questionnaire at the end of the practice period in order to also contribute to the qualitative analysis of their perceptions of the *Bones for Life* method, noting any changes or benefits they experienced as a result of their participation.

The women in England participated only in the qualitative study, through the completion of comprehensive questionnaires at the end of each of the five modules. The questionnaires explored perceptions relating to their sense of well-being, preferred processes, potential difficulties, and any observed benefits in their bodies — such as changes in movement patterns or posture, during and after the practice.

[1] Due to differences between the healthcare systems of the two countries, these tests were not taken by pilot study participants in England.

About Osteoporosis

Osteoporosis is a disease characterized by excessive loss of bone mass and deteriorating microarchitecture of bone tissue, causing bone fragility and increased risk of fractures. It accelerates in postmenopausal women, when the ovaries cease to produce estrogen (an inhibitor of bone resorption, when bone tissue is broken down, leading to a loss of bone mass and density) and progesterone.

Among the factors directly influencing bone loss and calcium fixation in bones over time are: diseases such as hyperthyroidism, hyperparathyroidism, inflammatory diseases and neoplasms or tumors; prolonged use of medications such as corticosteroids; poor dietary and lifestyle factors (including low intake of calcium, protein, and vitamin D; alcohol intake and tobacco use; physical inactivity); as well as perimenopause and menopause and genetic factors. *Bones for Life* seeks to inhibit the progression of osteoporosis and resultant risks of fractures, including vertebral microfractures, by promoting bone health through healthy movement. The demands made and types of movement imposed on bone tissue are important influences on the process of remodeling our skeleton.

Analysis of Quantitative Results

Our limited quantitative results point to some bone density benefits from regular practice of *Bones for Life*, particularly in the lumbar region. We hope this will encourage more comprehensive future study. Most of the pilot study participants were already in menopause. Within the first 5 to 10 years after the last menstruation, expected annual decreases in BMD are 2% to 4% for bones predominantly made of **trabecular** (high porosity) tissue, such as in the lumbar region, and around 1% for bones predominantly composed of **cortica**l (low porosity) tissue, such as the femur (Radominski, 2004). The absence of important hormones for calcium fixation in the bones is an important factor in this typical decline.

The bone densitometry tests compared the patient's bone mineral density (BMD) both to that of young adults of the same sex or ethnicity (the T-score[2]) and to that of people of the same age, sex, and ethnicity (the Z-score). In this study, we used the BMD data collected to analyze changes in bone mass in the femoral neck, total femur, and lumbar spine of six Brazilian volunteers who undertook the tests before and after the practice period.

[2] The T-score (referring to the number of standard deviations above or below the average for young adults) recognizes three categories: normal (T-score ≥ -1), osteopenia (T-score < -1 and > -2,5) and osteoporosis (T-score ≤ -2.5).

Comparing bone densitometry tests before and after the practice period of the project demonstrated some positive results. Five out of six volunteers showed improvement in the lumbar region, and the one with a lower BMD result showed less than the expected decrease for her age. At the femoral neck, two showed improved BMD and only one experienced a loss above what is expected for their age. In total femur densitometry, one of four volunteers showed material improvement, while three showed a decline, with only one declining more than expected for their age. The charts with results can be found in the full article, or here.*

Qualitative Analysis

As part of the aging process, the human body tends to lose both motor and cognitive abilities, increasing the risk of falling. Falls, in turn, can lead to periods of reduced mobility and a consequent loss of both muscle mass and balance. Regular practice of *Bones for Life* may slow this process and reduce fall risk — supporting bone health by promoting more conscious movement, better balance, and improved motor abilities. Our qualitative study explored these potential benefits.

The **Brazilian** group of eight volunteers responded to a single questionnaire after fourteen months of practice. This questionnaire focused on the participants' perceptions of physical and mental health benefits after completing the program.

All Brazilian participants reported that practicing *Bones for Life* contributed positively to greater body awareness, relating this to factors such as better posture and improved balance. Five Brazilian volunteers reported a reduction in pain after starting regular *Bones for Life* practice, also citing improvements in areas such as coordination. A similar proportion reported better sleep quality. Seven reported improved energy levels, with increased well-being and emotional health. Some noted improvements in the circulatory system, breathing, the urinary tract and the digestive tract, as well as increased libido.

The **English** group, consisting of fifteen participants, responded after each module to questionnaires addressing their perceptions of the processes practiced, giving information about changes in daily life, physical and general well-being. After fourteen months of practice, they were also asked about their preferred processes.

As in Brazil, all of the English participants mentioned increased body awareness, and 93% of the volunteers reported contributions to postural alignment. About 47% of English volunteers spontaneously reported experiencing a reduction in pain; around 60% reported improved balance or motor coordination; and 47% mentioned positive changes in their daily life tasks.

* https://drive.google.com/file/d/1-CjZ9CiWNSeAZEaDLlmfZYb_hi-ulM9O/view

The discovery of new movement possibilities was also cited as a highly beneficial aspect, as initially challenging new movements became more fluid and natural over time. This expansion of movement possibilities helped improve self-confidence, balance, and motor coordination — fundamental to reducing fall risk.

Discussion

Though based on a small sample, the bone densitometry test results, particularly in the lumbar region, prompted us to seek possible explanations.

An important clue may be in the improved body awareness and postural alignment in daily tasks mentioned by all participants, and reported in the qualitative section of our study. One inspiration that motivated Ruthy Alon to develop the *Bones for Life* method was the observation of the walking patterns of African women[3] who often carry water containers balanced on their heads. Alon believed that bone building is stimulated by elastic and rhythmic pressure on bones when one walks, and that there are efficient and economical movement configurations, determined by the evolution of the human body itself, that make the incidence of this pressure more fluid throughout the skeleton. Then, the transmission of forces or pressure, upward and downward between the body's polarities — feet and head — occurs in a "domino effect." "Bones become stronger as they are used to successfully sustain this bidirectional pressure." (Alon, 2018)

For Ruthy Alon, safety in performing the movement and good balance are essential to minimizing the risk of injury, and aligned posture is fundamental for this pressure to flow evenly through the body, without disproportionately overloading and overworking any particular joints.

Factoring in Fascia

How forces are transmitted through the body was often emphasized by Alon. Several studies on fascia provide valuable insights into how *Bones for Life* can benefit bone health. The term "fascia" refers to various types of connective tissue that cover and continuously connect all structures of our body (such as muscles, bones, tendons, and organs), and provide support, fill spaces between tissues, and supply them with nutrients. Bone tissue is a special type of connective tissue, and, as shown later, some consider it part of the fascial system.

[3] Ruthy Alon visited some African countries, and these encounters with different cultures resulted in many insights that influenced the development of her *Bones for Life* method. She closely observed the walking patterns of women carrying water on their heads. In Ethiopia, she had the opportunity to witness traditional movements in ceremonies that inspired the chest tapping used in the method.

Transmission of Forces and Fascial Biotensegrity

According to Schleip, fascia is a “fibrous collagenous tissue that is part of a broad tensile force transmission system in the body” (Schleip, 2012b, as cited in Chaitow, 2017). It combines strength and elasticity in order to adapt to different movements, or forces, and is then able to restore itself, and return to its initial position. The dynamic tension of this connective tissue throughout the body causes a movement in one part, such as the arm, to reverberate throughout various other parts of the body. Fascia is also a mechanosensory organ, with many mechanoreceptors that inform us of *where* and *how* our body is positioned in space — integrating and organizing our posture and movement. Fascial dysfunctions can interfere with posture, and fascia can adapt to poor posture and movement habits, or even lack of movement, which can harm this tissue’s long-term health.

The *Bones for Life* method was formulated before studies on fascia became widespread. However, several *Bones for Life* processes are highly beneficial to the health of fascial tissue, by positively stimulating the fascial network; helping to develop greater body awareness; and reducing poor posture and movement habits. As discussed below, the health of fascial tissue has a direct influence on the health of our bones, as it is closely related to bone remodeling — a continuous process of osteogenesis during which osteoclasts remove old, damaged bone that is, in turn, replaced with new bone by osteoblasts.

Histology of Bone Tissue, and Its Correlation with Fascial Tissue

Bone tissue is a specialized type of connective tissue, highly vascularized and innervated, formed by specific cells and calcified extracellular material called bone matrix. There are three types of specialized cells in bone tissue: **osteoblasts** (responsible for producing the organic part of the matrix and participating in the mineralization process), **osteoclasts** (which reabsorb bone tissue, participating in bone remodeling processes), and **osteocytes** (which have mechanosensory functions monitored by a complex neuronal network). The bone matrix is composed of an **organic** part (called **osteoid**, which is produced by osteoblasts and mainly composed of **collagen** fibers) and an **inorganic** part (formed during a process of mineralization and mainly composed of phosphate ions and calcium). Calcium and phosphorus form crystals called **hydroxyapatite**[4] that fill the spaces between collagen fibers during the mineralization process. The inorganic part of the matrix provides strength, while collagen fibers (the organic part) provide flexibility to bone tissue

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[4] The composition of hydroxyapatite is: $Ca_{10}(PO_4)_6(OH)_2$

(Junqueira & Carneiro, 2008, p.137).

Type I collagen is the most prevalent in bone tissue; this protein possesses important **thixotropic**[5] characteristics that allow it to adapt to **mechanical** stresses, and thus to functional demands. Because collagen fibers resist tension and traction, they enable the absorption of energy after an impact. Changes in collagen properties directly affect the mechanical quality of bone, and can increase its susceptibility to fracture. Collagen also exhibits **piezoelectric**[6] characteristics, meaning that mechanical loads imposed on bone tissue are transformed into **electrical** stimuli, which, in turn, aid in the modulation of specialized cells. (Bicalho, 2020).

Bone tissue is highly dynamic and continuously undergoes modeling and remodeling. Although bones grow in size until adolescence, they continuously change in density throughout life. In 1882 surgeon/anatomist Julius Wolff was the first to remark that bone density changes according to the intensity and direction of mechanical forces acting upon the bones. According to Wolff's Law, the greater the impact, the greater the deformation and stimulation for bone to gain mass during the remodeling process (Hall, 2016, p.123). The remodeling process is also influenced by nutrition, and the action of various hormones such as parathyroid hormone (PTH), calcitonin (CT), vitamin D, and estrogen.

All bones are covered on their external and internal surfaces by connective tissue membranes called **periosteum** and **endosteum**, respectively, which contain **osteogenic** cells, i.e., cells involved in bone formation. The periosteum protects, nourishes, and assists in both bone formation and fracture repair. The endosteum covers the inner layer of cortical bone and is thinner, composed of one layer of loose connective tissue.

The periosteum contains collagen fibers, called **Sharpey's fibers**, which penetrate the tissue and connect with the innermost layer of compact bone tissue, the endosteum. These fibers are essentially an extension of the outer bone envelope into the interior of bone tissue. Thus, through these fibers, there is direct communication between the external covering of the bone and its inner envelope. Sharpey's fibers are more present in regions where bone is subjected to greater functional demand, such as areas of fascia, ligament, and tendon insertion.

[5] Thixotropic properties refer to substances that, when agitated, transition from a gel-like state to a liquid state.

[6] Piezoelectricity is an electric polarization produced by certain materials, such as some molecules and crystals, when subjected to mechanical deformation. The structure of bone collagen fulfills the characteristics of a piezoelectric material which, under mechanical deformation (such as that produced by tension, compression, or torsion), can undergo spatial changes that result in electric polarization (LIRANI, 2005).

Therefore, functional demand is crucial regarding the presence of these fibers. According to Junqueira and Carneiro (2008), the nutrition of bone tissue and the supply of new osteoblasts are the main functions of the periosteum and endosteum.

When movement takes place, mechanical stimuli placed on bone or fascial tissues are converted into biological signals through a process called **mechanotransduction** that promotes structural and tissue changes. Collagen is closely linked to this process due to its adaptive and piezoelectric characteristics. In bone tissue, collagen fibers or Sharpey's fibers are connected to proteins called **integrins** that penetrate into the cells. Therefore, tension imposed on these fibers causes integrins to alter the electrical charges of the cell membrane, modifying cell metabolism. In this sense, osteocytes — affected by mechanical tension from collagen fibers — regulate the behavior of osteoblasts by increasing bone formation and the behavior of osteoclasts by increasing bone resorption.

The periosteum is included as part of the fascial tissue by several authors, while others go further and include the bone tissue itself as part of the fascial system. For example, Bicalho comments that, according to Sharkey (2019), definitions which do not include other components of bone tissue as part of the fascial system are incomplete since bones are vital elements for musculoskeletal continuity. He emphasizes that ligaments and tendons are connected to the periosteum, which, in turn, attaches to the bone matrix through Sharpey's fibers. Bordoni and Lagana (2019) also consider bone tissue as part of the fascial system and demonstrate that, in addition to the anatomical continuity of these tissues, there is the same embryological origin between them, as well as autocrine and paracrine[7] activity between these tissues that influence each other and generate mechano-metabolic responses in bone cells (Bicalho, 2020).

As noted above, the collagen present in Sharpey's fibers of the periosteum, with its piezoelectric characteristics, plays a role in the mechanotransduction process that promotes bone remodeling. Collagen also provides flexibility to bone, making it more resistant to impact, which is essential for its health.

There is substantial literature addressing the importance of impact exercise in combating the loss of bone density. More recent studies on fascial tissue suggest that stimulating this tissue efficiently can also benefit bone health since, when stimulated correctly, it can enhance collagen production. *Bones for Life* combines movements that involve impact, such as moderate degrees of percussion, with others that

[7] In paracrine communication, the signaling molecules act on neighboring cells. In autocrine signaling, the signaling molecule acts on the signaling cell itself, meaning that the target cell is the secreting cell.

stimulate the fascial network in various ways. These do not necessarily involve impact but are also believed to benefit bone remodeling by improving the transmission of forces through the body. This hypothesis may help us understand why better bone densitometry results were obtained in the lumbar region of our volunteers after fourteen months of practice of *Bones for Life*, when compared with the results of bone densitometry tests performed on the femur. The passage of certain fascial anatomical ***lines***[8] through the lumbar region and connecting it to various areas of the body results in the presence of a large quantity of collagen-producing fibroblasts. This enables the lumbar area to receive stimuli from movements performed by many body parts — such as the arms, hands, legs, and feet — especially when the transmission of forces flows efficiently through the fascial tissue network.

Bones for Life and the Health of Fascia and Bone Tissue

During the aging process, fascial tissue loses its elasticity and its ability to slide, but this process can be delayed and even reversed with various movement practices that stimulate collagen production, flexibility, and mobility of this tissue (Schleip, 2012, p.3). Several *Bones for Life* processes correspond with movement practices that various authors identify as benefiting fascial health.

The most common cells found in fascial tissue are **fibroblasts**[9]. These are cells that secrete the collagen proteins that make up the extracellular matrix. This collagen production can be stimulated according to the movement to which these cells are subjected. According to Chaitow, based on Kumka and Bonar (2012): "Fibroblasts are highly adaptable to their environment and show an ability to remodel in response to various mechanical stimuli, producing biochemical responses."

Chaitow (2017) explains that when fibroblasts are subjected to a continuous or cyclic stretching load, they secrete **collagenases**, enzymes that break peptide bonds in collagen. Based on the in vitro study conducted by Carano and Siciliani (1996), the author also states that *cyclic stretches* — involving 10% of available elasticity — are considerably more efficient in this regard, as they can *double* the production of collagenase. Continuous stretching, on the other hand, is only *half* as effective.

[8] The fascial anatomical lines are a concept developed and extensively studied by Thomas Myers. As described by Myers, among the anatomical lines that pass through the lumbar region, we can mention the Superficial Posterior Line, the Deep Anterior Line, and the Posterior Functional Line (Chaitow, 2017)

[9] According to Junqueira and Carneiro, osteoclasts found in bone tissue, responsible for bone remodeling, have a morphological similarity to fibroblasts found in fascia. (Junqueira & Carneiro, p. 139, 2008)

The observation that intermittent loading has a greater influence on collagenase production than sustained loading is also clinically relevant[10]. (Chaitow, 2017)

Bones for Life incorporates various processes that provide stimuli with effects similar to **cyclic or intermittent stretching of low intensity**, as if there were springs in the body. Movements such as the "Wave" and "Axis" are excellent examples that involve rhythmic and elastic swings. Schleip is another author who highlights the benefits of dynamic stretching[11], especially for long-term effects, as it can positively influence the architecture of connective tissue when performed correctly (Schleip & Müller, 2012, p.4). Quoting the author Magnusson, Schleip and Müller explain:

> A dynamic muscular loading pattern in which the muscle is briefly activated in its lengthened position promises the most comprehensive stimulation of fascial tissues . . . the resultant increase in collagen production tends to be largely independent of exercise volume (repetitions); meaning that only few repetitions are necessary to yield an optimum effect (Magnusson et al., 2010, as cited in Schleip & Müller, 2012, p.6). The proposed fascia training therefore recommends soft elastic bounces in the end ranges of available motion. (Schleip & Müller, 2012, p.6)

In *Bones for Life*, with proportional movement initially focused on using just 20% effort, one can comfortably go towards the end range of available motion, without forcing. Having a full range of motion available is important for various activities in everyday life.

Fascia is fibrous tissue that branches out in multiple directions, whether superficially covering organs, muscles, or bones, or penetrating more deeply into these structures. This **multidirectional characteristic** is also stimulated more efficiently with multidirectional movements and soft elastic bounces because they reach a greater number of fibroblasts, enhancing collagen production in the body. Spiral movements are excellent examples that promote multidirectional stimuli. This type of movement was extensively studied by Moshe Feldenkrais, and is also prevalent in Ruthy Alon's work.

One fascinating characteristic of fascial tissue is its **proprioceptive capacity**, due to the large number of sensory receptors transmitting information about the body's positioning that underlies motor coordination and balance. Schleip (2012) emphasizes the importance of stimulating proprioception through refining one's sensitivity to the subtleties of movement. This is extensively explored by Alon in

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[10] According to Bonewald and Mundy (1990), transforming growth factor-beta (TGF-β1) plays an important role in bone remodeling by stimulating the synthesis of proteins that have effects on bone cells such as osteoblasts and osteoclasts, which are responsible for bone formation and resorption.

[11] The literature that was reviewed showed that dynamic, cyclic, or intermittent stretches, all involving movement, are more effective than continuous stretches in stimulating the production of collagen by specialized fascial cells.

Bones for Life through various processes that enhance body awareness, balance, and motor coordination. This is key for improving force transmission throughout the body, by allowing self-correction and promoting efficiency through developing greater “Movement Intelligence.” In daily life, improved proprioception aids balance, posture, and motor coordination, and helps to reduce susceptibility to falls and injuries.

Self-massage is also explored by Alon at certain moments, such as when a cloth “Wrap” with one or two knots is pressed between the back and a wall, providing tension relief in the tissues around the spinal column, and potentially improving tissue glide and fascial tissue health.

Bones for Life incorporates various percussive and tapping movements in several of its 90 processes to create impacts on different body regions, while exploring variations in direction and angle. Many studies on osteoporosis prevention emphasize the importance of performing **impact exercises at different angles** to stimulate bone strengthening. However, osteoporosis occurs predominantly among seniors — many of whom face difficulties when engaging in high-impact activities, whether from muscle-skeletal pain, fear of movement, inadequate muscle strength, or the risk of fracture from falling. *Bones for Life* addresses this dilemma with processes that safely promote impact by encouraging body awareness so movements can be performed without fear, with respect to sensed limits — physical or psychological. “Bouncing on Heels” is one of the most important and characteristic processes of the method, acting to stimulate the venous return circulation to the heart, benefit the nutrition of all tissues, and expedite the elimination of toxins. It also contributes to the formation of new bone cells. Proper postural alignment is emphasized during the execution of all *Bones for Life* processes to ensure joint stability during this percussive process, and to promote streamlined force transmission. Alon explores the most appropriate muscle involvement and optimal physical alignment, and some practices involve use of weights on ankles and wrists, or held by hands.

After a practice, Ruthy Alon incorporates processes that promote **relaxation** of the body and mind, such as visualizations, guided meditations, and encouragement to breathe deeply and yawn. Activating the parasympathetic system following physical activity is essential for maintaining the body’s self-regulatory capacity, including that of the fascia and bone tissue. Eduardo Bicalho mentions some studies indicating that parasympathetic innervation in the skeleton assists in regulating bone mass accumulation (Bajayo, 2012, as cited in Bicalho, 2020). He also points out the influence of the circadian rhythm on the bone remodeling process, suggesting that bone *resorption* peaks during the day — when sympathetic activity is dominant —

while bone *formation* is more active at night, when parasympathetic activity predominates (Shao, 2003, as cited in Bicalho, 2020). Therefore, relaxation practices that stimulate the parasympathetic system after physical activity tend to be beneficial for overall body health, including bone health.

Final Thoughts from Ruthy Alon

“You may remind yourself that Nature always strives towards Healing — that is its initial intention. Through a slow gravitation towards well-being, Nature bestows upon you, minute by minute, the choice of helping it help you.”

“Achieving dynamic movement that streams throughout a well-aligned body gives pleasure, promises readiness to move, inspires biological optimism, and strengthens bone.”

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Ruthy Alon Ph.D. [1930–2020] inspired us to undertake this work. *Bones for Life*® was the first of her five *Movement Intelligence* programs which address concerns about loss of mobility, balance, coordination and bone strength by providing practical self-care strategies for optimal movement.

Many others freely gave help, guidance, and support (referenced in the full paper) and our dedicated volunteers provided invaluable feedback. The Foundation for Movement Intelligence (FMI), a non-profit organization, based in North America, provided a generous grant and encouragement for this work.

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