Bone & Joint Health

Definition

Osteoarthritis (OA, aka degenerative arthritis, degenerative joint disease), is a group of diseases and mechanical abnormalities entailing degradation of joints, including articular cartilage and the subchondral bone next to it.

- Source: Dorlands Medical

Definition

"Wear And Tear"

Most common joints affected: knee, hip, lumbar spine (L_{4-5}) and cervical spine (C_5)

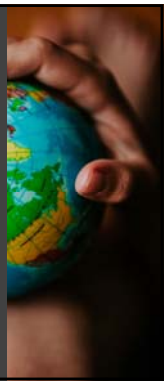
Process of causality:

- Loss of joint space
- ***Inflammation***
- Loss of function
- Pain

OA is "the world's primary crippler"

"One in three families in western industrialized nations are now afflicted"

Source: Nutrition News & Views, July/Aug 1997 Vol 1., No. 4



Epidemiology

- According to the Centers for Disease Control and Prevention (CDC), over 32.5 million adults in the U.S. live with OA. Accounting for 25% of visits to primary care physicians, and half of all NSAID (Non-Steroidal Anti-Inflammatory Drugs) prescriptions.
- It is estimated that 80% of the population will have radiographic evidence of OA by age 65, although only 60% of those will show symptoms.
- In the United States, hospitalizations for osteoarthritis soared from about 322,000 in 1993 to 735,000 in 2006.

Epidemiology

Osteoarthritis (OA) is the most common joint disorder in the world.

- In Western populations it is one of the most frequent causes of pain, loss of function and disability in adults.
- Radiographic evidence of OA occurs in the majority of people by 65 years of age and in about 80% of those aged over 75 years.
- In the US it is second only to ischaemic heart disease as a cause of work disability in men over 50 years of age, and accounts for more hospitalizations than rheumatoid arthritis
  - **Source:** Osteoarthritis: Epidemiology *Best Practice & Research Clinical Rheumatology*, Volume 20, Issue 1, Pages 3-25 N. Arden, M. Nevitt

Factors leading to OA

- Obesity (esp. of knee)
  - Source: **Obesity and knee osteoarthritis: the Framingham Study** DT Felson, JJ Anderson, A Naimark, AM. Annals of internal Med. 1988. Am Coll Physicians
- Avascular necrosis (AVN)
  - Especially alcoholism and long term cortisone treatment
- Trauma
  - Particularly childhood femoral neck fractures
- Poor nutritional status
- Poor posture and gait abnormalities
- Genetics

Osteoarthritis is "the cooked food disease"

~ Dr. Royal Lee

Pottinger's Cats

According to Pottinger's research:

- Cats that were consistently fed a diet comprising pasteurized milk and cooked meat reportedly exhibited a tendency to develop arthritis. This occurrence, observed not only in the initial generation but consistently in the subsequent one, was preceded by symptoms such as constipation, ballooned colons, and tooth loss attributed to pyorrhea (Pyorrhea has been defined as arthritis of the articulations of the

1. Pottenger, F.M., Jr. "Effect of Heat-Processed Foods and Metabolized Vitamin D Milk on the Dentofacial Structures of Experimental Animals." *Am. J. Orth. & Surg.* 32:467, 1946. **teeth.**).

9

Wulzen Factor

The "Wulzen Factor," also known as the "anti-stiffness factor" or "Stiffness Prevention Factor," refers to a substance called raw butter oil.

This substance was observed by researcher Rosalind Wulzen in the 1930s, who found that it had beneficial effects on joint health in animals.

Here are some key points about the Wulzen Factor:

1. Discovery: Rosalind Wulzen, a biochemist, conducted research on animals and observed that when they were fed a diet lacking this specific factor found in raw butter oil, they developed joint stiffness.

2. Benefits: The Wulzen Factor is believed by some to have potential benefits for joint health. It has been suggested that the factor may prevent or alleviate stiffness in the joints and might have a role in protecting against arthritis.

3. Heat Sensitivity: One notable aspect of the Wulzen Factor is that it is reported to be heat-sensitive. This means that *it can be destroyed by pasteurization*. As a result, the factor is found in raw, unpasteurized dairy products.

4. Presence in Raw Butter: Raw butter or raw butter oil is often cited as a source of the Wulzen Factor. It is important to note that the consumption of raw or unpasteurized dairy products carries potential risks, including bacterial contamination. Therefore, individuals considering such products should exercise caution and be aware of the associated health risks.

- SOURCE: Nutrition and Arthritis by Royal Lee

Osteoarthritis Myth

"Age causes OA"

- Aging does not cause osteoarthritis
- The two appear together because the risk factors that lead to the development of OA are revealed in older adults.
  - *Decreased ability of articular cartilage to repair itself* in the elderly.

Decreased Ability Of The Articular Cartilage To Heal

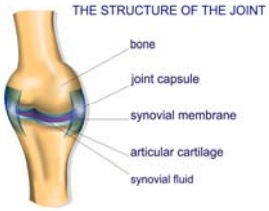
Several factors contribute to the reduced ability of articular cartilage to heal, including:

1. Lack of Blood Supply: Articular cartilage is *avascular.* Blood vessels play a crucial role in delivering nutrients and cells that aid in the repair process. Without a blood supply, the cartilage has limited access to the resources necessary for effective healing.

2. Low Cellularity: Cartilage contains chondrocytes, the specialized cells responsible for maintaining the extracellular matrix. However, the cell density in cartilage is low compared to other tissues. The limited number of cells available for repair can hinder the healing process.

3. Slow Metabolism: Chondrocytes have a slow metabolic rate, and the extracellular matrix of cartilage is relatively inert. This slow metabolism contributes to the slow turnover of cartilage and can impede the response to injury.

4. Inflammatory Processes: Inflammation plays a role in the progression of osteoarthritis. However, the inflammatory response in cartilage is typically limited, and the tissue may not mount a robust healing response as seen in other tissues (due to lack of blood flow). In particular, production of metalloproteases.



- Goldring MB, Goldring SR. Articular cartilage and changes in arthritis: cell biology of osteoarthritis. Arthritis Res Ther. 2007;9
- Sophia Fox AJ, Bedi A, Rodeo SA. The basic science of articular cartilage: structure, composition, and function. Sports Health. 2009 Nov;1(6):461-8.

Metalloproteases

Are a type of protease enzyme that require a metal ion cofactor for their catalytic activity (often zinc). Proteases, also known as peptidases or proteinases, are enzymes that catalyze the breakdown of proteins by hydrolyzing peptide bonds between amino acids.

These enzymes are involved in various biological processes in organisms ranging from bacteria to humans.

They play key roles in essential physiological processes such as cell signaling, protein turnover, tissue remodeling, and the regulation of the extracellular matrix.

Additionally, metalloproteases are implicated in numerous pathological conditions, including cancer, inflammation, cardiovascular diseases, and neurodegenerative disorders.

Osteoarthritis of the Knee

Features
- Loss of joint space
- Inflammation
- Loss of function
- Pain

X-ray
- Narrowing of the joint space
- Bone spur formation

Medical Treatment Paradigm I

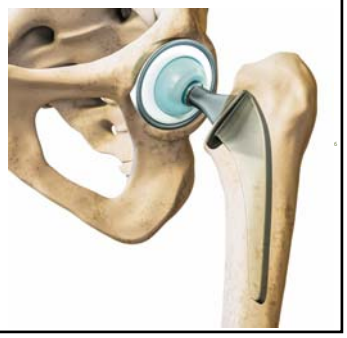
Interfere with inflammation at varying stages using drugs.
- Aspirin
- "Super Aspirin" (Celebrex)
- NSAIDS
- Cortisone
- Prednisone

The problem with this therapy is that abatement of symptoms comes at the expense of faster joint erosion
- The brain gets fooled by drugs while joint degeneration is hastened by excess wear and tear.

Medical Treatments II

Total joint replacement
- Knee
- Hip

Complications
- Infection
- Dislocation
- Loosening
- Thrombophlebitis
  - Potentially fatal if lung clot develops



Other Treatment Considerations

- 1. Improve range of motion
- 2. Support cartilage tissue
- 3. Reduce inflammation
  - Anti-inflammatory herbs
- 4. Support healthy joints
  - Glucosamine
- 5. Support healthy circulation to affected joint
- 6. Weight loss
  - especially for OA of knee and hip

Improve Range of Motion

- Chiropractic
- Stretching
- Yoga

Support Cartilage Tissue

"Instead of looking for a band aide let's start looking for real solutions"

- Judith DeCava

Real Solutions include cleaning up the diet by:

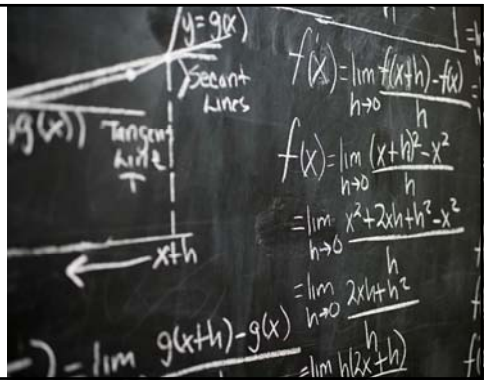
- Removing Inflammatory Foods:
  - Refined sugar and flour
  - Processed and chemicalized pseudo-food
  - Refined fats (margarine and deep frying fat)
  - Alcohol (in the case of AVN)

Support Healthy Cartilage Continued…

Avoid:

- High consumption of high fructose corn syrup
- Processed foods/ canned foods
- Non-organic foods
- Alcohol use
- Plastic-packaged foods
- Low intake of fruits and vegetables
- Low intake of detoxification-related foods and nutrients

Joint Support Formulas



Joint Support Formulas

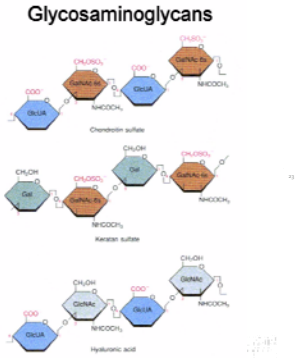
- A number of formulations exist to try to support joint health.
- Many of the products feature joint compounds that target the building blocks:
  - Glucosamine
  - Chondroitin
  - MSM (Methylsulfonylmethane)
  - Hyaluronic acid
- Often these formulas also try to target the inflammatory component of joint health as well:
  - Turmeric/Curcumin
  - Boswellia Serrata
  - Omega-3 Fatty Acids

GAG's

Glycosaminoglycans (GAG's) are protective carbohydrates that are linked to proteins known as proteoglycans

Proteoglycans, which contain sulfur, make these compounds effective joint lubricants and repair molecules.

- NOTE: The formation of GAG's is more complex than just supplying glucosamine, MSM or chondroitin, even though these levels are typically low in arthritic patients.



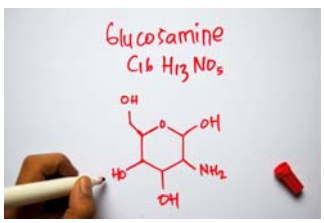
Glucosamine

It's not just glucosamine sulphate

The glucosamine myth:

Most of the information on glucosamine relates to its pharmacological effect in the body.

- Studies done comparing 500 mg of glucosamine sulphate 3x daily to ibuprofen measured pain levels
- The results of the glucosamine research are related to the masking of pain, rather than the repair of cartilage.



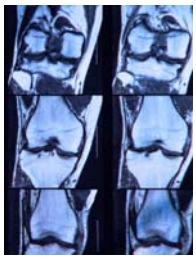
Glucosamine or Chondroitin? Which is better?

Chondroitin is a large macromolecule containing alternating sugars (N-acetylgalactosamine and glucuronic acid)

Glucosamine is a simple amino sugar

Absorption in the gut is the main issue

- Some studies have shown chondroitin sulfate is not rapidly absorbed in the gastro-intestinal tract
  - **Source**: Ronca F, Palmieri L, Panicucci P, Ronca G. Anti-inflammatory activity of chondroitin sulfate. Osteoarthritis Cartilage. 1998;6 Suppl A:14-21.



Glucosamine

- Most products contain glucosamine HCL
- Glucosamine Hydrochloride (HCl):
  - Composition: Glucosamine hydrochloride lacks the sulfate component. It is a more concentrated form of glucosamine without the additional sulfate molecule.
  - Research: While some studies have shown positive effects of glucosamine hydrochloride on joint health, the evidence is not as extensive as that for glucosamine sulfate.
- Glucosamine Sulfate:
  - Composition: Glucosamine sulfate is a compound that contains both glucosamine and a sulfate molecule. The sulfate component is believed to contribute sulfur, which is important for the synthesis of joint tissues as already mentioned.
  - Research: Some studies have suggested that glucosamine sulfate may be more effective than glucosamine hydrochloride in relieving symptoms of osteoarthritis. The sulfate form has been the subject of several clinical trials examining its potential benefits for joint health.
    - A quality product needs to have Glucosamine Sulfate
    - Ideally, there would also be other anti-inflammatory components in the product too

Glucosamine

Glucosamine may have analgesic effects as well as cartilage repair effects.

- A Cochrane 2005 meta-analysis of glucosamine for osteoarthritis found that only "Rotta" preparations (including older studies) found beneficial effects for pain and functional impairment.
  - **Source**: Towheed TE, Maxwell L, Anastassiades TP, et al. (2005). "Glucosamine therapy for treating osteoarthritis". Cochrane Database Syst Rev (2): CD002946.

Glucosamine & Pain

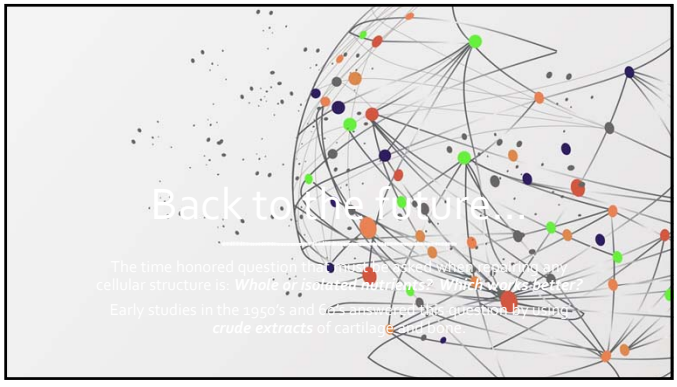
The effects of glucosamine sulfate in patients with osteoarthritis may be the result of:

- Its anti-inflammatory activity
- The stimulation of the synthesis of proteoglycans
- The decrease in catabolic activity of chondrocytes inhibiting the synthesis of proteolytic enzymes.

Glucosamine

How glucosamine reduces knee pain

- Most of the glucosamine studies done by the Italians focused on the long term effects of taking 1500 mg per day of glucosamine
  - **Source:** Vangsness Jr, C.; Spiker, W.; Erickson, J. (2009). "A review of evidence-based medicine for glucosamine and chondroitin sulfate use in knee osteoarthritis". *Arthroscopy* **25** (1): 86–94.
  - **Source:** Long-term effects of glucosamine sulphate on osteoarthritis progression: a randomised, placebo-controlled clinical trial The Lancet, Volume 357, Issue 9252, Pages 251-256 Authors: J.Reginster, et al.



Back to the forum

The time honored question that [illegible] while [illegible] this cellular structure is: ***Whole or isolated nutrients?*** ***Which is better?***

Early studies in the 1950's and [illegible] ***crude extracts*** of cartilage [illegible]

Crude?

Crude = ***unprocessed and unrefined***.

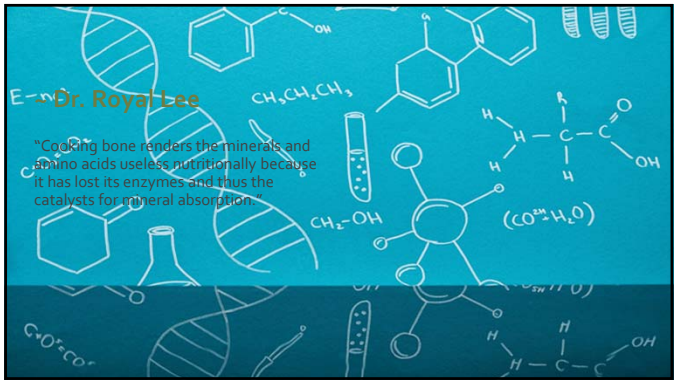
- Contain the whole food factors that provide a complex collection of synergistic co-factors.
  - Demonstrate the greatest benefits for repair and regeneration.
    - **Source**: CM Parsons, F Castanon, and Y Han. Protein and amino acid quality of meat and bone meal. Poultry Science, Vol 76, Issue 2, 361-368

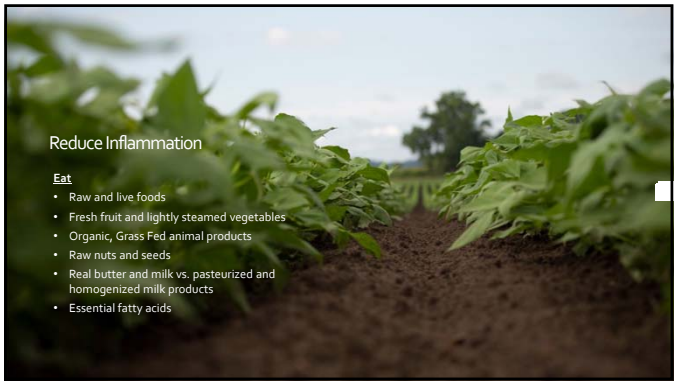
Calcium Food Product

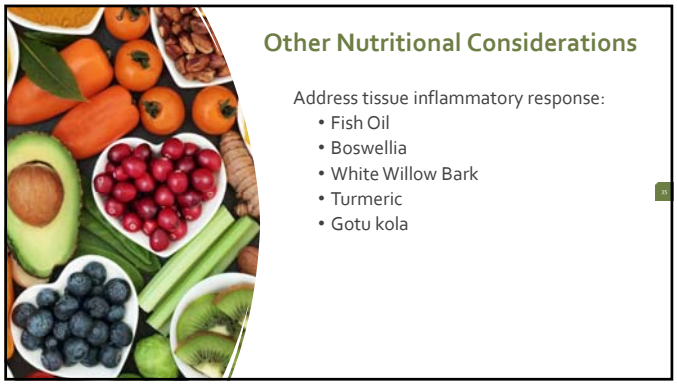
Whole Food Formulations:

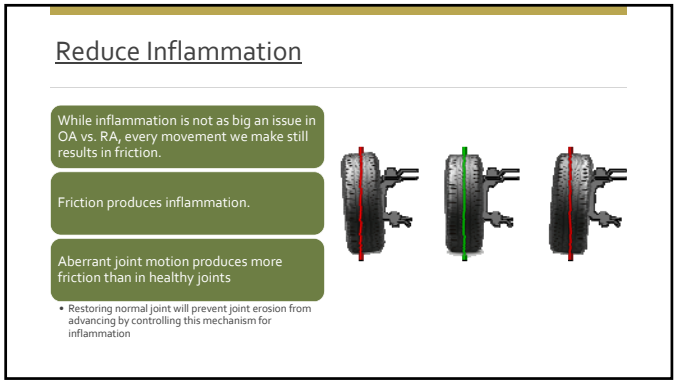
Uncooked stone milled raw bone meal

- "Crude"
- Raw bone meal is 50% protein and 50% minerals in a biologically active form




Reduce Inflammation
Eat
• Raw and live foods
• Fresh fruit and lightly steamed vegetables
• Organic, Grass Fed animal products
• Raw nuts and seeds
• Real butter and milk vs. pasteurized and homogenized milk products
• Essential fatty acids


Other Nutritional Considerations
Address tissue inflammatory response:
• Fish Oil
• Boswellia
• White Willow Bark
• Turmeric
• Gotu kola


Reduce Inflammation
While inflammation is not as big an issue in OA vs. RA, every movement we make still results in friction.
Friction produces inflammation.
Aberrant joint motion produces more friction than in healthy joints
• Restoring normal joint will prevent joint erosion from advancing by controlling this mechanism for inflammation

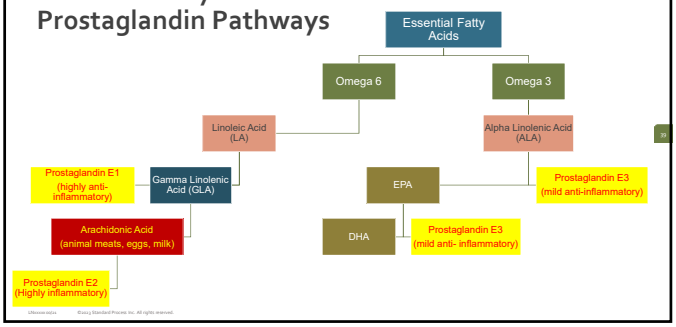
Natural Metalloprotease Inhibitors

Several natural substances have been identified as metalloprotease inhibitors, including:

1. **Green tea polyphenols**: Green tea contains polyphenolic compounds such as epigallocatechin gallate (EGCG), which have been shown to inhibit metalloproteases.
2. **Curcumin**: Found in the spice turmeric, curcumin has been reported to inhibit various metalloproteases.
3. **Resveratrol**: This compound, found in grapes and red wine, has shown inhibitory effects on metalloproteases.
4. **Quercetin**: Found in various fruits and vegetables, quercetin exhibits metalloprotease inhibitory activity.
5. **Ellagic acid**: Present in fruits like strawberries, raspberries, and pomegranates, ellagic acid has been reported to inhibit metalloproteases.
6. **Allicin**: Found in garlic, allicin has been studied for its potential inhibitory effects on metalloproteases.
7. **Tannins**: Certain tannins found in plants have been investigated for their inhibitory activity against metalloproteases.
8. **Berberine**: This compound, found in various plants such as Berberis species, has been reported to inhibit metalloproteases.
9. **Sulforaphane**: Present in cruciferous vegetables like broccoli, sulforaphane has been studied for its potential inhibitory effects on metalloproteases.
10. **Genistein**: Found in soybeans and soy products, genistein has shown inhibitory activity against some metalloproteases.

Essential Fatty Acids

Essential Fatty Acids and Prostaglandin Pathways



Tuna Oil

How Tuna Oil Reduces Inflammation

- EPA leads directly to the formation of the "good prostaglandin" PG3
- Ingestion of EPA in this form
  - Only one biochemical step that leads to formation of PG3.
    - **Source**: Compiled Notes on Clinical Nutritional Products. 2nd Ed. Walter Schmitt DC David Barmore Productions Chapel Hill, NC

Vegetable Oils

Can They Reduce Inflammation?

Yes, but….

- Safflower, Sunflower, Evening Primrose oil, and Black Currant Seed Oil lead to PG3 formation BUT in 4 steps, not one.
- Examples of Omega 6 fatty acids
  - Must be balanced with appropriate ratio of Omega 3s (otherwise = inflammatory)

Glucosamine Plus Omega 3's Better

- Patients who used Glucosamine and Omega 3 FA's showed improvement in OA symptoms by 44% and 48%
  - **Source**: Adv Ther. 2009 Sep;26(9):858-71. Epub 2009 Sep 4. **Effect of glucosamine sulfate with or without omega-3 fatty acids in patients with osteoarthritis.** Gruenwald J, Petzold E, Busch R, Petzold HP, Graubaum HJ.

Boswellia and Inflammation

- In this human study involving an extract of boswellia serrata (BSE) it was shown to create a notable reduction in the serum levels of high-sensitive C-reactive protein, an inflammatory marker associated with OA of the knee.
- BSE also significantly improved the physical function of the patients by reducing pain and stiffness compared with placebo.
  - Majeed M, Majeed S, Narayanan NK, Nagabhushanam K. A pilot, randomized, double-blind, placebo-controlled trial to assess the safety and efficacy of a novel Boswellia serrata extract in the management of osteoarthritis of the knee. Phytother Res. 2019 May;33(5):1457-1468. doi: 10.1002/ptr.6338. Epub 2019 Mar 6. PMID: 30838706; PMCID: PMC6681146.

Boswellia

The anti-inflammatory activity of Boswellia can be attributed to four triterpene pentacyclic acids which alter the arachidonic acid cascade leading to inflammation.

- **Source**: H. P. T. Ammon, et al. Mechanism of antinflammatory actions of curcumine and boswellic acids. *Journal of Ethnopharmacology*. Volume 38, Issues 2-3, March 1993, Pages 105-112

Boswellia

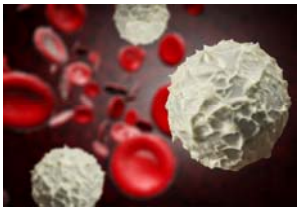
2 main mechanisms

Anti-inflammatory activity mechanisms

Three potential mechanisms:

1. Selective inhibition enzyme 5-lipoxygenase
   - Causes a reduction in the production of leukotrienes
2. Inhibition of C_3 convertase
   - A serine protease that releases pro-inflammatory anaphalactic peptides
3. Inhibition of leukocyte migration to the site of inflammation

Inhibition of Leukocyte Migration



Boswellia serrata inhibited the infiltration of polymorphonuclear leukocytes (basophils, neutrophils, and monocytes) in rats with induced pleurisy.

- **Source:** Agents Actions. 1988 Jun;24(1-2):161-4. **Effect of salai guggal ex-Boswellia serrata on cellular and humoral immune responses and leucocyte migration.** Sharma ML, Khajuria A, Kaul A, Singh S, Singh GB, Atal CK

Boswellia: Evidence of Therapeutic Benefit

Patients with OA experienced a reduction in pain and disability scores in response to treatment. Specific improvements were:

- Reduced pain, swelling & stiffness
- Lowered erythrocyte sed rates
- Reduction in the need for NSAID
  - **Source:** Ammon HP. **[Boswellic acids (components of frankincense) as the active principle in treatment of chronic inflammatory diseases].** Wien Med Wochenschr. 2002;152(15-16):373-8.

Pharmacokinetics of Boswellia

Patients should be dosed every six hours.

After 30 hours plasma concentrations of boswellic acids stabilize.

- Phytomedicine. 2004 Feb;11(2-3):255-60. **Pharmacokinetic study of 11-Keto beta-Boswellic acid.** Sharma S, Thawani V, Hingorani L, Shrivastava M, Bhate VR, Khiyani R.

Anti Inflammatory Synergists

- Celery seed
  - Anti-inflammatory and analgesic. One clinical study of rheumatic pain indicated a drop in pain intensity after 3 weeks
- Tumeric rhizome
  - Clinical studies confirmed a significant drop in severity of pain and disability, when used in combination with B. seratta
- Ginger rhizome
  - 75% of arthritis (OA & RA) sufferers experienced relief from pain and swelling of the joints

White Willow Bark

White Willow Bark product containing salicin and other phenolic glycosides :

- Salicin's inhibit cyclooxygenase (cox 1 & 2).

White Willow (Bark)

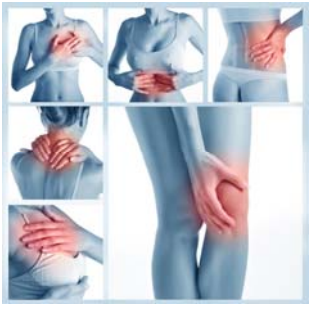
Ideally contains: salicin and salicin esthers

- Salicin's inhibit cyclooxygenase (cox 1 & 2)

Therapeutic indications: acute or chronic joint pain from inflammatory conditions.

- In clinical trials on low back pain over a four week period it was at least as effective as Vioxx and Celebrex at alleviating pain without the gastrointestinal side effects.
  - Source: Gagnier, Joel J. ND. Et al. Herbal Medicine for Low Back Pain: A Cochrane Review. Spine: January 2007 - Volume 32 - Issue 1 - pp 82-92When to use: for joint pain control

White Willow Bark



Action:

- Post-exercise muscle and joint pain

Clinical Indications:

- Acute joint pain from post-exercise inflammatory conditions

Turmeric Benefits

- Has post-exercise anti-inflammatory and immune system enhancing properties.
- Turmeric is a component of curry. One of Turmeric's derivative is *CURCUMIN,* which inhibits the formation of prostoglandin E2 and inflammatory leukotrienes

Curcumin Supplements Worthless?

- It all comes down to absorption.
- Curcumin's stability and pharmacokinetics are terrible. It's less than 1% bioavailable, and its half-life under physiological conditions is measured in minutes (according to research 30 seconds to 3 minutes)

Curcumin Will Waste Your Time **The Essential Medicinal Chemistry of Curcumin** Miniperspective Nelson, et. al *J. Med. Chem.* 2017, 60, 5, 1620–1637 Publication Date:January 11, 2017

Curcumin: How Do You Overcome This Rapid Breakdown?

- Fenugreek!
- Fenugreek prevents breakdown of turmeric in the liver
- Increase milk production
- Snot buster

59

Curcuminoid Galactomannosides (CGM)

- Combination of curcuminoids and fenugreek will create CGM
- In studies CGM showed 45.6 times bioavailability uplift at a dose of 1000 mg and 24.8 times uplift at a dose of 250 mg.
- This resulted in 74% free curcuminoids and 26% conjugated
- This suggests that CGM inhibits initial liver metabolism thereby increasing effectiveness.
  - *Enhanced bioavailability and relative distribution of free (unconjugated) curcuminoids following the oral administration of a food-grade formulation with fenugreek dietary fibre: A randomised double-blind crossover study.* Kumar D, Jacob D, Subash PS et al. J Funct Foods 2016; 22: 578-587

60

CGM and the Blood Brain Barrier

- CGM delivered 245 times more free curcuminoids compared to unenhanced non CGM (not bound to Fenugreek).
  - Krishnakumar IM, Abhilash Maliakel, Gopakumar G, Dinesh Kumar, Balu Maliakel, Ramadasan Kuttan. *Improved blood–brain-barrier permeability and tissue distribution following the oral administration of a food-grade formulation of curcumin with fenugreek fibre.* **Journal of Functional Foods** Volume 14 2015, pp. 215-225.
- Curcumin boosts DHA in brain!
  - Wu A, Noble EE, Tyagi E, Ying Z, Zhuang Y, Gomez-Pinilla F. *Curcumin boosts DHA in the brain: Implications for the prevention of anxiety disorders.* **Biochim Biophys Acta**. 2015 May;1852(5):951-61. doi: 10.1016/j.bbadis.2014.12.005. Epub 2014 Dec 27.

61

Gotu Kola

Known as "The Healer" It Augments Treatment For Joint Health

Gotu Kola or its actives (TFGK) have been shown to improve healing when taken orally in many clinical trials

Healing of key body tissues (eg skin, bone fractures, damaged discs)

- Adjunctive treatment to support connective tissue development in osteoarthritis and osteopenia
  - Source: Vogel HG. Et al. Acta Therapeutica 1990; 16:285
  - Source: Siguna L. et al. Indian J Exp Biol. 1996; 34(12): 1208-11

Herbal Support: Gotu Kola

- Helps repair exercise-related tissue damage.
- Many studies in both human and animal models show Gotu Kola's effectiveness in a variety of tissue damage situations.

Clinical Indication:

- Support prevention of natural degeneration pathways.
- Healing related to tissue damage.

64

What Is Gotu Kola?

- An evergreen perennial plant native to India, Japan, China, Indonesia, South Africa, Sri Lanka, and the South Pacific. Gotu Kola is a member of the parsley family, it has no taste or smell. It does best in and around water. Fan shaped green leaves with white or light purple-to-pink flowers it produces a small oval fruit. Traditional preparations include the leaves and/or stem.

Gotu Kola

Gotu Kola extract or the triterpenes of Gotu Kola (TGK) have demonstrated the following effects:

- Increased collagen content and promotion of collagen cross-linking in granulation tissue of dermal wounds (I.e. an increased rate of synthesis and maturation of collagen)
- Improved mechanical properties of the scar tissue (e.g. improved strength)

66

Vogel HG, De Souza N, D'Sa A. Acta Therapeut 1990; 16: 285
Suguna L et al. Indian J Exp Biol 1996; 34: 1208

Gotu Kola

- Connective Tissue Support
  - Wound/scar tissue control:
    Reduces fibroblast formation, scar tissue, and supports connective tissue healing
    - Therapeutic dose: 120 mg per day

Gotu Kola – The Healing Herb the Phytotherapist Perspective, No. 115, Oct 2007

Support Healthy Joints

Support Healthy Joints

- Correcting biomechanical problems early is critical in OA
- Example: Whiplash injury
  - Those who treat just the pain of whiplash and not the underlying joint dysfunction from the trauma are at much greater risk for OA of the Cervical spine. "Hohl found a high percentage of degenerative changes on long term follow up of patients involved in MVA"
    - Arthur Croft, Whiplash Injuries 1988

What Is The Real Issue Here?

Problem With Treating Symptoms?

- Misalignment of knee joint (many causes)
- Arthritis can develop in several months to a few years
- This has a systemic component to be sure.

Support Healthy Joints

- Nutritional considerations:
  1. **Support healthy circulation**
  2. **Decrease stress on joint**
     - Healthy weight loss protocol
       - Purification

Support Healthy Circulation

- Articular joints are **avascular**
- Diffusion of nutrients and metabolites occur from adjoining bones.
  - **GOAL**: Remove the by-products of altered joint metabolism and improve oxygenation.
    - Increase O_2
    - Remove CO_2
    - Remove damaged tissue and metabolites

Blood Flow

- Nutrients and strategies to help the process of blood flow can help tissue healing:
- Nitric Oxide raising food and supplements help blood flow as shown in various studies.
  - Source: Biorheology. 2014;51(2-3):121-34. *Nitric oxide, vasodilation and the red blood cell.* Simmonds MJ1, Detterich JA2, Connes P3.
  - Am J Surg. 2002 Apr;183(4):406-12. *Role of nitric oxide in wound repair.* Witte MB1, Barbul A.
- Ginkgo has had a longstanding reputation in the herbal world of helping to increase blood flow both through vasodilation via nitric oxide and the anti-platelet aggregating effects.
  - Source: Clin Chim Acta. 2004 Jan;339(1-2):129-33. *Comparative vasodilating actions among terpenoids and flavonoids contained in Ginkgo biloba extract.* Nishida S1, Satoh H.

Decrease Joint Stress: Weight Loss & OA

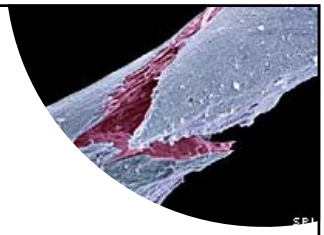
- Reduce the effects of OA by losing weight
  - Studies show that a loss of as little as 11-12 pounds reduced knee pain and decreased the rate of osteoarthritis progression.
    - Every additional 10 lbs. Of body weight causes an extra 30-50 lbs of stress on the knee for every step taken
      - **Source**: Roland Moskowitz, MD. Case Western Reserve University, Cleveland.

Weight Loss

- The prevalence of OA among the obese is about twice that of people who maintain a normal "height to weight ratio"
  - Detoxification and Dietary/Lifestyle modifications
    - A healthy (and effective) weight loss protocol
    - Offers doctors and patients a three prong approach to helping overweight patients with OA
      - Weight loss
      - Liver, kidney, bowel, and blood purification
      - Post Purification Diet changes (maintenance protocol)

Detoxification & Weight Loss

- Common results:
  - Lose 11-20 lbs.
  - Reduce blood sugar
  - Reduce blood lipids
  - With less toxins/weight, may notice significantly less joint stiffness/pain



- A reduction in the normal amount of bone mass leading to fractures after minimal trauma.
- The reduction in bone mass affects both the mineral and matrix part of the bone.

Definition

Osteopenia vs. Osteoporosis

- Osteopenia is loss of minerals in the bone.
- Osteoporosis is the loss of *both* the minerals in the bone and the collagen matrix. (more on the matrix coming up)

Etiology

- Osteoporosis is frequently over-simplified as merely a lack of calcium and vitamin D in bone formation, when in fact is a breakdown of both the mineral and organic matrix of the bone.

Osteopenia vs. Osteoporosis

Not the same condition and if you have osteopenia it does not mean you will get osteoporosis.

Think of a building and how it provides strength vs. interior walls, carpet, etc.

Strength Of Bone

Signs/Symptoms

- Typically osteoporosis is ***asymptomatic*** until a fracture occurs.
  - Fractures can be spontaneous or secondary to trauma (a fall is usually the precipitating event) with the anterior thoracic crush-type vertebral fracture and hip fracture being the most common break sites.
- Stooped posture (dorsal kyphosis)
- Decrease in overall height
- Demineralization of spine and pelvis
  - Visualized by x-ray or bone scan
    - DEXA – Dual Energy X-ray Absorbtiometry is considered the most reliable method currently

T-Score & Z-Score

- Measure of bone minerals by the use of an x-ray absorptiometry called a DXA or DEXA scan.
- Bones that most often fracture are hips and spine, so they tend to test those areas.
- Compares bone mass to that of a 30 year old, so it's not age specific.
- T-Score is measured by the following:
  - 1 or higher your bone is healthy.
  - -1 to -2.5 you have osteopenia.
  - -2.5 or lower you have osteoporosis.
- Risk of fracture increases by 1.5 to 2x with each 1 point drop in the T-score.
- Z score is a comparison to a person the *same* age of the patient (also of the same sex and ethnicity) and is used for those patients that are under the age of 50. This is the test used for children.
  - Source: NIAMS.NIH.Gov "Bone Mineral Density Tests: What the Numbers Mean"

No Correlation To Calcium Intake

- Research has shown no correlation to calcium intake:
  - **Conclusions:** Dietary calcium intake is not associated with risk of fracture, and there is no clinical trial evidence that increasing calcium intake from dietary sources prevents fractures. Evidence that calcium supplements prevent fractures is weak and inconsistent.
    - Bolland MJ, Leung W, Tai V, Bastin S, Gamble GD, Grey A, Reid IR. Calcium intake and risk of fracture: systematic review. BMJ. 2015 Sep 29;351:h4580

Collagen Matrix

- In bone, collagen represents more than 90% of the organic matrix!
- Most prevalent collagen in bone is Type I collagen.
  - Tzaphlidou M. Bone architecture: collagen structure and calcium/phosphorus maps. J Biol Phys. 2008 Apr;34(1-2):39-49.

What Is Bone?

Bone matrix is a living growing tissue:

~ 25% collagen, the protein that provides the flexible framework (90% of organic material)
~ 50% crystallized mineral salts including calcium phosphate, calcium carbonate, magnesium hydroxide, fluoride & sulphate provides the strength & hardens the framework
~25% water

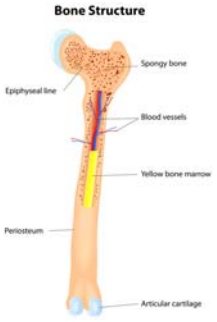
Tortora, GJ, Grabowsky, SR. *Principles of Anatomy and Physiology* 10th Ed. John Wiley & Sons, NY, 2003, pp 162-184

Bone Structure

Divided into 2 compartments:

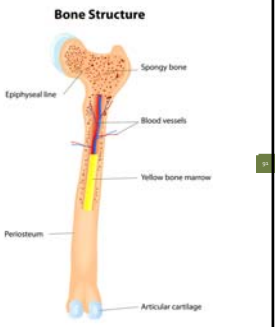
- Cortical bone (compact bone)
  - Dense & compact
  - Surrounds the marrow cavity
  - Accounts for 80% of the mature skeleton
- Trabecular bone
  - Inner layer of bone
  - Spongy, honeycomb-like structure

- **Source**: Tortora, GJ, Grabowsky, SR. *Principles of Anatomy and Physiology* 10th Ed. John Wiley & Sons, NY, 2003, pp 162-184



Bone Structure

- Cortical bone (also called compact bone) is made up largely of type-I collagen. This gives the bone its tensile strength and framework, and calcium phosphate, a mineralized complex that hardens the skeletal framework.
- This combination of collagen and calcium gives bone its hardness, and yet bones are flexible enough to bear weight and withstand stress.
- More than 99% of the body's calcium is contained in the bones and teeth.
- Most of the remaining 1% is found in the blood
  - **Source**: Tortora, GJ, Grabowsky, SR. *Principles of Anatomy and Physiology* 10th Ed. John Wiley & Sons, NY, 2003, pp 162-184



Bone Functions

Produces red and white blood cells:
- Bones contain red bone marrow that produce RBC and WBC.

Stores energy in the form of fat (triglyceride).
- Yellow Bone Marrow.

Store minerals, e.g. calcium and phosphorous.
- Vital for the functioning of all the cells in your body.
- If the body needs to use these stored minerals (not enough is obtained from the diet), then the bone tissue releases them into circulation.

Acid/Base Balance.
- Buffers excessive acidity by releasing alkaline salts
- Acid base balance is primarily done in the kidneys

Stores important growth factors such as insulin-like growth factors.
- Mineralized bone matrix

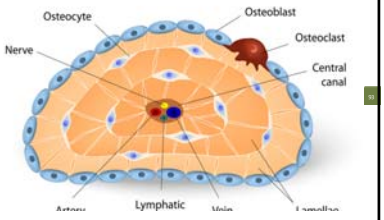
Acts as an endocrine organ.
- Helps control phosphate metabolism by releasing fibroblast growth factor - 23 (FGF-23); which acts on kidneys to reduce phosphate reabsorption

Supports the detoxification processes in the body by storing heavy metals such as lead and cadmium.

Source: Wikipedia

Bone Homeostasis

- Balanced remodelling process that ensures the continual replacement of old bone, weakened by normal microfracture, with new bone
  - Bone resorption (removal) by osteoclasts
  - New bone formation by osteoblasts / osteocytes
- Failure to reach peak bone mass or disturbances to remodelling can result in bone fragility
  - **Source**: Downey PA, Siegel MI. Bone Biology and the Clinical Implications for Osteoporosis, *Physical Therapy,* 2006; **86**(1): 77-91



Bone Remodeling

Bone is constantly renewed

Deposits & withdrawals

During childhood & the teenage years there are more deposits than withdrawals, this increases bone density, length & weight

Deposits peak around age 30 and are dependant on adequate nutrition (protein, Calcium, vitamins D & K) & exercise

Source: Downey PA, Siegel MI. Bone Biology and the Clinical Implications for Osteoporosis, *Physical Therapy*, 2006; **86**(1): 77-91

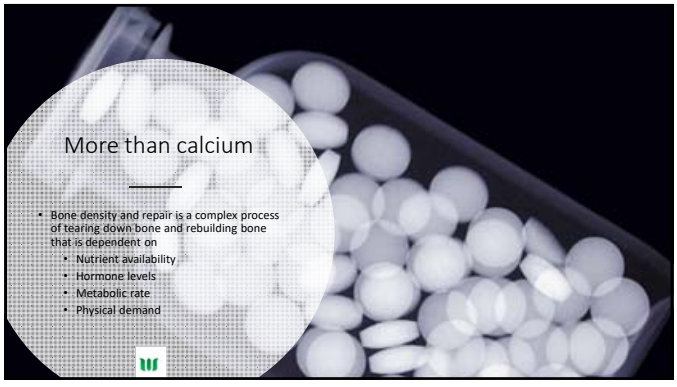
Vitamin K

Vitamin K1

- Heavily involved in blood coagulation.
  - Adv Nutr. 2012 Mar 1;3(2):166-73. The role of vitamin K in soft-tissue calcification. Theuwissen E1, Smit E, Vermeer C.

Vitamin K2

- 9 related types, with K2-7 (Menaquinone) being the most popular.
- K2 was first discovered by Weston A Price, the famous dentist nutritional expert. He referred to K2 as "Activator X"
  - **Nutrition and Physical Degeneration** by Weston Andrew Price Price-Pottenger Nutrition Foundation, 2008
- K2 is heavily involved with blood vessel calcium levels.



Bone Loss Factors: Diet and Nutritional Risk Factors

- Lack of adequate calcium intake early in life
  - And throughout the woman's life-time.
- Intake of calcium & vitamin D *plus* proper intestinal and kidney function
  - Affects calcium and phosphate homeostasis.
- Eating Disorders
- Acidic Diet (low veggies)

- Sugar
- Soda
- Caffeine
- High intake of animal protein

97

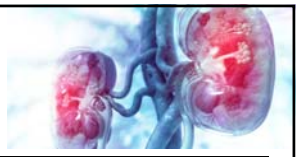
Kidney Health & Bones

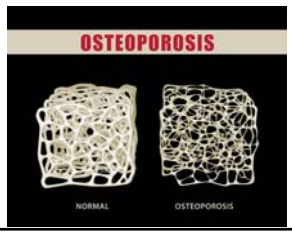
Hidden thing to check when dealing with bone health is the kidneys.

Kidneys have strong relationship to bone health.

- Conversion of Vitamin D occurs in the kidneys.
- The kidneys convert 25 hydroxycholecalciferol (vitamin D) from liver to its more active form. (more coming up)

Multiple kidney factors affect bone.





98

Kidney Function & Osteoporosis

- Chronic kidney disease (CKD) is linked to the onset of mineral bone disorder (MBD), osteoporosis, and susceptibility to fractures.
- When the kidneys are impaired, they lose the ability to regulate the levels of calcium and phosphate in the bloodstream.
- An increase in phosphate occurs, and it binds with calcium, extracting calcium from the bones and resulting in their gradual weakening. This combined calcium-phosphate mixture may accumulate in blood vessels, contributing to vascular and cardiac ailments.
- Impaired kidneys are unable to convert vitamin D into its active, usable form, leading to a decline in bone strength.
- In the context of kidney disease, an excess of parathyroid hormone is released to maintain equilibrium in blood calcium levels, depleting calcium from the bones and causing a reduction in bone density.
  - Source: Hsu CY, Chen LR, Chen KH. Osteoporosis in Patients with Chronic Kidney Diseases: A Systemic Review. Int J Mol Sci. 2020 Sep 18;21(18):6846.
  - https://kidneycareuk.org

Nutritional Risk Factors

Caffeine

- Excessive caffeine can take calcium from the bones.

Soda

- Interferes with calcium/phosphorus balance.
- Phosphorus binds with calcium, leaving calcium unavailable to the body.
- Calcium is thereby drawn from bones.
- Kligler B, Lee R. *Integrative Medicine,* McGraw-Hill, New York, 2004, pp 549-566

Nutritional Risk Factors

Sugar

- Decreases calcium & magnesium absorption.
- Upsets intestinal flora and decreases calcium and magnesium ions.

Salt

- Increases calcium excretion.

Nutritional deficiency

- Vitamins K, D and C

Alcohol consumption

- Toxic to osteoblasts & interferes with calcium absorption.

Kligler B, Lee R. *Integrative Medicine,* McGraw-Hill, New York, 2004, pp 549-566

Exercise & Bone Density

Bone remodels based on the amount of stress that is placed upon it.

- The worst thing a peri-menopausal woman can do is lead a sedentary lifestyle.
  - **Source:** Effects of different exercises on the bone metabolism level of middle-aged and old women. Wang C, Yang Z, Chen Y. Sheng Wu Yi Xue Gong Cheng Xue Za Zhi. 2009 Dec;26(6):1306-10.

Green Leafy Vegetables

Green vegetables are the source of alkaline minerals that offset the acidifying effect of excess protein.

"…Meat Should Be A Condiment To The Meal – Vegetables Being The Main Course."

~Thomas Jefferson

Nutritional Considerations

Bone Health Support → Vitamin D supplementation

Vitamin D

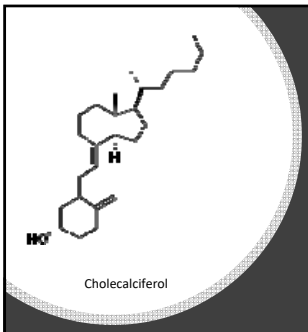
Functions:

- Aides the absorption of calcium and phosphorus from food in the small intestine.
  - Hence it aides in the mineralization of bone matrix
- Protective against disease
  - Some evidence suggests Vitamin D may lower mildly elevated blood pressure.
  - Vit. D may be linked to lower cancer rates.
  - Almost every tissue type has a receptor for the active form of Vit. D.
    - Researchers think Vit. D may provide some kind of anti-cell proliferation factor

Source: http://www.vitamindcouncil.org/research.shtml

Vitamin D and Fracture

- Post-menopausal woman need calcium and vitamin D for bone support.
- Women without vitamin D had a higher rate of fractures.
  - **Source**: Eur Surg Res. 2009;42(1):1-10. Bone mineral density and vitamin D status in female and male patients with osteoarthritis of the knee or hip. Breijawi N. et.al.



Cholecalciferol

Vitamin D3

- Natural vitamin D
- Body has feedback mechanisms to prevent overdose.
- Converted to calcifediol by liver, hydroxylated by the kidney, and becomes calcitriol (1,25-dihydroxyvitamin D_3).
- Calcitriol is the most active hormone form of vitamin D_3.
  - Source: Wikipedia

What About Vitamin D2?

It still works, it's just not as effective as D3…was often used because you could do higher doses.

Vitamin D Deficiencies

Most people don't get enough sun:

- Use of sun block
- Live at higher latitudes
  - Scribe a line from LA to Atlanta and if you live north of that, at risk for deficiency

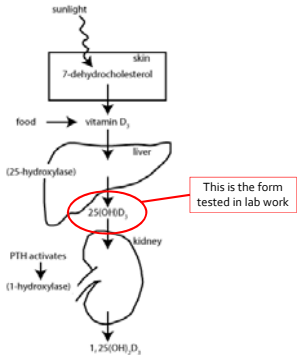
Foods rich in Vitamin D are not eaten.

Aging influences conversion in skin/liver.

Sun vs. Location

Source: Scientific American, March 23, 2009 Vitamin D deficiency soars in the U.S., study says. New research suggests that most Americans are lacking a crucial vitamin. Jordan Lite

Sunlight Converts Vitamin D



Aging, Absorption & Conversion

- With aging, there is no effect on digestive absorption of Vitamin D, but there is a decrease in conversion from the sun.
  - At 70 years old, the skin can only convert about 25% of what you could at age 20.
  - Nutritional sources of vitamin D and adequate mineral consumption are critically important factors in bone loss prevention for those in Northern latitudes.
    - **Source:** Gallagher JC. Vitamin D and aging. *Endocrinol Metab Clin North Am*. 2013;42(2):319-32.

Medical Treatment Model

Pharmacological Interventions

- Hormone replacement therapy (HRT)
- Bisphosphonates: Fosamax, Actonel & Boniva
- Selective Estrogen Receptor Modulators (SERMs): Raloxifene (Evista)
- Calcitonin: Miacalcin, Fortical
- Recombinant human parathyroid hormone analogues: Teriparatide

Pharmacological Side Effects

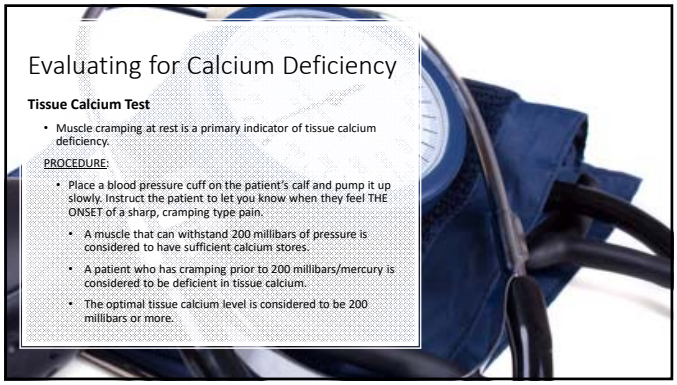
Bisphosphonates

- Brittle Bone Disease
  - Increase in fracture rate is related to old bone not being remodeled along stress lines.
  - Drugs stop osteoclast activity.
    - The result is bone density increase but poor bone.
    - Body tears down old bone in areas of microfracture and lays down new bone to strengthen weak spots.

Pharmacological Side Effects

Bisphosphonates

- Dead Jaw, osteonecrosis of the jaw
  - It is commonly assumed that the bisphosphonates somehow cause cell death (osteocyte necrosis) within the jawbone, which makes it prone to chronic infection. In this article, an alternative pathogenetic theory is suggested, based on the normal effect of bisphosphonates. According to the new theory, the bone is alive until it is injured and infected, and the reduced resorptive ability due to bisphosphonates hinders the formation of a fresh bone surface for re-establishment of bone cell coverage.
    - **Source:** Per Aspenberg (2009) Bisphosphonates and implants. *Acta Orthopaedica* **80**:1, 119-123



Evaluating for Calcium Deficiency

Tissue Calcium Test

- Muscle cramping at rest is a primary indicator of tissue calcium deficiency.

PROCEDURE:

- Place a blood pressure cuff on the patient's calf and pump it up slowly. Instruct the patient to let you know when they feel THE ONSET of a sharp, cramping type pain.
  - A muscle that can withstand 200 millibars of pressure is considered to have sufficient calcium stores.
  - A patient who has cramping prior to 200 millibars/mercury is considered to be deficient in tissue calcium.
  - The optimal tissue calcium level is considered to be 200 millibars or more.

How To Know Calcium vs. Magnesium Deficiency

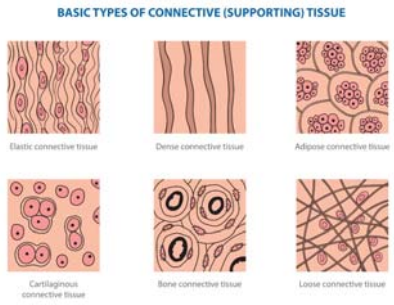
- Obviously History
- Calcium Cuff Test

Ensure Acidic Environment

Calcium is a buffer, and requires an acidic environment to ensure absorption.

- This is why many indigestion products utilize calcium carbonate.
  - Neutralizes acid
- You can utilize products to increase acidity.

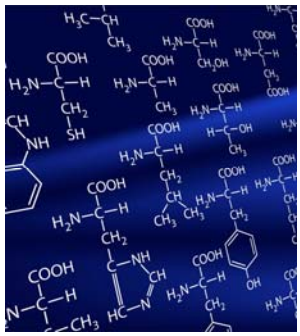
Connective Tissue



Connective Tissue

Collagen

- Unusual Amino acids sequence: Glycine (Gly) is found at almost every third residue and Proline (Pro) makes up about 9% of collagen.
- Contains two uncommon derivative amino acids not directly inserted during translation.
  - These amino acids are found at specific locations relative to glycine and are modified post-translationally by different enzymes
  - Both require vitamin C as a cofactor.



Two Types

- Type I Collagen
- Type II Collagen

1 2

Type I Collagen

- Type-I collagen is the most abundant collagen of the human body:
  - Present in scar tissue
    - End product when tissue heals by repair.
  - Found in tendons, the endomysium of myofibrils and the organic part of bone.

Type II Collagen

- Type-II collagen is the basis for articular cartilage and hyaline cartilage.
  - It makes up 50% of all protein in cartilage and 85-90% of collagen of articular cartilage.
  - Type II collagen does form fibers.
    - This fibrillar network of collagen allows cartilage to entrap the proteoglycan aggregate as well as provide tensile strength to the tissue.

Collagen I Formation

- Importance of Vitamin C in collagen I formation.
  - Hydroxylation of lysine and proline amino acids occurs inside the lumen.
  - This process is dependent on Vitamin C as a cofactor.
- An essential co-factor in collagen synthesis.
  - Exercise-damaged collagen will be weaker and more prone to continued wear leading to exercise-related tissue damage and inflammation.

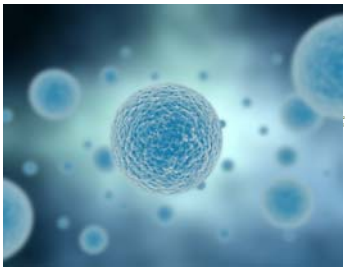
Strengthen Collagen Framework

- Utilize whole food vitamin C or whole food vitamin C products.

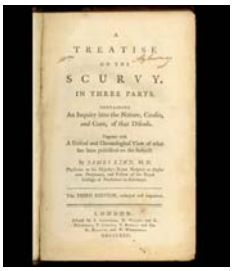
Immune Correlation

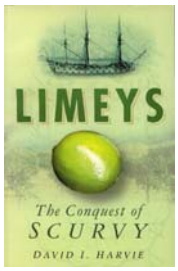
Vitamin C deficiency causes scurvy

- Characterized by defective collagen preventing the formation of strong connective tissue.
- Gums deteriorate and bleed, with loss of teeth; skin discolors, and wounds do not heal.



Sailors & Scurvy





Connective Tissue Support

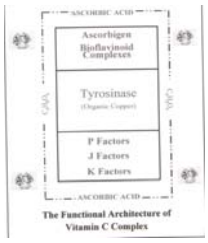
Some whole food pioneers believed that joint problems such as tendonitis were related to subclinical scurvy.

Deficiency of the Vitamin C Complex potentially results in damage to connective tissue and predisposition to injury, re-injury or failure to repair after injury.

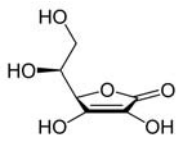
FLOUR IS NOT A CAKE!

Vitamin C complex diagram

Whole Food C



Ascorbic Acid



Other C Factors

P factor strengthens collagen.
- A flavonoid that prevents capillary fragility

J factor improves Oxygen carrying capacity.

K factor aides the formation of protein.

Collagen Proteins

- Collagen is a protein that plays a crucial role in the structure and strength of various connective tissues in the body, including bones. However, the impact of supplementing with collagen proteins on bone health is an area of ongoing research, and the evidence is not yet conclusive.
- Several studies have explored the potential benefits of collagen supplementation for bone health. Some suggest that collagen peptides may stimulate the synthesis of collagen in bone tissues and promote bone mineral density. Additionally, collagen is a significant component of the extracellular matrix in bones, and it may contribute to bone strength.
- A couple of studies have demonstrated positive effects:
  1. **Koizumi S, et al. (2018):** This study suggested that collagen peptide supplementation may enhance bone metabolism and have a positive impact on bone mineral density.
  2. **Porfirio B., et al. (2019):** The research explored the effects of collagen supplementation on bone mineral density and bone biomarkers, indicating potential benefits for postmenopausal women.

Is It Collagen Protein…Or Just Protein?

- Proteins, including collagen, are essential building blocks for various tissues in the body, and they play a role in supporting bone health.
- The specific benefits of collagen for bone health may be related to its role in the extracellular matrix of bones, potentially influencing bone structure and strength.
- Here are some studies that show whey protein as beneficial:
  1. **Kerstetter JE, et al. (2006):** This study investigated the effects of whey protein supplementation on bone density in postmenopausal women. The results suggested a positive influence on lumbar spine bone density.
  2. **Tang JE, et al. (2007):** The study examined the impact of whey protein supplementation on bone mineral density in young women. It concluded that there were no significant changes in bone density over the study period.
  3. **Hartman JW, et al. (2007):** This research focused on resistance-trained men and women and found that a diet high in protein, including whey protein, did not adversely affect bone density.

Treatment considerations

Weight bearing exercise

Increased consumption of green leafy vegetables

Ensure adequate hydrochloric acid secretion

- Decreased HCl can result in a reduced amount of readily absorbable ionized calcium.
- Tea & Toast Syndrome: Low HCL may cause problems with the digestion of protein and prevent older women from eating an adequate amount of protein to form healthy bone matrix .

Provide adequate bone regrowth nutrients to assure optimal bone repair.

Bone Health Strategies Summary

Adequate weight bearing exercise

- Especially weights/resistance training

Adequate Vitamin D

Adequate Calcium

Proper intake of other essential trace minerals

- Zinc, boron, magnesium

Proper intake of whole food vitamin C

Proper Vitamin K2 intake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Osteoporosis
Questions & Answers