

Methods of Prediction of Leg Length Discrepancy

Essay

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List of Contents

List of Contents	I
List of Figures	II
List of Tables	VI
List of Abbreviations	VII
Abstract	IX
Introduction	1
Aim of the study	4
Normal growth rate of lower limbs	5
Diseases affecting growth of lower limbs	30
Methods used in prediction of leg length discrepancy	42
Arithmetic method of Menelaus	46
Green-Anderson Growth Remaining Method	50
Mosley's Straight line graph method	55
Paley's Multiplier method	65
Others	77
Conclusion	90
References	93
Arabic Summary	103

List of Figures

<u>No.</u>	<u>Title</u>	<u>Page</u>
1	Foetal femoral diaphyseal growth with radiographic images at 14, 20, 24 and 40 weeks	8
2	Femoral growth velocity from the foetal period to skeletal maturity (girls) demonstrating a peak growth velocity at 4 months of antenatal life.	9
3	Growth velocity in boys and girls from birth to skeletal maturity.	10
4	Pubertal growth in boys & girls	12
5	Growth rates Shown are yearly growth rates for girls and boys for stature and femoral and tibial lengths.	14
6	Growth of femur (distal physis) and tibia (proximal physis) in boys and girls.	15
7	Example of recording measurements on the Egyptian growth chart	18

List of Figures.....

(a) boys (b) girls

8	Chart of stature for age percentiles: Egyptian girls 2-21yrs	19
9	Chart of stature for age percentiles: Egyptian boys 2-21yrs	20
10	Relative growth from each end of the major long bones.	21
11	Percentage of growth of each end of the femur from birth, mid childhood, and at maturity.	22
12	Percentage contribution of longitudinal growth of the distal femoral physes from age 7 years to maturity.	23
13	Annual increment of growth for the femur from age of 7 years to skeletal maturity.	23
14	The amount of growth remaining in the distal femur in boys and girls from age 7 years to skeletal maturity.	24
15	The percentage contribution of proximal and distal physes to the growth of the femur.	25

List of Figures.....

16	Amount of growth from each end of the tibia at birth, midway through growth and at completion of growth.	26
17	The percentage contribution of growth of the tibia from the proximal physis.	27
18	The annual increment of growth for the proximal tibia from age 7 years to skeletal maturity.	27
19	Centimeters of growth remaining in the proximal tibia from age 7 years to skeletal maturity.	28
20	The contribution of the proximal and distal physes to the growth of the tibia.	29
21	Radiological changes at the onset of puberty, sesamoid ossification left hand, double ossification left olecranon apophysis.	44
22	Pubertal diagram showing characteristic morphology of the left olecranon apophysis during puberty.	45
23	Green-Anderson chart for prediction of leg-length discrepancy.	51
24	Step-by-step instructions for use of the growth-remaining method. An example, shown in the right column.	52

List of Figures.....

25	The Straight Line Graph as it is used clinically.	57
26	An example of the use of the graph. The numbered steps correspond to the stepby- step instructions in the text.	58
27	Step-by-step instructions for use of the straight-line graph method. An example, shown in the right column.	62
28	The spreadsheet for calculating the proper timing of epiphyseodesis by interpolating the equations for the multiplier.	76
29	The Hechard-Carlitz growth chart.	83
30	Clinical leg-length discrepancy graph for boys.	87

List of Tables

No.	Title	Page
1	Causes of leg length discrepancy	31
2	Causes, Effects, and Extent of Lower Extremity Length Discrepancies	33
3	Femoral multipliers for girls by percentile group	66
4	Tibial multipliers for girls by percentile group	66
5	Femoral multipliers for boys by percentile group	67
6	Tibial multipliers for boy by percentile group	67

List of Abbreviations

AP	Anteroposterior
Avg	Average
CFD	Congenital Femoral Deficiency
cm	Centimeter
G	Amount of growth remaining.
G _ε	Amount of femoral or tibial growth remaining at age of epiphysiodesis
I	Amount of growth inhibition.
In	inch
L	Current length of long limb
L'	Length of long limb as measured on previous radiographs
LLD	Leg Length Discrepancy
L _m	Length of femur or tibia at skeletal maturity
L _ε	Desired length of bone to undergo epiphysiodesis at time of epiphysiodesis.
M	Multiplier
mm	millimeter
M _ε	Multiplier at age of epiphysiodesis
PFFD	Proximal Femoral Focal Deficiency
S	Current length of short limb
S'	Length of short limb as measured on previous radiographs
SD	Standard Deviation
S _m	Length of the short limb at skeletal maturity
yr	year

List of Abbreviations.....

Δ	Current limb-length discrepancy
Δ_g	discrepancy in growth remaining
Δ_m	Limb length discrepancy at skeletal maturity
ε	Desired correction following epiphysiodesis

Abstract

Prediction of LLD at skeletal maturity is an important prerequisite for determining the necessary treatment to equalize leg length. In order to determine this, future growth potential is estimated. There are several methods to predict future growth as the arithmetic method, the growth remaining method, the straight line graph method and the multiplier method, they differ significantly in their convenience, complexity, and accuracy, but the analysis moves through the same stages.

Key words: growth, L.L.D. arithmetic, growth remaining, straight line, multiplier.

Introduction

Introduction

The influence of growth must always be considered when evaluating orthopedic problems in children and adolescents. This is where pediatric orthopedics differs substantially from adult orthopedics. [1]

The growth rate does not remain constant throughout physical development. While it largely follows a linear pattern during childhood, the growth rate increases markedly during two phases of life, namely during infancy and puberty. [2]

The numerous causes of limb length inequality can generally be divided into two broad categories:

Congenital causes due to limb hypoplasia syndromes, hemihypertrophy or skeletal dysplasias.

Acquired causes include anything that injures or slows the growth of the physis, such as a bony bar due to trauma or infection; shortening from a femoral fracture with comminution or overriding bone fragments; and any systemic condition that results in asymmetric innervation or vascularization. [3]

In planning the surgical control of unequal extremity lengths during the growing years, knowledge of the amount of growth which may occur in the long bones after various ages is fundamental. Such knowledge is necessary in all techniques of arrest. This information is also useful in assessing the progress of abnormalities of growth and in estimating the ultimate extent of shortening in children with asymmetrical growth of the lower extremities. [4]

Several methods for Prediction of expected leg length discrepancy at maturity where developed, Hatcher's growth increment curve was the initial approach for determining the best timing for epiphyseal arrest.

The arithmetic method provides a rough estimate of growth potential for children older than 10 years. This method assumes that the distal femoral physis grows 10 mm per year and the proximal tibial physis grows 6 mm per year. The method also assumes that boys reach maturity at chronologic age 16, and girls at age 14. [5]

The growth-remaining method may be used to estimate growth potential in the distal femoral and proximal tibial physes at various skeletal ages. There are separate charts for boys and for girls. This method has withstood the test of time, and is especially useful if a treatment decision needs to be made without the benefit of serial measurements. [6]

The straight-line graph method is a logarithmic representation which allows the growth of both lower limbs and the skeletal age to be plotted as straight lines and no calculations are necessary but becomes more accurate if one has the luxury of multiple measurements over many years.[7]

The multiplier method allows for a quick calculation of the predicted limb-length discrepancy at skeletal maturity, without the need to plot graphs, is the same for the prediction of femoral, tibial, and total-limb lengths, its values are also independent of generation, height, socioeconomic class, ethnicity, and race. [8]

These methods differ significantly in their convenience, complexity, and accuracy, but the analysis moves through the same stages in all four. *The first stage* is the analysis of past growth, including the determination

of the present discrepancy. *The second stage* involves the prediction of future growth, including the lengths of the legs and discrepancy at maturity. *The third stage* is the prediction of the effects of corrective surgery. [9]