Guest Editorial

SCOLIOSIS IN CHILD ATHLETE

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'Orthopedics', meaning straight (ortho) child (pedics), has a very important challenge —case-finding of scoliosis (lateral curvatures and rotations of the spinal column), in particular, in the child athlete. If scoliosis develops in an athlete during the tender years, due to intense training routines, pressure on spinal vertebrae from demanding practice sessions, lack of exposure to fresh air and sunshine, resulting in vitamin-D deficiency, or load on delicate spinal column by carrying heavy school bags, at times worn on one shoulder, with asymmetrically-stuffed books and copies, the entire career of the athlete may suffer a setback (Mousavi *et al*., 2022). According to ICP (Infancy-Childhood-Puberty) model of Johan PE Karlberg, three periods of rapid growth exist**:** (*i*) immediately after conception lasting for the next 2-3 *months*, (*ii*) at start of the childhood phase, following the release of growth hormone, around the age of 3 to 4 *years* and (*iii*) at the start of first sign of puberty, following the release of sex hormone, around the age of 11-13 *years*. As shown in Figure-1, scoliosis, which manifests itself during the first

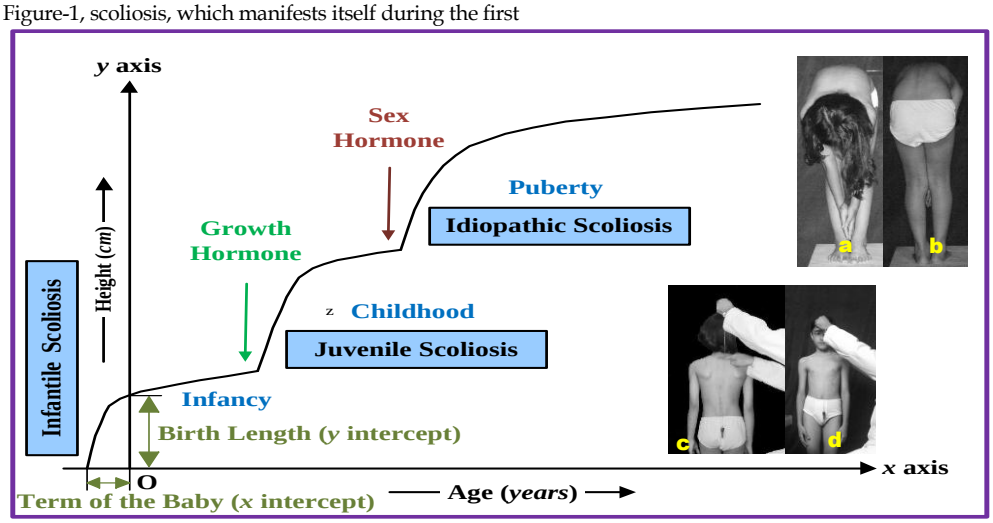

Figure-1: The ICP model of child growth and presence of scoliosis in different age ranges; inset (*a*, *b*) Adam's forward bending test and (*c*, *d*) checking body alignment with the help of a plumb line

phase, is classified as 'infantile scoliosis' (conception/birth to 3 *years*); if the condition is discovered during the second phase, it is termed as 'juvenile scoliosis'; whereas the one showing up during the third phase is generally called 'idiopathic scoliosis' (Kamal *et al*., 2020). The last one is of utmost concern to orthopedic surgeons (Linker, 2012). Since 1980s, Hierholzer & Lüxmann (1982) and the author (Kamal, 1982) have been involved in modeling of the spinal column in three dimensions to better understand the etiology and the prognosis of scoliosis, the latest model put forward 3-*year* ago (Kamal, 2019). The author proposed different indicators to assess risk of acquiring scoliosis, namely cumulative-scoliosis-risk weightage (CSRW) and normalized-scoliosis-risk weightage (NSRW) as well as Differential-Spinal-Function Testing to rule out scoliosis-like conditions, which include postural problems, leg-length inequality and hip weakness (Kamal *et al*., 2015 — Figure-1*a-d*, Figure-6*a-d*). There is need of regular surveillance of backs of the school-going children using moiré fringe topography, rastersterography and dotted-rasterstereography, to classify these child athletes as low risk (followed through till they reach their 11th birthday), medium risk (followed through till they reach their 16th birthday) and high risk (followed

through till they reach end-of-growth — boys 21st birthday; girls 19th birthday) to suffer from scoliosis (Kamal *et al*., 2020 — Table-5).

According to Bachmann (2021), idiopathic scoliosis is to be discovered in two to three percent of typically-developing athletes. Screening for scoliosis should be mandatory in all sport physicals. In addition, growing athletes should be thoroughly examined twice-a-*year* in the following manner (Kamal *et al*., 2015 — Figure-2*a-c*, Figure-3*a*, *b*, Figure-4*a-c*).

The examinee is required to be barefooted and strip completely except briefs or panties. Visual examination of back in the attention position (Kamal, 2019 — Figure-1) should focus on presence of drooping shoulders, scapulae level, body-triangle asymmetry, spinal-dimples level as well as back midline — shape straight, C (postural problems may be the reason) or S (pathological — scoliosis may be present). Further, the athlete should be visually examined facing the examiner to ascertain shoulder drooping, unequal body triangles (if seen during examination of back) and shape of sternum as well as level of nipples and knee joints. Body alignment is to be figured out by placing a plumb line along midline of back. Body is considered to be aligned from back if the plumb line passes through midpoint of the line segment joining the spinal dimples. From the front, plumb line should be aligned with sternum. Body is supposed to be aligned from front if the plumb line passes through the navel. Forward-bending test (standing position) is performed both with the athlete facing the examiner and with back towards the examiner. The examinee is instructed to touch (or try to touch) toes with palms together and without flexing knees. Frontal examination highlights curves in the lumbar and the sacral regions, whereas as the observation from the back side brings to light curves in the cervical and the thoracic regions. The asymmetry observed in forward-bending test (youngster facing the examiner or back towards the examiner) is to be confirmed by observing the incumbent in forward-bending position observed from the side opposite to elevated back, *i. e.*, an individual showing left side of back elevated is observed from the right side and vice versa. The side observation highlights elevated portion as well as indicates missing spinous process, if present. After that the athlete is required to lift each foot for a count of 3 to check for hip weakness — the pelvis tilts downward on the side of unaffected hip, when weight is borne on weak hip abductors (positive Tredelenburg sign). Uneven spinal dimples indicate leg-length inequality.

In the sitting position visual and forward-bending examinations are performed by asking the child athlete to sit on a stool with back straight. To make sure that the thighs are positioned perpendicular to back and feet are not hanging, wooden planks are to be placed under the feet to stabilize sitting posture. Body triangles cannot be seen in the sitting-position-visual examination.

To discover the causes of idiopathic scoliosis, much more research is required at the molecular level. Scoliosis is a disease, which disfigures the body and affects vital organs. It is imperative that this condition should be detected early through unclothed visual, forward bending as well as moiré and raster examinations, so that the orthopedic surgeon, dealing with athletes, plans proper intervention to save from deformation of the body of a sportsman.

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